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VARYING THE PARAMETERS OF THE SLOVENIAN PENSION SYSTEM: AN ANALYSIS WITH AN OVERLAPPING-GENERATIONS GENERAL EQUILIBRIUM MODEL[1]

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Abstract

The article presents an analysis of welfare effects in Slovenia, an analysis of macroeconomic effects of the Slovenian pension reform and an analysis of effects of the pension fund deficit on sustainability of Slovenian public finances with a dynamic OLG general equilibrium model. Stress was layed upon varying two parameters of the current pension system; the age of retirement and the indexation rate of pensions. It was established that by tightening these parameters the elderly would lose, while the present and future generations would gain. The macroeconomic effects were in accordance with expectations; the employment level increased, while the effects of tightened parameters on real consumption were negative. Since the PAYG burden on incomes decreased, the investment activity and thus the capital stock increased somewhat as well. Nevertheless, the long-term impact on the real GDP appeared to be ambiguous. Without doubt one has to take into account the demographic slowdown of GDP growth. Finally, tightening the parameters of the pension system substantially increased the long-term sustainability of the pension system; while lower indexation level of pension considerably decreased the deficit of the public pension fund, increase of retirement age was even able to delay the incidence of additional deficit.

JEL classification: C68, D58, D61, D91, E62, H55.

Keywords: general equilibrium models, indexation of pensions, macroeconomic effects, OLG-GE, PAYG, pension system, retirement age, Slovenia, welfare analysis.

1. Introduction

Economic sustainability of social security systems is under severe pressure nowadays due to ageing caused by decreasing fertility rate, increasing life expectancy, increasing share of recipients of social benefits, and decreasing share of active population (*cf*. OECD, 2000; European Commission, 2001). These are the reasons for anticipated increase of traditional social security benefits and introduction of new types of old-age insurance. Among key topics of social security in Slovenia is therefore the development of sustainable, efficient and fair system of funding social security in the environment of expected further ageing of the population. Mechanisms and actions adopted and implemented by the Republic of Slovenia ought to ensure solid foundations for the social security, as well as enable and promote social inclusion of the population (*cf*. IMAD, 2001). Special emphasis is being put on the pension system due to its weight in the system of public finances; therefore it is also the focus of our research.

Early 1990s represent the beginning of Slovenia's economic transformation from the workers' self-management to a market economy through the process of restructuring. This process, which has led to recession as a result of the loss of former Yugoslavian markets, was also the cause of surpluses on the labour market. To maintain social sustainability, the costs of transition were shifted to the pension system through mass early retirement. If the increasingly perceivable unfavourable demographic developments are taken into account, it becomes obvious that the pension system, implemented with the 1992 Pension and Disability Insurance Act (PDIA), would not be able to sustain the pressure. This became distinctly obvious in 1996, when the state pension fund needed additional financing from the central budget for the first time. This was enough to start intense preparations for the Slovenian pension reform, which was adopted in the form of the 1999 PDIA and is being implemented from 1 January 2000.

In the present analysis we are interested in the effects of varying the parameters of the current Slovenian pension system on welfare of different generations in Slovenia and on sustainability of Slovenian public finances. Stress is being layed upon two such parameters; (1) the age of retirement and (2) the indexation rate of pensions. To achieve this, Slovenian economy is being analyzed with an overlapping-generations general equilibrium (OLG-GE) model, which is the most developed version of computable general equilibrium (CGE) models. Namely, the model SIOLG 2.0 makes possible analysis of intra-generational and inter-generational redistribution effects of potential effects of

different strategies of public financing in order to achieve sustainable long-term economic growth and social development. It also enables monitoring and anticipation of effects of unfavourable demographic developments on the volume of social transfers to the population.

The outline of the article is as follows. In Chapter 2 a short description of the OLG general equilibrium model of the Slovenian economy is presented, while the developments in the Slovenian public pension system from the 1990s onwards are explained in some detail in Chapter 3. In Chapter 4 some of the simulation results of the model are presented, with special focus on welfare effects, macroeconomic effects of the pension reform and effects of the state pension fund deficit on sustainability of public finances. Each of these aspects is then being thoroughly analyzed from the viewpoint of altered parameters of the Slovenian pension system, i.e. increased age of retirement and decreased indexation rate of pensions. In the final chapter we summarize the central findings of the article.

2. Description of the OLG-GE Model of the Slovenian Economy

The model SIOLG 2.0 is a dynamic overlapping-generations general equilibrium model of the Slovenian economy, based on social accounting matrix (SAM) for the year 2000, data on demographic structure of the population, expected future demographic developments, characteristics of Slovenian households, and decomposition of households within generations (*cf.* Verbič *et al*., 2006; Verbič, 2007). The model has been developed with the very intention of analyzing the sustainability of the Slovenian public finances, though it can be used to analyze any part or any sector of the economy.

The starting points of the OLG-GE model are the life cycle theory of consumption by Modigliani and Brumberg (1954) and the permanent income hypothesis by Friedman (1957), which are actually special cases of the more general theory of intertemporal allocation of consumption (Deaton, 1992). Unlike in the Keynes's theory of behaviour of consumption and savings, based only on current income, in the OLG-GE model consumption and savings are derived from intertemporal optimization behaviour and are therefore dependent on full lifetime income. In the simplest case of unchanged income until retirement (*cf.* Modigliani, 1986), consumers save during their active lifetime and spend their savings after the retirement in order to maintain unchanged consumption. The retirement is therefore *raison d'etre* for saving.

Overlapping-generations general equilibrium models represent the pinnacle of dynamic CGE modelling. OLG-GE modelling was established and promoted by Auerbach and Kotlikoff (1987) and is based on detailed decomposition of the consumption side of the model. Namely, unlike in the Ramsey-type models the consumers live a finite length of time, but long enough to live at least one period with the next generations of consumers. Determination of consumers by their birth cohort enables analysis of inter-generational effects, which makes OLG-GE models especially valuable for analysis of tax policies, pension policies and other social policies.

Dynamic general equilibrium model SIOLG 2.0 comprises not only the standard model structure of a national economy, but also the demographic block and the pension block, within the framework of which the first and the second pillar of the Slovenian pension system are being modelled. Since the model incorporates most of the contemporary techniques of the CGE modelling, the arrears in this field in Slovenia compared to the rest of the world have practically been eliminated. Namely, the model is build within the general algebraic modelling system (GAMS), which has become both most widely used programming language and most widespread computer software (Brooke *et al*., 1998) for construction and solving large and complex CGE models.

Within the GAMS framework, the dynamic general equilibrium model is written in Mathiesen's (1985) formulation of the Arrow-Debreu (1954) equilibrium model, i.e. as a mixed complementarity problem (MCP). The key advantage of this formulation is the compact presentation of the general equilibrium problem, which is achieved by treating variables implicitly and thus significantly reducing the computation time for higher-dimensional models. Namely, the mathematical program includes equalities as well as inequalities, where the complementarity slackness holds between system variables and system conditions (*cf*. Rutherford, 1995a; Böhringer *et al*., 2003). Functions of the model are written in Rutherford's (1995) calibrated share form; a reasonably straightforward algebraic transformation, which nevertheless considerably simplifies the calibration of the model (*cf*. Böhringer *et al*., 2003; Balistreri and Hillberry, 2003). To solve the model, i.e. to achieve convergence, a recent version of the PATH solver (Ferris and Munson, 2000) is used, which is renowned for its computational efficiency.

Consumers live in the model according to their expected length of life, i.e. their life expectancy at birth. Assuming that the life expectancy is approximately 80 years and that the active lifetime period starts at the age of 20, there are 60 generations in each period of the model. There is a new cohort of consumers born in each such period, thus increasing

the population, while at the same time a number of consumers pass away and decrease the total population. Consumers are observed in five-year intervals within households, which maximize the expected lifetime utility subject to their income constraints, where one has to put out the need to save for retirement and to support children. Households are differentiated in the model according to year of birth, income and size; within each cohort distinction is made between couple without children and nuclear family with two children on average, and five income profiles representing different income brackets. Consequently, there are ten versions of the model altogether, which facilitates analysis of intragenerational effects of different economic policies.

The volume of labour and the labour productivity growth are given exogenously. Changes in wages are reflected in changes of the labour supply. Consumption of households with children is additionally corrected due to extra cost per child, where the children are born in the childbearing age of the woman or, to be precise, the household, i.e. in the age bracket of 20-40 years. In the first ten years after retirement the household is comprised of two persons and afterwards of one adult. Saving decisions of households affect investment decisions of firms in the capital markets and thus future production. The effects ascribed herein have recurrent effects on product market through decreasing prices and on labour market through higher productivity, leading to higher wages and finally higher income of households. Both effects can be analyzed with a dynamic OLG-GE model quite straightforwardly.

The perfect foresight assumption in the forward-looking model specification implies the ability of households to perform intertemporal optimization of the present value of entire future consumption. In other words, the consumers have full information at their disposal, adopt on average the right decisions and are familiar with future modifications of key economic indicators, which is the quintessence of rational expectations. They are able to anticipate new policies and to prepare themselves to future changes. The assumption of equilibrium in all markets and assumption of achieved sustainable economic growth enable analysis of different scenarios, which cause deviations from the reference growth path and changes in macroeconomic and microeconomic indicators. This is especially important when analyzing social security, because it makes possible projecting the effects of demographic changes on the social security system. For this we have three variants of demographic projections available; the low variant combines lower fertility with lower life expectancy and lower net migration, while the high variant combines higher fertility with higher life expectancy and higher net migration than in the reference medium variant.

On the other hand, the assumption of perfect foresight is also valid for firms, which maximize profits in the environment of perfect competition. Technology is given by the constant elasticity of substitution (CES) production function. The number of production sectors in the model is dependent on availability of the input-output table for the base year, which means that there are 60 sectors of the standard classification of activities (SCA) available for discretionary aggregation. Government spending is dependent on economic growth and growth of the population, and is financed with revenues from personal income tax, capital income tax, value-added tax and import duties. Sources of revenue of the Slovenian system of public finances represent various possibilities of funding different economic policies in the simulation phase of the modelling.

The dynamic general equilibrium model SIOLG 2.0 is closed using the Armington's (1969) assumption of imperfect substitutability, where the commodities are separated by its source on domestic and imported products. Demand for imported products is derived from cost minimization criterion of firms and utility maximization criterion of consumers. As regards the export side of the model, domestically produced products are sold at home and abroad, but are nevertheless treated as imperfect substitutes. Slovenia is assumed to be a small open economy, implying that the changes in the volumes of imports and exports do not affect the terms of trade. International capital flows are endogenous, given the intertemporal balance of payments constraint.

3. Representation of Developments in the Slovenian Pension System

The Republic of Slovenia inherited the legislation of its pension system, which was based on inter-generational contract and is therefore a pay-as-you-go (PAYG) system, from the former Yugoslavia. After Yugoslavia splintered into newly independent countries at the beginning of the 1990s, transformation from the workers' self-management to a modern market economy was initiated in Slovenia, thus requiring the formation of new markets and taking its rules into account. However, the consequences of bankruptcy of firms, economic recession and restructuring of the business sector, all resulting from economic transformation, were being "solved" contemporaneously in order to preserve social sustainability by mass early retirement.

After Slovenia's independence in 1991, the new pension legislation was adopted somewhat behind schedule in 1992, when the restructuring was for the most part already finished. Even the rise of retirement age was therefore not able to put the break on early

retirement pressure. Because the price of additional years of service was low and therefore not consistent with the actuarial principles, purchase of additional years of service was a common phenomenon. Consequently, the increase in actual retirement age was modest and very close to minimum retirement age. The ratio between the number of insured persons and the number of pensioners has been relatively steady over the last decade (Stanovnik, 2002), although this stability is somewhat misleading for the new pension legislation introduced additional categories of insured persons[1].

Legislative modifications adopted in 1992 are partially responsible also for the large increase of pension expenditure of the PAYG-financed state pension fund, i.e. the Institute for Pension and Disability Insurance (IPDI), in the same year. Namely, with the new Pension and Disability Insurance Act the IPDI was compelled to pay contributions for health insurance for pensioners, hence contributing at least additional per cent to the ratio of pension expenditure to GDP. After 1992 the pension expenditure, measured as percentage of GDP, somewhat stabilized at the level of 11 per cent. This could have been a sign of financial stabilization of the IPDI; however things took a drastic turn for the worse, as we will find out hereinafter. Until 1996 all extensive increases of pension expenditure were financed by increasing the pension contribution rate. As a result the (joint employer and employee) pension contribution rate ascended from 22.55 per cent of the gross wage in 1989 to 31 per cent of the gross wage in 1995. Finally, in 1996 the Government of the Republic of Slovenia decided to lower the employer pension contribution rate from 15.5 per cent of the gross wage to 8.85 per cent of the gross wage in order to increase competitiveness of the Slovenian economy.

The year 1996 hence represent a decisive moment, since until then financially autonomous state pension fund demonstrated a deficit for the first time, which has after that been filled up every year until 2004 with the so-called "generalized" transfers from the central budget in order to maintain social stability. Transfers of funds from the central government budget to the IPDI indeed existed prior to 1996, but were only intended for financing additional obligations of the government, such as pensions of farmers, policemen, customs officers and combatants of the World War II. Now the government actually committed itself to partially finance pensions, which were primarily established on actuarial principles and were before 1996 entirely funded with contributions of the active population. Until the economic transformation relatively favourable pension figures

[1] Evident examples of introducing additional categories of insured persons are "voluntarily insured persons" and "unemployed persons receiving unemployment benefits" for whom the contributions are paid by the National Employment Office.

become insupportable in just a few years. One should certainly adjoin that the effects of demographic changes on the social security system are yet to be observed in the subsequent years.

The decrease of employer pension contributions was thus a “suitable” occasion for the extreme measure of transfer funding of the pension system. The insolvency of the pension system therefore passed by unnoticed to the general public, but the consequences of the pension deficit can be seen in the structure of the Slovenian budget, where there are fewer funds available for investments and for research and development. Yet the economic situation is commonly not perceived to be so pessimistic. The fiscal position was relatively favourable for the whole time and certainly the most promising among the new EU member states; the budget deficit was relatively low in the last decade despite the difficult situation in the first years of economic transition, hence the public debt increased only moderately.

The problem, which has by that time drawn attention of economists of the International Monetary Fund and the World Bank, was being properly addressed with the preparation of the White Paper on the subject in 1997, which led to the adoption of new PDIA in 1999. The implementation of this law started on 1 January 2000 and is to be finished in 2024. The pension system has become more complex than ever before; partially due to difficult negotiations in the government coalition, but mainly because of tiresome negotiations between management and labour (Stanovnik, 2002). The main characteristic of the new pension legislation in comparison with the former legislation is path-dependency, which appears to be a universal feature of predominantly gradualistic reforms of the Slovenian economic system. In addition, the transitional periods are lengthy, so the actual values of parameters of the present three-pillar pension system in Slovenia converge only gradually to the final values.

Statutory retirement age under the 1999 PDIA, which guarantees insured persons retirement benefits, dependent only on completed years of service (without deductions), is 63 years for men and 61 years for women. This criterion is to be increased from 58 years and 6 months in 2000 by 6 months per annum for men and from 53 years and 4 months in 2000 by 4 months per annum for women. However, an individual can retire already at the age of 58 and receives pension without deductions in case he or she fulfilled the full pension qualifying period, which is 40 years of service for men and 38 years of service for women. The transitional period terminates at the end of 2008 for men and at the end of 2022 for women. Minimum pension qualifying period is still 15 years of service. The

retirement age can be decreased for every born or adopted child, brought up and supported by the insured person at least for five years.

There is more consideration given in the 1999 PDIA to actuarial fairness for the system of incentives and disincentives was adopted in case of retirement before and after fulfilment of retirement eligibility criteria, respectively. Namely, for all insured persons without full pension qualifying period, retired before completed 63 (men) and 61 years of service (women), the pension adequately decreases for every month missing until the statutory retirement age. Disincentives are applied to the pension base and amount to 0.1-0.3 percentage points of accrual rate for every month, negatively depending on actual retirement age of such individual; the closer actual retirement age is to statutory retirement age, the lower are the deductions. If, on the contrary, the insured pension remains employed after completed statutory retirement age and full pension qualifying period, the pension adequately increases for every month, completed after the statutory retirement age. Incentives likewise amount to 0.1-0.3 percentage points of accrual rate for every month, positively depending on actual retirement age of an individual. They are cumulative; yet do not rise further after three additional years of service. Both incentives and incentives are to be added 1.5 percentage points of accrual rate for every year of service missing or added, respectively.

The calculation of pensions is less favourable for insured persons under the 1999 PDIA. Old-age pension is calculated from the pension base in per cent, depending on number of completed years of service; 35 per cent in case of men and 38 per cent in case of women for the first 15 years of service, and 1.5 per cent for each additional year of service irrespective of gender. Under the proviso that the insured person is not subjected to pension disincentives, the pension in case of full pension qualifying period amounts to 72.5 per cent of pension base, instead of prior 85 per cent (1992 PDIA). Since the pension base under the 1999 PDIA is calculated out of best 18 consecutive years of service instead of prior best 10 consecutive years of service (1992 PDIA), the decrease in pensions is even higher. Also, the law further diminished possibilities of the self-employed to “tamper” with their contribution base. However, the most complex procedures of the 1999 pension legislation are revalorization of pension bases and indexation of pensions (*cf*. Stanovnik, 2004). Revalorization of the pension base in the Slovenian pension system is a procedure of recalculating sources of pensionable income in the best 18 consecutive years of service using a vector of revalorization coefficients, in order to obtain the pension base. It is actually an instrument in the pension system, used for obtaining horizontal equity between existing and new pensioners. Indexation of the pension, on the other hand, is a procedure

of adjusting retirement benefits to existent economic developments in the country using a complex set of rules, where consumer price index is the floor and wage index is the ceiling for the growth rate of pensions.

It has to be emphasized that in 2005 the Government of the Republic of Slovenia introduced several changes to the 1999 PDIA that were aimed at increasing the pensions (in real terms). The most important among then was the introduction of full indexation of pensions that is being carried out twice a year (in February and in November). Additionally, the changes of pension legislation include increases in the level of pensioner's recreation grant and lowering eligibility requirements of the widower's pension. These provisions, especially the introduction of full indexation of pensions, will undoubtedly have substantial negative long-term effects on controlling the expenditure of the system of public finances.

The 1999 PDIA introduced a number of elements that improved horizontal equity in the system (*cf*. Stanovnik, 2002). The gender divide regarding eligibility and benefits was considerably narrowed. Not only were accrual rates equalized, but the eligibility criteria for women are now closer to those for men. Nonetheless, even greater emphasis was laid on the principle of vertical equity or "solidarity". Thus the ratio between two comparable pensions[2] can not exceed 4:1, which is less than the prior ratio of 4.8:1 (1992 PDIA). Instead of explicit minimum and maximum pension, the Slovenian pension system includes minimum and maximum pension base; the former is set nominally, yet amounted to approximately 62.5 per cent of average net wage in 2000, while the latter is four times the minimum pension base. A further redistributive element lies in the fact that social security contributions are not capped.

And, last but not least, one should make known a very important novelty of the 1999 pension legislation, besides the system of incentives and disincentives. Namely, pensions of the existing pensioners are adjusted to entry pensions of new pensioners according to Article 151 of the 1999 PDIA; the adjustment amounts approximately to –0.6 percentage points of the pension per annum. This means that pensions of existing pensioners are being decreased in real terms, taking account of the lower pensions of new entrants. There was an initiative given to the Institutional Court of the Republic of Slovenia for constitutional review of this article, but the Court ruled in December 2003 that the article is congruent with the Constitution of the Republic of Slovenia. Such outcome is

[2] Comparable pensions exist when two pensioners enter the pension system under the same conditions and both have full pension qualifying period.

particularly important, since this modification of the pension legislation represent a large share of overall effects of the pension reform and has also a significant positive effect on managing expenditure of the pension system.

4. Results of the OLG-GE Simulations

The groundwork for our analysis is execution of dynamic calibration of the OLG-GE model and consequently preparation of the pertinent reference solution. In the framework of performing dynamic calibration of the model SIOLG 2.0, we follow the strategy of using the model to generate the entire dynamic path of endogenous variables in order to accurately reproduce the values of every endogenous variable in the base year (2000). The dynamic calibration scenario described herein simultaneously represents the benchmark scenario (BENCH), referring to steady-state growth of all relevant variables in the model. The reference scenario (REFER) is then obtained by solving the model with implemented both demographic and pension block, where additional deficit[3] of the state pension fund at changed demographic structure is being financed from the central government budget with revenues from value-added tax. Alternatively, the additional deficit could have been financed with revenues from labour income tax. The initial (base-year) IPDI deficit is of course being funded by pension contributions. The reference scenario represents the basis for comparison of consequences of a range of economic policies in the system of public finances.

Analysis of the Slovenian economy, where we take into account upcoming developments of the Slovenian pension system, is then performed by forming two counterfactual scenarios and comparing their outcomes to the results of the reference scenario. Whereas the latter refers to the present structure of financing the pension system, where only the additional deficit is being financed with revenues from value-added tax, the counterfactual scenarios are different. Namely, in the first counterfactual scenario (VAT) we assume that the entire state pension fund is financed with revenues from value-added tax, while in the second counterfactual scenario (LABS) the IPDI is by assumption funded exclusively with revenues from labour income tax. These scenarios are used in order to represent the effects of two extreme approaches to funding the pension system and to demonstrate their strengths and weaknesses. We commence by analyzing welfare effects in Slovenia, followed by an analysis of macroeconomic effects of the Slovenian pension

[3] Additional deficit is the excess of the state pension fund deficit in a particular year over its value in the base year, when it amounted to 3.9 per cent of the GDP.

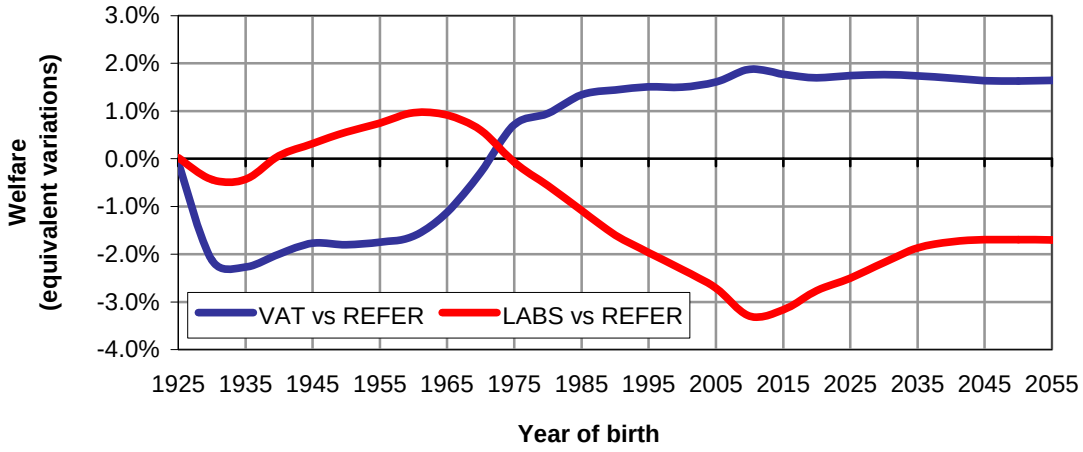
reform, whilst the chapter is being concluded by analyzing effects of the IPDI deficit on sustainability of Slovenian public finances.

Unless explicitly stated otherwise, steady-state growth rate of 2.5 per cent and medium variant of demographic projections are used for OLG-GE simulations. The GDP growth is endogenously determined, while the productivity growth is exogenous and equal to the chosen steady-state growth. Wage growth follows the productivity growth, but is also dependent on changes in labour supply. The pension block of the model SIOLG 2.0 follows the 1999 PDIA and its subsequent changes with the following key elements: (1) pension as proportion of the pension base is gradually decreasing for new and existing pensioners to 72.5 per cent; (2) number of consecutive years of service for calculation of the pension base is gradually increasing from 10 to 18; (3) eligibility criteria for retirement are being raised, to be reflected in estimated increase in average retirement age of either 2 years for men and 4 years for women or 7 years for men and 9 years for women; (4) average pension growth reaches either 100 or 80 per cent of average wage growth; and (5) calculation of the revalorization coefficients is based on lagging of pension growth behind wage growth, which enables equalizing the financial situation among existing and new pensioners. Supplementary pension saving in the second pension pillar remains at the reference level, while the growth of residual non-pension expenditure of the IPDI follows population growth and exogenous productivity growth.

4.1. An Analysis of Welfare Effects in Slovenia

For the purpose of welfare analysis we use the Hicks's equivalent variations (HEV) as a measure of change in the welfare of generations. Equivalent variations can be defined as the equivalent percentage change in full lifetime resources needed in the reference scenario to produce the same level of welfare under the counterfactual scenarios. A positive value means that a generation will gain from switching from the reference scenario to the counterfactual scenario. The inter-generational redistribution effects for the current pension system parameter values in Slovenia, i.e. retirement age of 60 years and full (100 per cent) indexation of pensions, are shown in Figure 1.

Figure 1. Welfare effects in Slovenia in case of applying different sources of financing the pension system (retirement age of 60 years and full indexation)



Source: Author's simulations using SIOLG 2.0.

A first glance at the Figure 1 shows that in case of funding the pension system with revenues from value-added tax, the future generations would gain. It is obvious that in this scenario the elderly would lose, as they have to pay more value-added tax in comparison with the reference scenario; they would be forced to bear a larger burden of the present value of public expenditure. In case of funding the pension system with revenues from labour income tax, all future generations would lose, as they alone would need to bear the burden of public expenditure.

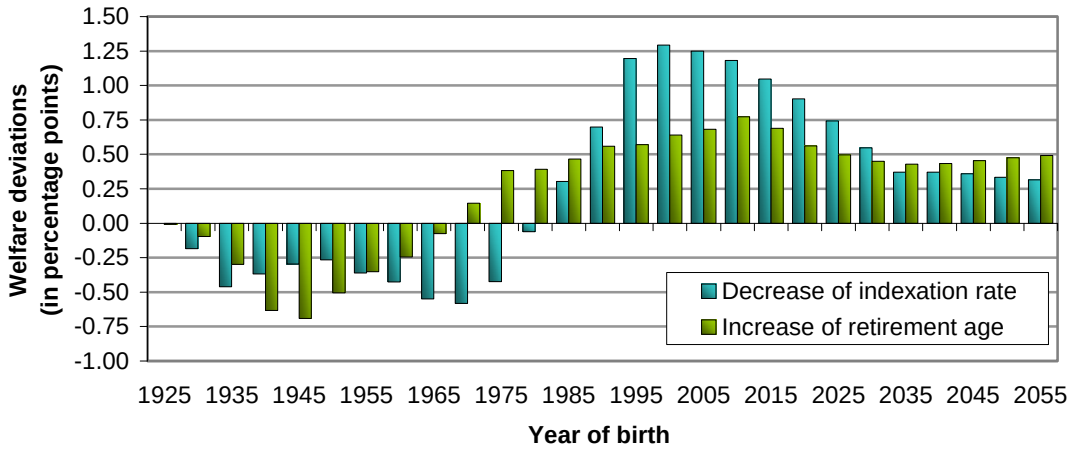
Funding of the pension system with revenues from value-added tax appears to be somewhat better alternative than funding of the pension system with pension contributions, which can be explained as follows. Replacement of social security contributions with revenues from value-added tax improves financial situation of young generations for the consumption of the elderly is being taxed additionally. Since young generations have lower marginal propensity to consume compared to the elderly, after the tax reform their consumption decreases, whilst their supply of labour has to increase. Total consumption therefore decreases, whereas the total labour supply increases; savings increase and higher capital stock leads to higher GDP.

As value-added tax rate is raised over time, making consumption in the future more expensive, the value-added tax acts like a capital income tax. In case of funding the pension system with revenues from value-added tax, there is a substantial increase in labour supply. This is to a lesser extent also true in case of funding the pension system with revenues from labour income tax. People will not only work more, they will also work

longer. The retired generations suddenly have to pay an increased tax on their consumption. As they live on their savings, the only way to keep their consumption at unchanged level is by providing additional labour to the labour market, i.e. by retiring later. Correspondingly, a raising labour income tax rate will change the relative intertemporal prices of leisure. The future price of leisure will fall relatively to the price of current leisure, inducing a substitution of future for current labour supply.

Figure 2 presents the changes in inter-generational redistribution effects in Slovenia in case of decreasing the indexation rate from 100 to 80 per cent and increasing the retirement age from 60 to 65 years. It can be observed that by tightening the parameters of the present pension system the elderly would lose, while the present and future generations would gain. In case of introducing partial (80 per cent) indexation of pensions, the pensions (on average the only source of income) of the elderly would decrease, leading to direct negative effects on their welfare, while the (future) pensions of the present and future active generations would indeed decrease as well, though in a PAYG system the burden imposed on them by the intergenerational contract to finance the pensions of currently retired people would evidently decrease by even more.

Figure 2. Welfare changes in Slovenia in case of decreasing the indexation rate from 100 to 80 per cent and increasing the retirement age from 60 to 65 years



Source: Author's simulations using SIOLG 2.0.

In case of increasing the retirement age from 60 to 65 years we obtain similar results. Generations that would lose the most are the ones just to be retired, while the present and future generations would gain, since by supplying more labour throughout their lifecycle they would earn more and thus they would also be able to consume more. In

a PAYG pension system their pensions, calculated by the pension formula and indexed to wages through the indexation process, would be higher and the loss of welfare caused by the decreased leisure time would evidently not be high enough to compensate the positive effects of increased consumption.

Another important aspect of the tax reform is its overall efficiency effect. In order to obtain this effect, we have changed the model in such a way that there are no inter-generational effects; all generations lose or gain the same amount. This is accomplished by introducing a lump-sum redistribution authority (LSRA), which redistributes gains and losses evenly among the generations using lump-sum transfers. These transfers have no distortional effects; hence what remains is the pure efficiency effect of the tax reform. As can be seen in Table 1, there is a positive overall efficiency effect in case of funding the pension system with revenues from value-added tax, i.e. the welfare level of all generations increases by 0.29-0.35 per cent. In contrast, the overall efficiency effect in case of funding the pension system with revenues from labour income tax is negative; the welfare level of all generations decreases by 0.12-0.74 per cent.

Table 1. Overall effect on efficiency (LSRA) given different methods of financing the pension deficit, different retirement ages, and different levels of indexation

Scenario determination		Efficiency effect (LSRA)	
Retirement age	Indexation level	VAT vs. REFER	LABS vs. REFER
60 years	100 per cent indexation	0.29%	–0.74%
	80 per cent indexation	0.35%	–0.51%
65 years	100 per cent indexation	0.29%	–0.22%
	80 per cent indexation	0.34%	–0.12%

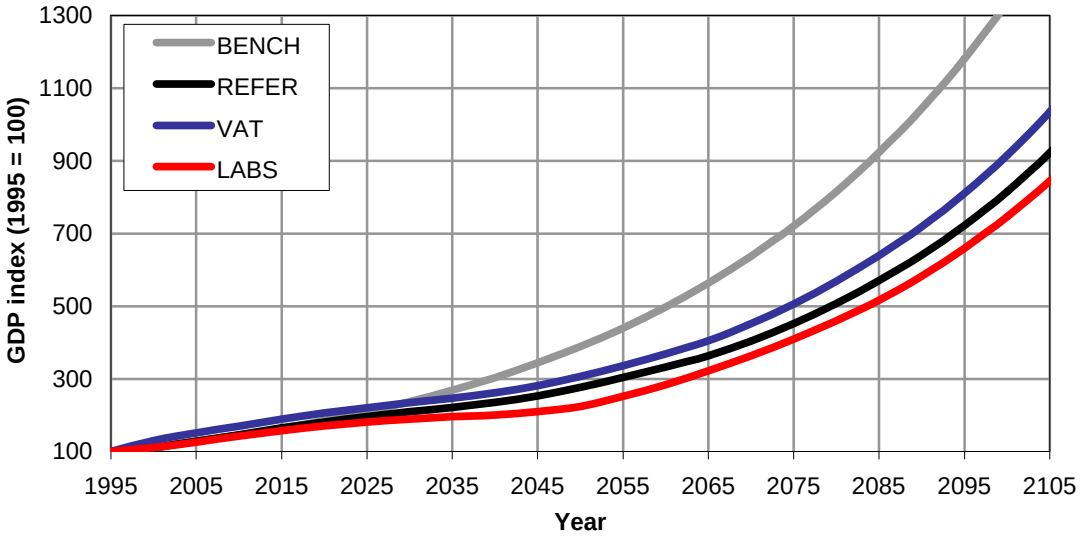
Source: Author's simulations using SIOLG 2.0.

Although potential financing of the pension system with revenues from value-added tax has a clearly positive effect on the economy in the long run, one has to bear in mind that a switch to a situation where a part of the social security system is financed by revenues from value added taxes is probably politically infeasible, as the generations that would decide on the tax reform are the ones that would lose. This is unfortunate as the young generations are the ones that will have to cope with relatively lower pensions and at the same time with higher taxes to finance the social security system.

4.2. An Analysis of Macroeconomic Effects of the Slovenian Pension Reform

Based on developed scenarios, it can be established that the choice of source of financing pensions does not have a significant effect on GDP growth and thus on GDP level. Namely, neither the annual growth rate in case of financing the pension system with revenues from value-added tax nor the annual growth rate in case of financing the pension system with revenues from labour income tax differ much from the annual growth rate of the GDP in the reference scenario, as can be seen from Figure 3 for the current pension system parameter values in Slovenia, i.e. retirement age of 60 years and full indexation of pensions. One should bear in mind that in the benchmark scenario, i.e. in the case with highest GDP growth (see Figure 3), unfavourable demographic developments are not implemented, and thus the differences between the benchmark scenario and other three scenarios clearly demonstrate the demographic slowdown of GDP growth.

Figure 3. Expected gross domestic product in Slovenia in case of applying different sources of financing the pension system (retirement age of 60 years and full indexation)

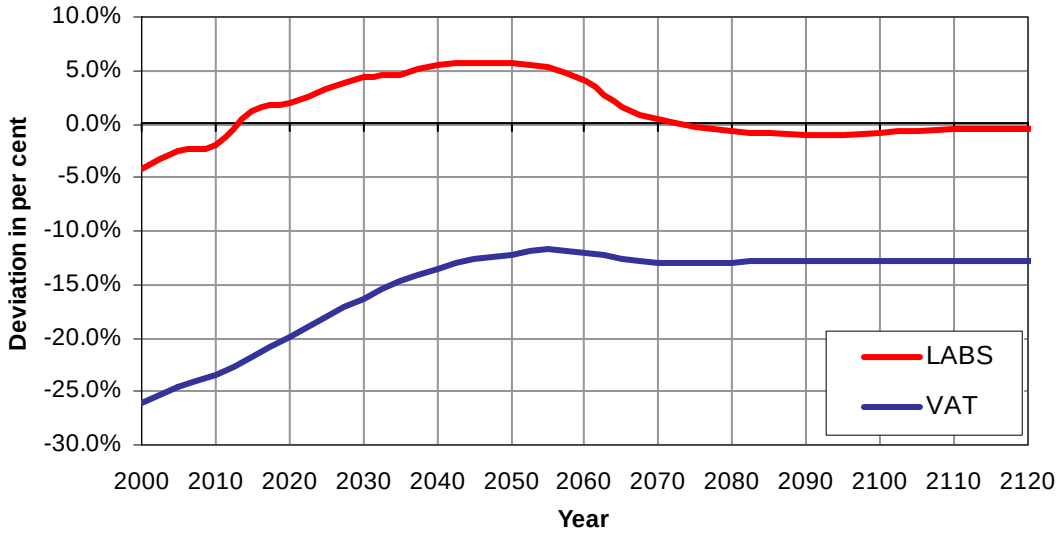


Note: The base year (2000) is not fixed in the model, because this would lead to too many additional restrictions on the model, i.e. it would increase its complexity significantly, and indirectly make the model less solvable. As a consequence of this fact the changes to economic variables occur already in the year 2000. The problem that arised is being 'solved' by fixing the (pre)model year of 1995.

Source: Author's simulations using SIOLG 2.0.

The effects of funding the pension system with revenues from value-added tax and with revenues from labour income tax on consumption, investment (savings[4]) and capital stock can be ascertained from Figures 4 – 6, respectively. Increase in the value-added tax rate makes consumption more expensive and therefore encourages households to reduce their present consumption (see Figure 4), and increase savings and therefore investment (Figure 5). This increases the capital stock (see Figure 6) and raises the level of possible future consumption. Increase in the labour income tax rate, on the other hand, increases the price of present compared to future leisure, inducing substitution of future for current labour supply. The latter therefore decreases. In order to maintain the present level of consumption (see the long-term trend on Figure 4), households decrease current savings, thus decreasing investment (Figure 5). This has an effect of decreasing the capital stock (see Figure 6), though it can potentially also represent an increase in the level of future consumption.

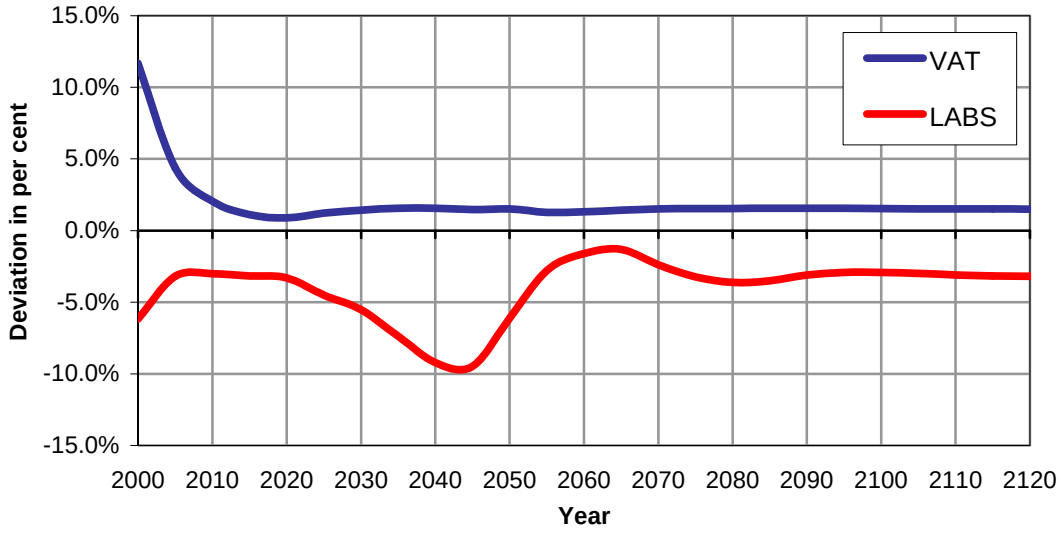
Figure 4. Expected real consumption in Slovenia in case of applying different sources of financing the pension system (retirement age of 60 years and full indexation)



Source: Author's simulations using SIOLG 2.0.

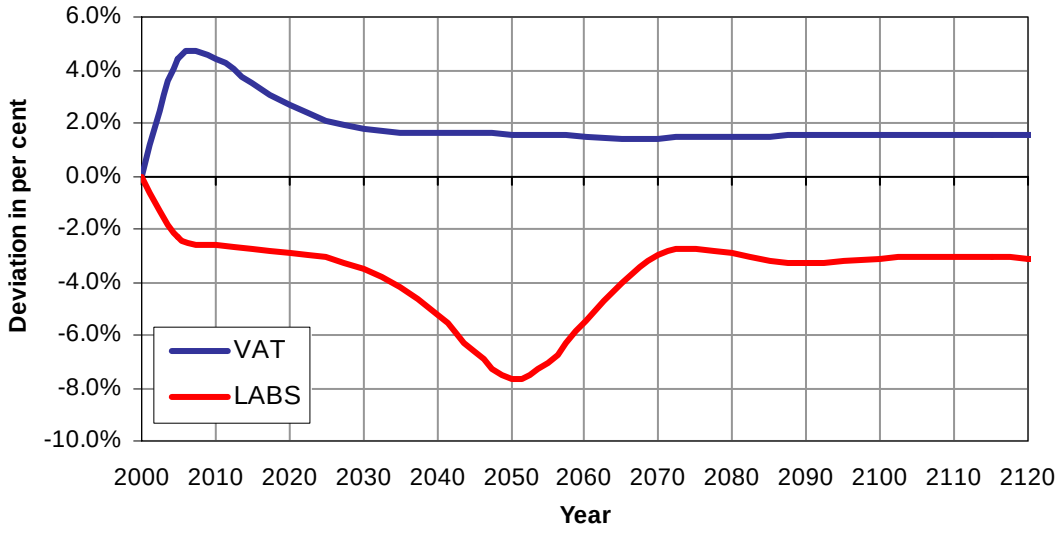
[4] Since general equilibrium theory is acknowledged as a version of the neoclassical theory, in an OLG-GE model effects on investment are also effects on savings.

Figure 5. Expected real investments in Slovenia in case of applying different sources of financing the pension system (retirement age of 60 years and full indexation)



Source: Author's simulations using SIOLG 2.0.

Figure 6. Expected capital stock in Slovenia in case of applying different sources of financing the pension system (retirement age of 60 years and full indexation)

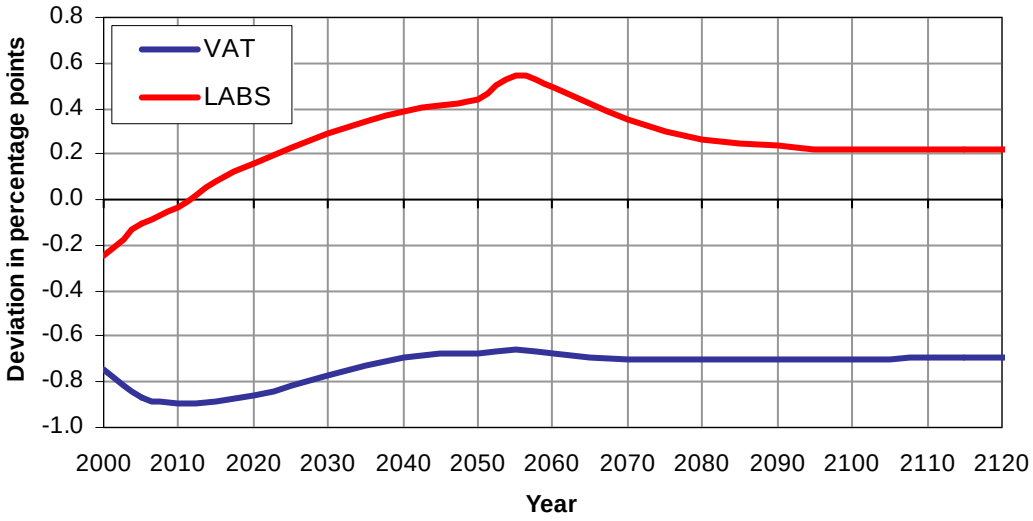


Source: Author's simulations using SIOLG 2.0.

The real interest rate changes can easily be explained by the effects of different scenarios on the capital stock (see Figure 7). In case of funding the pension system with revenues from value-added tax, the capital stock grows by more than in the reference case (Figure 7), which alone leads to a substantial fall in the real interest rate. This should be kept in mind as the second pillar, which is a fully-funded system in Slovenia, is expected to

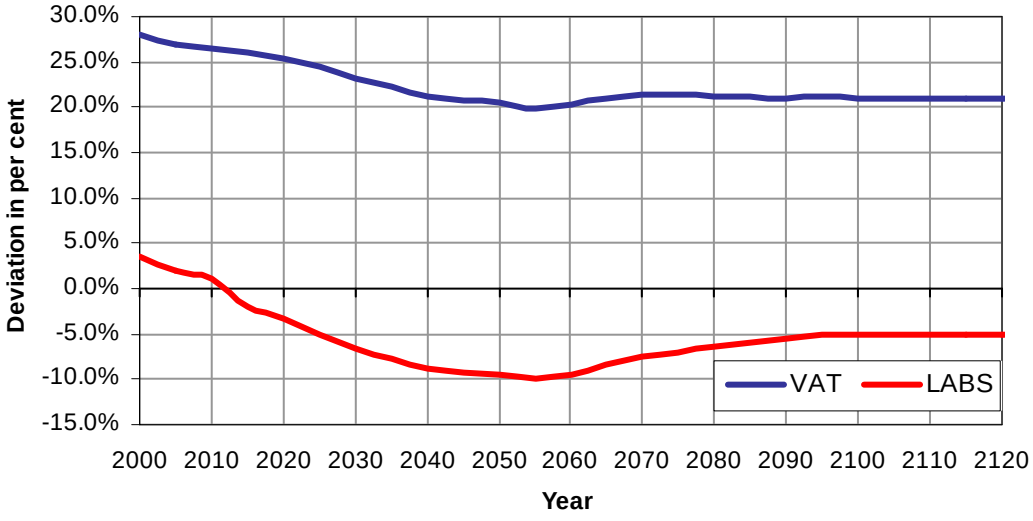
become of more importance in the following decades. In case of funding the pension system with revenues from labour income tax, on the other hand, the capital stock grows by less than in the reference case (see Figure 7), which leads to a somewhat higher real interest rate in the long run.

Figure 7. Expected real interest rate in Slovenia in case of applying different sources of financing the pension system (retirement age of 60 years and full indexation)



Source: Author's simulations using SIOLG 2.0.

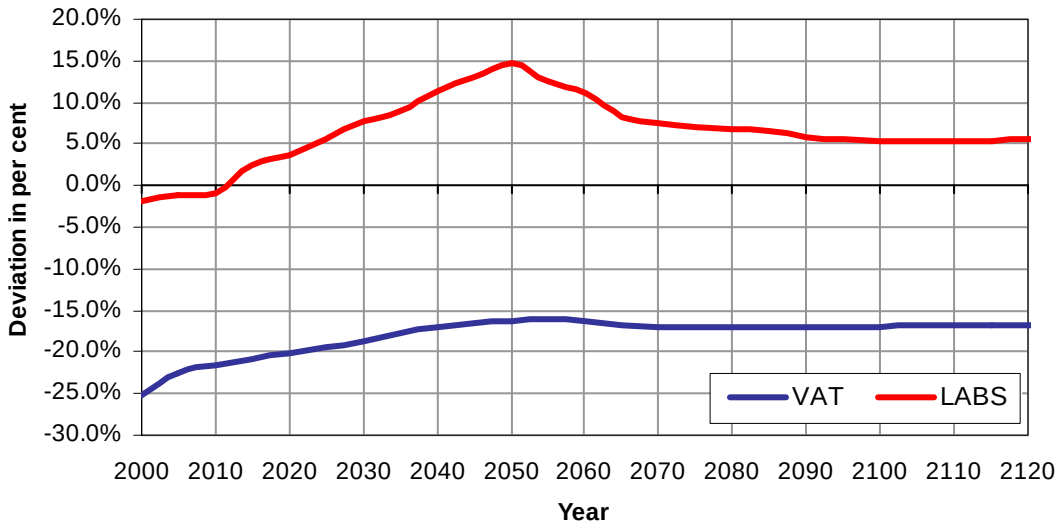
Figure 8. Expected consumer price index in Slovenia in case of applying different sources of financing the pension system (retirement age of 60 years and full indexation)



Source: Author's simulations using SIOLG 2.0.

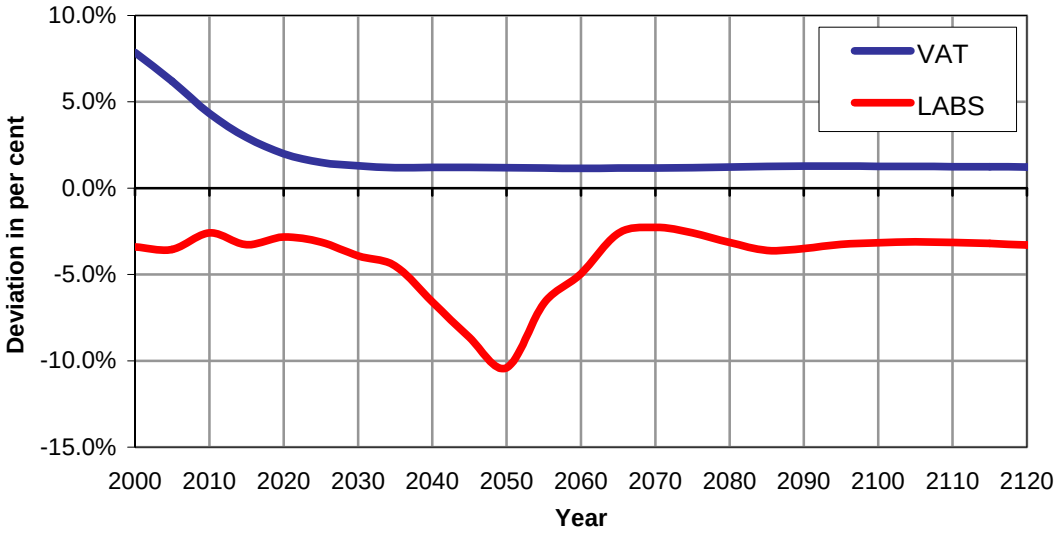
In case of funding the pension system with revenues from value-added tax, an important initial decline of real wages would arise (see Figure 9) due to necessary increase in the value-added tax rate and resulting raise in consumer prices (Figure 8). To keep unchanged level of consumption, economic agents need to increase their labour supply, hence the employment also increases (see Figure 10). Due to anticipated unfavourable demographic developments and consequential decrease in the number of active population, the labour supply and production factor prices would then adjust accordingly. Thus the real wages in case of funding the pension system with revenues from value-added tax are anticipated to gradually increase (after the initial decrease), as a consequence of gradual lessening of growth of consumer prices and accompanying increasing of labour costs. Changes in production factor prices would cause rising employment to settle down at somewhat higher level in comparison with the reference case.

Figure 9. Expected real wages in Slovenia in case of applying different sources of financing the pension system (retirement age of 60 years and full indexation)



Source: Author's simulations using SIOLG 2.0.

Figure 10. Expected employment in Slovenia in case of applying different sources of financing the pension system (retirement age of 60 years and full indexation)



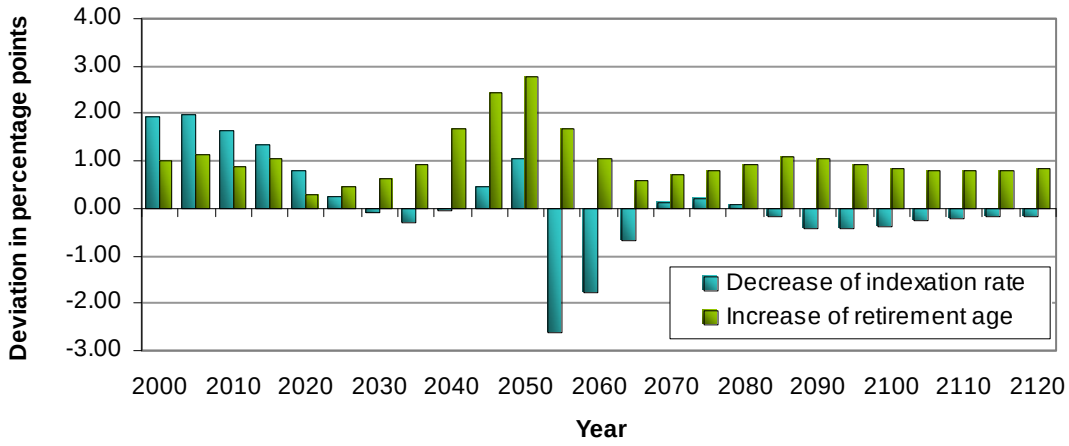
Source: Author's simulations using SIOLG 2.0.

In case of funding the pension system with revenues from labour income tax, increases of labour income tax rate would, as already said, alter the intertemporal price of leisure. The future price of leisure would decrease in comparison with the present price of leisure, resulting in substitution of future labour supply for present labour supply. Employment would consequently decrease (see Figure 10). The additional increase of labour income tax rate, needed to cover the IPDI deficit, would lead to additional reduction in the level of employment, while at the same time consumer prices would decrease in comparison with consumer prices in the reference case (Figure 8), resulting in rising real wages in comparison with real wages in the reference case (see Figure 9). The latter is certainly also a consequence of increasing labour costs due to declining number of active population.

Now consider the effect of the parameter values of the Slovenian pension system on macroeconomic trends within the Slovenian economy. Specifically, let us consider the retirement age and the level of indexation of pensions with respect to wages. Adjusting the parameter values assumed for the current pension system in this article leads to complex reciprocal effects within the economy between sources and sinks of economic activity by market participants. As Figure 11 indicates, raising the retirement age to 65 years increases the employment level as anticipated, as the activity rate in the 60-65 bracket increases significantly. Under the neoclassical assumption of perfect competition and assuming the

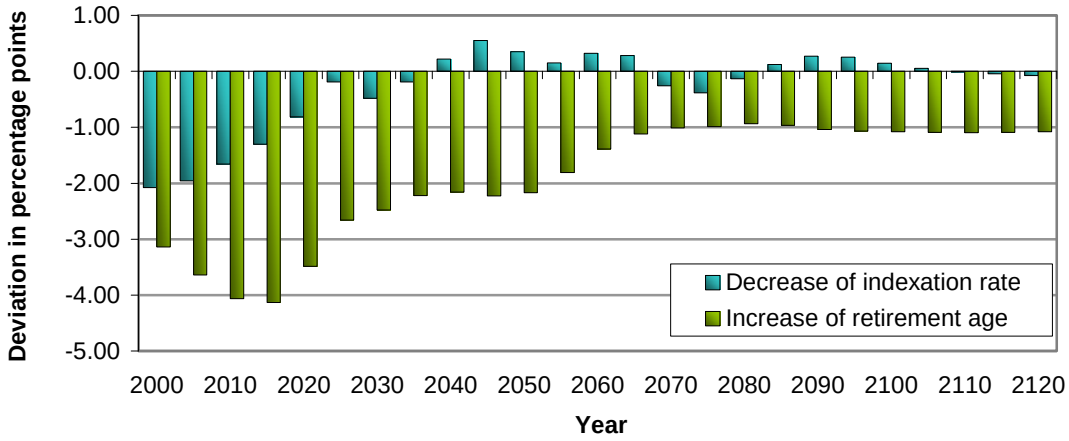
absence of a transition period for the measure, introducing a partial (80%) pension indexation also has a positive initial impact on employment (Figure 11), before the reciprocal actions of remain factors come into play and compensate for this effect. This part of the effect on real consumption, which is linked to raising the retirement age, and illustrated in Figure 12, is negative as anticipated. The effect on real consumption, related to the introduction of partial indexation, is analogous, although the reduction in consumption is less pronounced in this case (Figure 12).

Figure 11. Expected change in employment in Slovenia due to raising retirement age to 65 years and reducing the indexation level to 80 per cent



Source: Author's simulations using SIOLG 2.0.

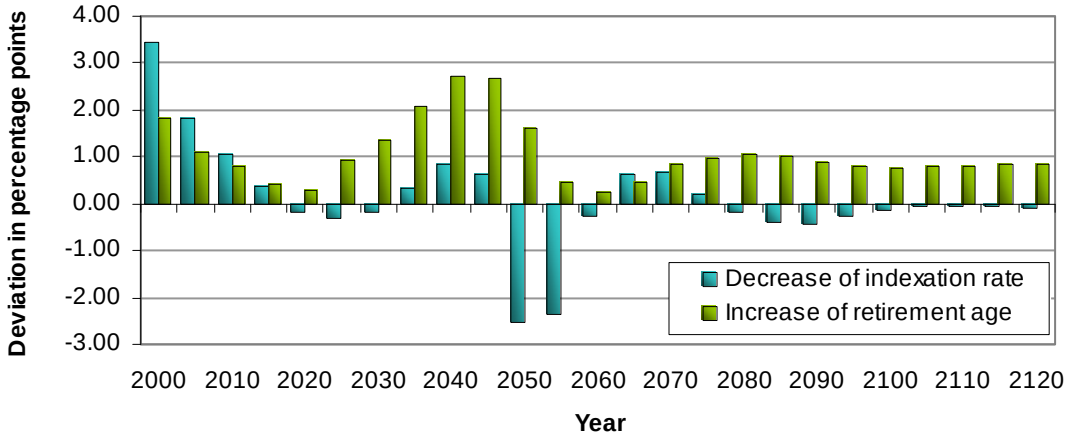
Figure 12. Expected real consumption in Slovenia due to raising retirement age to 65 years and reducing the indexation level to 80 per cent



Source: Author's simulations using SIOLG 2.0.

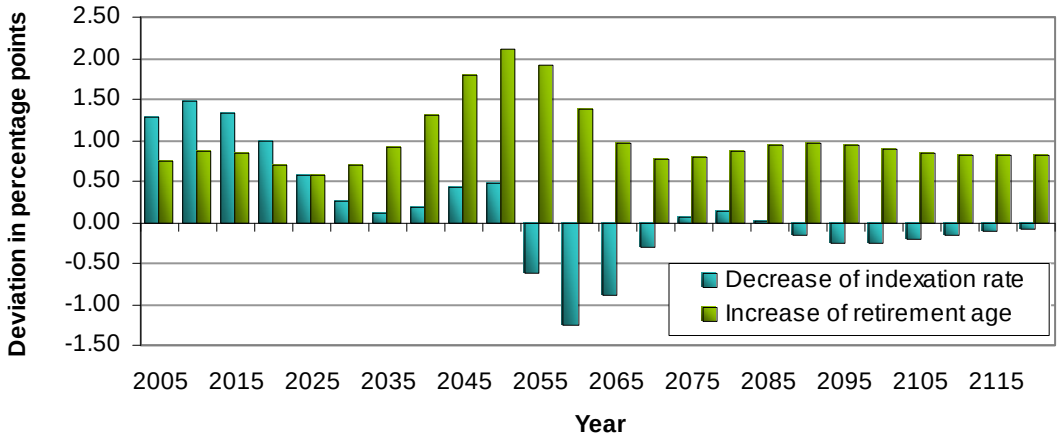
Within a PAYG pension system, the introduction of partial pension indexation leads to a reduction in the burden on current active generations to finance the pensions of retired generations, as it reduced the pressure from pension insurance contributions on employee labour costs. This can lead to increased investment, due to the release of resources, as illustrated by Figure 13. On the other hand, the increase in employment that primarily comes from raising the retirement age where no significant changes occur to the prices of production factors, leads to the balancing of capital-labour ratio, which then leads to investment activity. The latter effect is evidently more intense (see Figure 13). The consequences of higher investment activity are evident in the capital stock, which increases (Figure 14); in the long-term this applies particularly to raising the retirement age.

Figure 13. Expected change in real investment in Slovenia due to raising retirement age to 65 years and reducing the indexation level to 80 per cent



Source: Author's simulations using SIOLG 2.0.

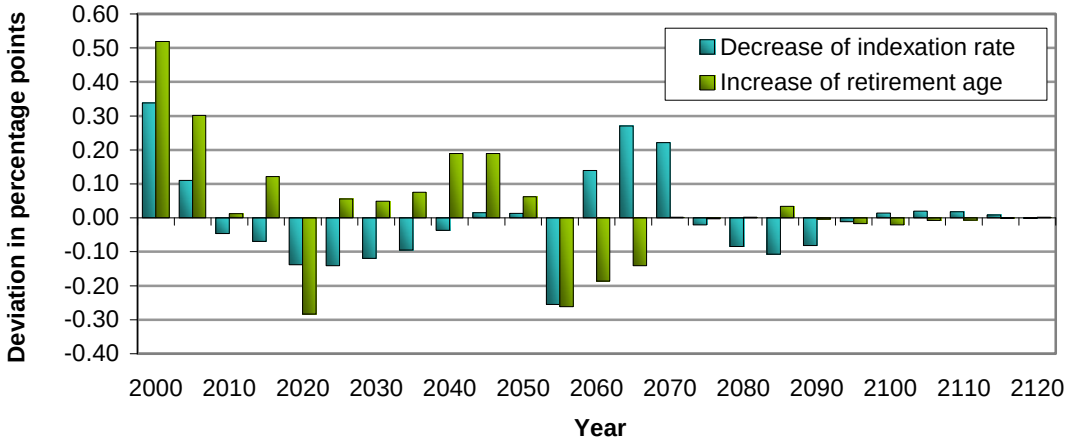
Figure 14. Expected change in capital stock in Slovenia due to raising retirement age to 65 years and reducing the indexation level to 80 per cent



Source: Author's simulations using SIOLG 2.0.

Based on Figure 15, it could be concluded that the effect of adjusting the parameter values of the current pension system on real growth of GDP is somewhat ambiguous (see Figure 15). In the case of raising the retirement age as well as introducing partial pension indexation, the initial increase in investment activity leads to somewhat higher real growth in GDP, but this effect quickly disappears and the real GDP growth change starts to fluctuate around zero. Nonetheless, the effect of adjusting the parameter values of the pension system is weak in the long-term. The demographic slowdown of the real GDP growth is undoubtedly one of the contemporary economic phenomena that have to be taken into account herein.

Figure 15. Expected change in real GDP growth in Slovenia due to raising retirement age to 65 years and reducing the indexation level to 80 per cent

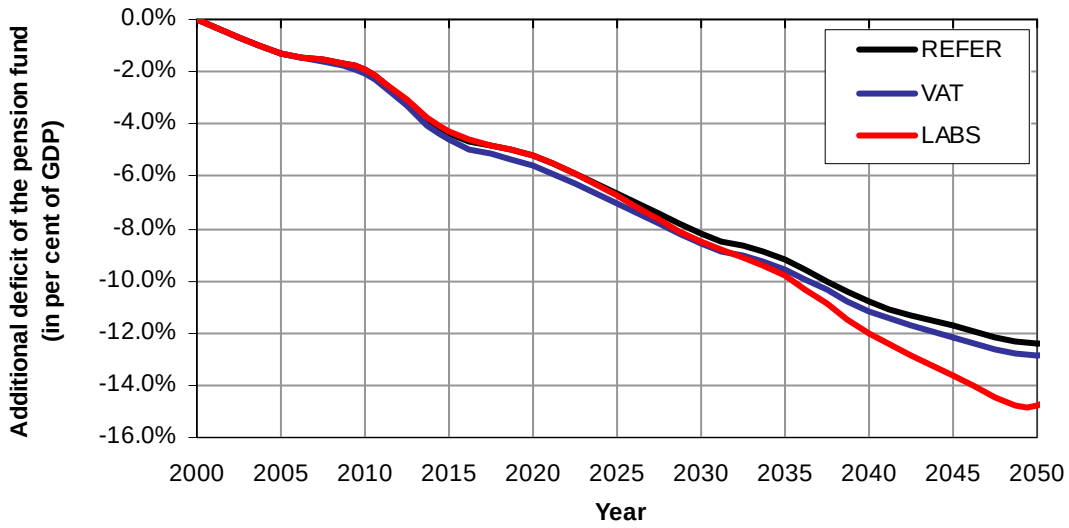


Source: Author's simulations using SIOLG 2.0.

4.3. An Analysis of Effects of the Pension Fund Deficit on Sustainability of Slovenian Public Finances

The model simulations indicate that in case of the current situation in the pension system, i.e. given retirement age of 60 years and full indexation of pensions with respect to wages, the additional IPDI deficit would grow to between 10% and 12% of GDP by 2040, given the scenario applied (see Figure 16). The significantly higher deficit seen in the scenario where the public pension system is financed with revenues from labour income tax is a consequence of growth of real wages and of a lower rate of GDP growth, compared to the reference scenario. To understand the dimensions of the forecast growth in pension expenditure, it is sufficient to mention the fact that over the period 1947 to 1951, when the pension system started functioning, the total proportion of the IPDI's funds in GDP was just 2.5% (Stanovnik and Kukar, 1995). Meanwhile, at the beginning of the 1990s, due to a drastic fall in the number of employees and the subsequent steep rise in pensioners, pension expenditure had already passed the 10% of GDP milestone, with the figure settling at around 13% of GDP following the implementation of the 1999 pension reform.

Figure 16. Additional deficit of the Slovenian state pension fund in case of applying different sources of financing the pension system (retirement age of 60 years and full indexation)

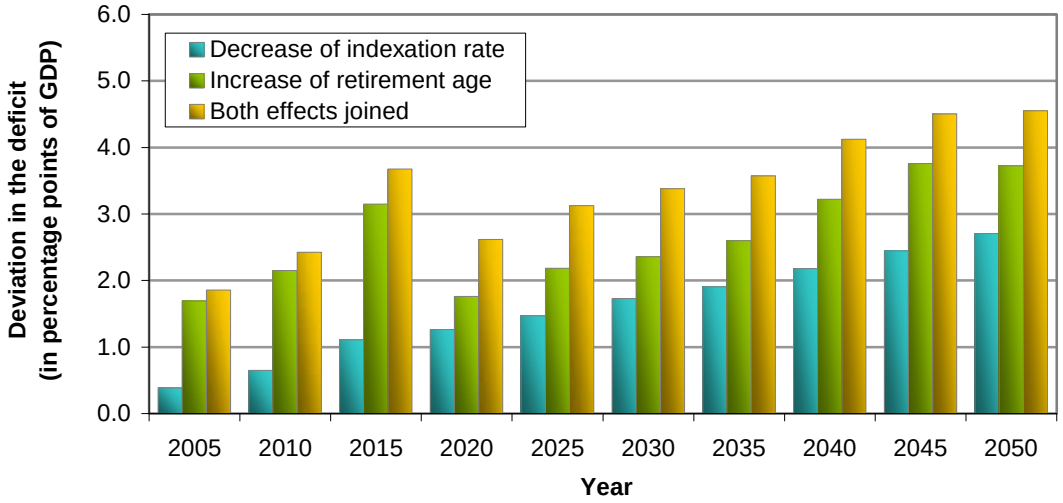


Source: Author's simulations using SIOLG 2.0.

It should be pointed out that the selection of the method for indexing pensions has an important impact on the pension fund deficit (see Figure 17); namely, the transition from full to partial (80%) indexation of pensions to wage in the counterfactual scenarios represents a reduction in the pension fund deficit in 2040 of 2.18 GDP percentage points.

Increasing the retirement age has an even more beneficial effect on the pension fund balance (Figure 17); the transition from a retirement age of 60 years to 65 years in the counterfactual scenarios represents a reduction in the pension fund deficit in 2040 of 3.22 GDP percentage points. Furthermore, the higher retirement age also defers the occurrence of an additional pension fund deficit by approximately ten years. Finally, the joint effect of increased retirement age and introduction of partial indexation of pensions would in the counterfactual scenarios represent a decrease of the IPDI deficit in 2040 by as much as 4.12 GDP percentage points.

Figure 17. Change in the deficit of the Slovenian state pension fund in case of increasing the retirement age to 65 years and decreasing the level of indexation to 80 per cent



Source: Author's simulations using SIOLG 2.0.

5. Conclusion

The article presents an analysis of welfare effects in Slovenia, an analysis of macroeconomic effects of the Slovenian pension reform and an analysis of effects of the pension fund deficit on sustainability of Slovenian public finances. Stress was layed upon varying two parameters of the current pension system; the age of retirement and the indexation rate of pensions. Thus a dynamic OLG general equilibrium model was constructed, which enables analysis of intra-generational and inter-generational redistribution effects of different strategies of public financing in order to achieve sustainable economic growth. Different scenarios were then prepared and analyzed with the model SIOLG 2.0 in order to fulfil our goal.

It has been established that by tightening the parameters of the present pension system the elderly would lose, while the present and future generations would gain. In case of introducing partial indexation of pensions, the pensions of the elderly would decrease, leading to direct negative effects on their welfare, while the pensions of the present and future active generations would indeed decrease as well, though in a PAYG system the burden imposed on them by the intergenerational contract to finance the pensions of currently retired people would evidently decrease by even more. In case of increasing the retirement age the generations that would lose the most are the ones just to be retired, while the present and future generations would gain, since by supplying more labour throughout their lifecycle they would earn more and thus they would also be able to consume more. In a PAYG pension system their pensions would be higher and the loss of welfare caused by the decreased leisure time would evidently not be high enough to compensate the positive effects of increased consumption.

From the macroeconomic perspective, raising the retirement age as anticipated increases the employment level, as the activity rate in the currently active age bracket increases significantly. Under the neoclassical assumption of perfect competition and assuming the absence of a transition period for the measure, introducing a partial (80%) indexation of pensions with respect to wages also has a positive initial impact on employment, before the reciprocal actions of remaining factors come into play and compensate for this effect. The part of the effect on real consumption, which is linked to an increase in the retirement age, is negative as anticipated. The effect on real consumption related to the introduction of partial indexation is analogous, although the reduction in consumption is less pronounced in this case.

Within a PAYG pension system, the introduction of partial pension indexation leads to a reduction in the burden for financing the pensions of retired generations on current active generations, as it reduced the pressure from pension insurance contributions on employee labour costs. This can lead to increased investment, due to the release of resources. On the other hand, the increase in employment that primarily comes from raising the retirement age where no significant changes occur to the prices of production factors, leads to the balancing of capital-labour ratio, which then leads to investment activity. The latter effect is evidently more intense. The consequences of higher investment activity are evident in the level of capital stock, which increases; in the long-term this applies particularly to the case of raising the retirement age.

The effect of adjusting the parameter values of the current pension system on real growth of GDP was nevertheless rather ambiguous. In the case of raising the retirement age as well as introducing partial pension indexation, the initial increase in investment activity leads to somewhat higher real growth of GDP, but this effect quickly disappears and the real GDP growth change starts to fluctuate around zero. The effects of adjusting the parameter values of the pension system are therefore weak in the long-term. This undoubtedly has to take into account the demographic slowdown of real GDP growth.

And finally, the selection of the method of pension indexation also has an impact on the pension deficit. The transition from a full to an 80% indexation of pensions with respect to wages in the counterfactual scenarios represents a reduction in the pension fund deficit in 2040 by 2.18 GDP percentage points. Increasing the retirement age has an even more beneficial effect on the pension fund deficit; the transition from a retirement age of 60 years to 65 years in the counterfactual scenarios represents a reduction in the pension fund deficit in 2040 by as much as 3.22 GDP percentage points. Furthermore, the higher retirement age also defers the occurrence of an additional pension fund deficit by approximately ten years. The overall effect of a higher retirement age and the introduction of the partial pension indexation is likely to lead in the counterfactual scenarios to a reduction in the pension fund deficit in 2040 by 4.12 GDP percentage points.

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