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Political (In)Stability of Social Security Reform

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Abstract

We analyze the political stability of welfare enhancing privatization of the social security. We consider an economy populated by overlapping generations, who vote on abolishing the funded system and replacing it with the pay-as-you-go scheme, i.e. "unprivatizing" the pension system. We show that even if abolishing the system is overall welfare deteriorating, the cohort distribution of benefits along the transition path turns some ways of "unprivatizing" social security always politically favorable.

Key words: pension system reform, time inconsistency, welfare

JEL Codes: H55, D72, C68, E17, E27

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1 Introduction and motivation

With aging of populations, a large number of countries underwent a reform from defined benefit pay-as-you-go (PAYG DB) pension system to defined contribution partially funded systems (FDC) between mid 1990s and early 2000s, see Holzman and Stiglitz (2001), Bonoli and Shinkawa (2006), Gruber and Wise (2009). The reforms from this period had some specific features in each of these countries, but they also shared many common characteristics. First, with no exceptions, these countries started from PAYG DB systems and honored all the pension obligations during a transition period for the cohorts not yet retired but already unable to adjust to the FDC rules. Second, these systems typically consist of multiple pillars: a mandatory PAYG DC pillar as well as a mandatory funded DC pillar.[1]

These reforms were likely to deliver long-run welfare gains, even accounting for the transition costs, see Hagemejer et al. (2015a). Yet, with the fiscal pressure ushered by the global financial crisis, many of these countries have reverted the reform, see Schwarz (2011). As scrutinized Jarrett (2011) as well as Schwarz et al. (2014), all of the Central and Eastern European countries have temporarily shifted the contributions to the mandatory pay-as-you-go pillar at the expense of the mandatory funded pillar. In addition, some of these countries – notably Hungary and to a smaller extent Bulgaria, Poland and Slovakia – have effectively nationalized the stock of private pension savings, increasing further the importance of the pay-as-you-go pillar. At the same time, none of these countries attempted to abandon the defined contribution feature of their pension systems.

One should expect a reduction in capital accumulation as well as reduction in future benefits due to lower indexation in the state-run PAYG pillars when compared to the rate of return in funded pillars. In fact, Jarrett (2011) argues that the reduction in future pension benefits amounts to about 10% for Slovakia and as much as 21-22% for Hungary and Poland. Similar figure for Poland is suggested by Hagemejer et al. (2015b). In fact, the "unprivatizations" prove to be welfare deteriorating over longer horizon. Yet, these reforms were introduced without much political or social opposition – unlike the increases of the minimum eligibility retirement age introduced in roughly the same circumstances of the global financial crisis. How come a welfare deteriorating policy of reverting the privatization of the social security meets no social unrest? Given the noticeable number of such cases, are pension system reforms establishing a funded pillar inherently politically unstable?

Political viability of the pension system privatization has received substantial attention in the literature, following the contributions from Cooley and Soares (1996), Cooley

[1] In addition, voluntary funded pillars were equipped with tax incentives to foster private old-age savings in the face of decreasing replacement rates in the obligatory pension system.

and Soares (1999).[2] This literature typically considers voting over the reform and shows how such policies gain contemporaneous political support. Privatizing social security is unlikely to deliver immediate gains, because of the gap and its financing: it typically involves cohorts with a welfare loss to be followed by cohorts with a welfare gain. Political viability necessitates either between or within cohort redistribution. For example Cooley and Soares (1999) show that relatively large DB PAYG social security can emerge as an outcome of political equilibrium, a voting coalition between low-productivity youth and the old, who all benefit from the inherent redistribution. Cooley and Soares (1996) also show that the PAYG funding of the social security system survives also the shocks to the demographic structure, such as the baby boom.

Somewhat in opposition to this approach, majority of the literature on privatizing social security *per se* emphasizes welfare and macroeconomic gains only in the long-run – with the overall efficiency gains, i.e. gains of winners are larger than losses of losers.[3] Implicitly, this type of approach is equivalent to placing the decision about the reform in the hands of a benevolent government with long-run objectives. In this paper we propose to consider the following case: a benevolent government adopts a welfare enhancing partial privatization of a social security. Does this type of reform eventually become politically stable? The economic intuition suggests that with time passing, the losing cohorts pass away and the proportions between losing and gaining cohorts gradually change in favor of the adopted reform. Is that purely demographic change sufficient for the reform to become politically stable?

We run simulations in which we allow agents to vote at different dates (once in each simulation) on reverting the original partial privatization. The living cohorts – even if they benefit from having the funded pillar in the past – may still prefer to capture the collected contributions in exchange for a contemporaneous gain from lower taxes. For such choice to be optimal, current gain must be higher than the loss due to the decrease of the future pension benefits of the living cohorts – not all cohorts. While majority of the literature asks if a reform can gain sufficient political support to get implemented, we focus the analysis on the interplay between the per-living-cohorts welfare and the changes in population structure after the reform. We thus contribute to the literature by analyzing whether the pension system reforms are politically stable – rather than just feasible. To this end, a benevolent government introduces a reform which is welfare

[2]See overviews by Galasso and Profeta (2002), Mulligan and Sala-i Martin (2004) and de Walque (2005).

[3]The general conclusion of welfare gains survives a number of sensitivity checks. Long-run gains are somewhat lower but still positive when taking into account idiosyncratic income uncertainty. For example Conesa and Krueger (1999), Nishiyama and Smetters (2007), Fehr (2009) demonstrate that it lowers the gains from privatization since the loss of insurance against bad income shocks lowers welfare. The generations alive during the transition periods lose since they have to both save for their pensions and pay higher taxes in order to finance pensions of agents who are old during reform, see for example Huang et al. (1997), which makes the reform politically challenging. Hagemejer et al. (2015a) argues that public debt allows to smooth out the cost of transition among both current and future cohorts, reducing the welfare loss for the living generations.

enhancing in the long run. The government introduces no explicit instruments of between cohort redistribution (we will allow a variant where costs of privatizing are partially funded by public debt, which implicitly redistributes the costs between cohorts). We then exogenously switch the political regime to majority voting, which unexpectedly gives agents the opportunity to revert some of the reform features at given periods, an approach similar to Phelan (2006). The date of switching the political regime is a choice variable in our study, i.e. we check at which point living cohorts do not revert the pension system reform in a majoritarian vote.

One of the intuitions we want to check concerns the role of cohort exchange in determining the political stability. Two effects are at play. On the one hand, as time passes the losing generations pass away and gaining generations are born, which is likely to gradually shift the political support for privatization among the living cohorts. On the other hand, the stock of savings accumulated in the funded pillar as well as the role the pension benefits play in financing the old-age consumption are likely to affect the welfare evaluation of reverting the reform. Namely, in contrast to the reform, which implies immediate costs and delayed gains, reverting the reform implies immediate gains and delayed costs.

The policy relevance of our study is rather immediate. Since the privatization of the pension system implies an unequal between cohort distribution of costs and benefits of the reform it is crucial for such a reform to be politically stable. Otherwise it may be the case that before societies start enjoying the benefits of the privatization itself, the reform is reverted implying a massive inefficiency: costs without gains. As evidenced by the recent wave of changes to the pension systems, such risks are not theoretical, but have already materialized in a number of countries.

To relate closely to this particular issue, the economy and the reforms have been calibrated to the case of Poland, a country that introduced a change from PAYG DB to a two-pillar DC with a PAYG pillar and a funded pillar in 1999. In 2011 this country has shifted the contributions away from the funded pillar towards the PAYG pillar, whereas in 2013 part of the savings in the funded pillar were nationalized. Such developments were not singular, which makes Poland a useful and a fairly representative case study.

Our main findings are that in general pension system reform does not become politically stable as time passes. Agents want to dismantle the reform even though it benefits the society (when taking into account current and future unborn populations). The main reason underlying their support for such a vote is the fact that reverting the reform benefits the living cohorts immediately. Nevertheless, some of the elements of the reform do gain political support with due time.

The paper is structured as follows. In section 2, we outline our overlapping generations model including the political economy component. In the next section, we describe calibration and analyzed policy options. Then, in section 4, we discuss results. Section 5 concludes the paper.

2 Theoretical model

We use the overlapping generations model in the spirit of Auerbach and Kotlikoff (1987) with exogenous productivity growth.[4] We assume that the defined contribution pension system with a pay-as-you-go and funded pillars is introduced unexpectedly in period 2. Period 1 – the first steady state – is used to calibrate the model to the case of a Polish economy prior to the 1999 pension system reform.

2.1 Firms

We assume perfectly competitive production sector that uses labor L_t and capital K_t to produce output Y_t with the Cobb-Douglas technology:

$$Y_t = K_t^{\alpha}(z_t L_t)^{1-\alpha}, \tag{1}$$

where z_t captures exogenous labor augmenting technological progress. Hence, return on capital r_t and real wage w_t are given by

$$r_t = \alpha K_t^{\alpha-1}(z_t L_t)^{1-\alpha} - d \tag{2}$$

$$w_t = (1-\alpha)K_t^{\alpha} z_t^{1-\alpha} L_t^{-\alpha} \tag{3}$$

with depreciation rate of capital denoted as d.

2.2 Households

Each agent lives for for up to J periods, with age $j \in \{1, 2, ..., J\}$[5]. Agents of the same age are homogeneous. We denote the size of cohort of age j in period t as $N_{j,t}$. Agents discount factor is denoted as δ, additionally agents may die in each period. Probability that the agent born in period t is alive in period $t+j$ is denoted as $\pi_{t,t+j}$. Agents choose consumption $c_{j,t}$, labor $l_{j,t}$ (for which they receive the real wage w_t) and savings $s_{j,t}$ (the interest rate on savings is denoted as r_t) to maximize the following utility function

$$U_t = \sum_{j=1}^{J} \delta^{j-1} \pi_{t,t+j-1} u(c_{j,t+j-1}, l_{j,t+j-1}), \tag{4}$$

where $u(c_{j,t}, l_{j,t}) = \ln c_{j,t} + \phi \ln(1 - l_{j,t})$, with $\phi \geq 0$. The budget constraint that agents face follows

$$(1-\tau_{c,t})c_{j,t} + s_{j+1,t+1} = (1-\tau_{l,t})\Psi_{j,t} + (1 + r_t(1-\tau_{k,t}))s_{j,t} + \Upsilon_t, \tag{5}$$

[4] See Belan et al. (1998), Futagami and Nakajima (2001), Shakuno (2014) for a discussion on why the exogeneity of technological progress is not relevant in the context of the pension system reform analyses.

[5] We set $J = 80$ which corresponds to $j = 1$ to 20 years and 100 years as the life time limit in the data.

where τ_l denotes income tax, τ_c consumption tax, τ_k capital income tax and $\Psi_{j,t}$ current period income from labor or pension, which is given by the following formula

$$\Psi_{j,t} = \begin{cases} (1-\tau)w_t l_{j,t}, & \text{for } j < \bar{J}_t \\ b_{j,t} & \text{for } j \geq \bar{J}_t \end{cases} \tag{6}$$

In the above formula τ denotes the social security contributions, $\bar{J}_t$ exogenous retirement age, Υ_t lump sum taxes, and $b_{j,t}$ pensions, which we discuss below[6].

2.3 Pension system

In the initial steady state the economy is characterized by the pay-as-you-go defined benefit (PAYG DB) pension system and we change the system unexpectedly in the 2 period to a two-pillar, partially funded defined contribution (FDC).

In the PAYG DB system contributions go into the public fund which are used to pay pensions of retired. If there is deficit in the pension fund the government is obliged to finance it, denoted as $subsidy_t$. The budget constraint of the pension fund under PAYG DB is thus given by:

$$\sum_{j=\bar{J}}^{J} N_{j,t} b_{j,t}^{PAYG-DB} = \tau \sum_{j=1}^{\bar{J}-1} N_{j,t} w_{j,t} l_{j,t} + subsidy_t. \tag{7}$$

In the FDC system there are two pillars: the pay-as-you go and the funded one. Both are defined contribution, with τ^I denoting the contribution rate to the PAYG pillar and τ^{II} denoting contributions to the funded pillar with $\tau^I + \tau^{II} = \tau$. Keeping the total contribution rate constant allows to maintain the distortions unchanged after the pension system reform and replicates the features of the actual reform implemented in Poland. Similarly, b^I and b^{II} denote benefits from, PAYG and funded pillar, respectively. Contributions to the the PAYG pillar are recorded and indexed at the rate r_t^I which is equal to payroll growth in the economy. Such choice, again, replicates the features of the reform implemented in Poland. Contributions to the funded pillar are invested with return r_t^{II}=r_t. At retirement both stocks of contributions are converted to an annuity, but the difference between indexation in the PAYG pillar and accruing interest in the funded pillar remain[7]. Moreover, the pension benefit from the PAYG pillar is indexed by 25% of the payroll growth, again, replicating the features of the Polish pension legislation.

[6] We assume that unintended bequests are redistributed within the same cohort.

[7] Savings of pensioners who died earlier in the funded pillar are used to finance pensions of pensioners that live longer.

Summarizing, the pension benefits are given by:

$$b^I_{j,t} = \begin{cases} 0, & \text{for } j < \bar{J}_t \\ \frac{\sum_{s=1}^{\bar{J}_t-1}\left[\Pi_{i=1}^{s}(1+r^I_{t-j+i-1})\right]\tau^I_{t-j+s-1}w_{t-j+s-1}l_{s,t-j+s-1}}{\prod_{s=\bar{J}_t}^{J}\pi_{s,t}}, & \text{for } j = \bar{J}_t \\ (1+0.25\cdot r^I_t)b^I_{j-1,t-1} & \text{for } \bar{J} < j \leq J \end{cases} \tag{8}$$

$$b^{II}_{j,t} = \begin{cases} 0, & \text{for } j < \bar{J}_t \\ \frac{\sum_{s=1}^{\bar{J}_t-1}\left[\Pi_{i=1}^{s}(1+r^I_{t-j+i-1})\right]\tau^{II}_{t-j+s-1}w_{t-j+s-1}l_{s,t-j+s-1}}{\prod_{s=\bar{J}_t}^{J}\pi_{s,t}}, & \text{for } j = \bar{J}_t \\ (1+r^{II}_t)b^{II}_{j-1,t-1} & \text{for } \bar{J} < j \leq J \end{cases} \tag{9}$$

Consequently, the balance in the PAYG pillar, to be financed by the government via $subsidy_t$, is given by:

$$\sum_{j=\bar{J}_t}^{J} N_{j,t}b^I_{j,t} = \tau^I_t \sum_{j=1}^{\bar{J}_t-1} N_{j,t}w_t l_{j,t} + subsidy_t. \tag{10}$$

In the funded pillar, the collected contributions are invested, earning the return $r^{II}_t = r_t$. Therefore, the funded pillar savings of agent aged j in period t evolve according to:

$$s^{II}_{j+1,t+1} = (1+r^{II}_t)s^{II}_{j,t} + \tau^{II}_t w_t l_{j,t}. \tag{11}$$

The pension system reform as described above constitutes the baseline scenario. First, we establish the initial steady state of the PAYG DB economy. In period $t = 2$ social security system is unexpectedly changed to a defined contribution with a PAYG and funded pillars. Despite the reform, the pension benefits of the living retirees are honored. The reform affects cohorts born after 1950, i.e. cohorts of age $j \leq 49$ in period $t = 2$. The analyzed scenarios will comprise changes to this pension system.

2.4 Government

Government collects taxes in order to finance some exogenously given government expenditure, pension system deficit and to service outstanding debt. The revenues of the budget are defined by:

$$T_t = \tau_{l,t}\big[(1-\tau)\sum_{j=1}^{\bar{J}} w_t l_{j,t}N_{j,t} + \sum_{j=\bar{J}_t}^{J} b_{j,t}N_{j,t}\big] + \sum_{j=1}^{J}(\tau_{c,t}c_{jt} + \tau_{k,t}r_t s_{j,t})N_{j,t}, \tag{12}$$

which implies the government budget constraint of:

$$G_t + subsidy_t + r_t D_{t-1} = T_t + (D_t - D_{t-1}) + \sum_{j=1}^{J} N_{j,t} \Upsilon_t,$$

where G_t denotes government expenditure and D_t government debt. Furthermore, we assume that the budget constraint is closed with the government debt whenever feasible, i.e. the debt cannot exceed certain threshhold (as a rate in GDP). When this threshhold is passed, consumption taxes adjust accordingly. In order to assure that the debt returns to the steady state in the long run we assume the following fiscal rule on the consumption income tax:

$$\tau_{c,t} = (1 - \varrho)\tau_c^{final} + \varrho \tau_{c,t-1} + \varrho_D (\frac{D_{t-1}}{Y_{t-1}} - \frac{D^{final}}{Y^{final}}) \tag{13}$$

where ϱ measures the autoregression of the tax rate, and ϱ_D the strength of reaction to deviation of government debt from its steady state values. The values of τ_c^{final} and D^{final}/Y^{final} denote in the new steady state values of consumption tax and debt share in GDP, respectively.

2.5 Closing the model

The model is closed with clearing conditions for the goods market:

$$\sum_{j=1}^{J} N_{j,t} c_{j,t} + G_t + K_{t+1} = Y_t + (1 - d) K_t, \tag{14}$$

the labor market:

$$L_t = \sum_{j=1}^{\bar{J}_t - 1} N_{j,t} l_{j,t}, \tag{15}$$

and the capital market:

$$K_{t+1} + D_{t+1} = \sum_{j=1}^{J} N_{j,t} (s_{j+1,t+1} + s_{j+1,t+1}^{II}). \tag{16}$$

2.6 Political economy

We allow agents to (unexpectedly) vote on keeping the reformed pension system intact or to make some changes. We allow for different dates of such a voting to see how the political decision changes with the changing demographic structure and the progress of financing the initial privatization of the social security. We assume in each simulation that once there is sufficient political support for a given change, agents treat is as remaining intact henceforth (i.e. they never vote again and expect no subsequent changes).

We allow voters to vote on two elements of the pension system. First, voters can decide about diverting social security contributions away from the funded pillar to the

PAYG pillar. We call such change i which we call shift of contributions and denote in the reminder of this paper as Policy 1. It mimics the type of changes that have been temporarily or permanently implemented by all Central and Eastern European countries in the aftermath of the global financial crisis. Since in most countries which followed policy of this type, some contributions continue to be transferred to the funded pillar, instead of completely removing it, we change the proportions. More specifically, prior to any voting $\tau^I = 2\tau^{II}$ whereas the vote changes to $\tilde{\tau}^I = 5\tilde{\tau}^{II}$. Naturally, in this scenario we keep the total social security contributions as well as other features of the system intact.

Second, voters can decide that assets are transferred from the funded pillar to the PAYG pillar. We implement it in our model as a shift of all accrued contributions from the funded pillar to the PAYG pillar for each retiring cohort at retirement. We call this policy shift of pensions and in the reminder of the paper denote as Policy 2. Such changes have been implemented by Hungary, Bulgaria, Poland and Slovakia, although to a differing extent. In Hungary the nationalization of accumulated assets was immediate and complete, whereas in the other countries it is more or less gradual. Thus, as opposed to the system as described in Section 2.3, at retirement all accrued contributions become public, whereas pensions are subsequently indexed according to equation (8) for $\bar{J} < j \leq J$ rather than earn actual interest. This is why our agents savings in the second pillar are transferred to the public pension funds and pensions are calculated according to:

$$b^I_{j,t} = \begin{cases} 0, & \text{for } j < \bar{J}_t \\ \dfrac{\sum_{s=1}^{\bar{J}_t-1}\left[\Pi_{i=1}^{s}(1+r^I_{t-j+i-1})\right]\tau^I_{t-j+s-1}w_{t-j+s-1}l_{s,t-j+s-1}+s^{II}_{j,t}}{\prod_{s=\bar{J}_t}^{J}\pi_{s,t}}, & \text{for } j = \bar{J}_t \\ (1+0.25\cdot r^I_t)b^I_{j-1,t-1} & \text{for } \bar{J} < j \leq J. \end{cases} \tag{17}$$

If this policy gains polititical majority, for all cohorts after the voting

$$b^{II}_{j,t} = 0, \tag{18}$$

which too replicates the features of the changes in the pension systems among the CEECs.

In some of the countries, both Policy 1 and Policy 2 were implemented. Thus, in our setting a third policy option is the combination of the two, i.e. voters can express support for both shift of contributions and shift of pensions in the same voting. We call this Policy 3.

Note that each of these policies has different effects on the welfare of the living as well as future cohorts. Policy 1 reduces the amount of contemporaneous deficit in the PAYG scheme at the expense of slower capital accumulation and lower pension benefits after the retirement. With general government consumption fixed, reduction in $subsidy_t$

allows for a contemporaneous reduction in taxes, relative to the baseline scenario, thus yielding a moderate but immediate benefit. While future pension benefits are likely to be lower, this can be compensated for by the private voluntary savings of the agents. Note however, that interest earned on private voluntary savings is subject to capital income tax, whereas the contributions to the funded pillar are not. Thus, distortions in the economy decrease due to lower consumption taxes, but increase due to higher capital taxes. Policy 2 reduces immediately the debt of the government (government collects the large transfer to the pension system). Since the stock of accrued contributions is high (and increases with time until cohorts in the new pension system start retiring), government debt rather than current expenditure is reduced. This allows current and future taxes to be substantially reduced, because the costs of servicing public debt are decreased (reduction in the outstanding government bonds). With the fiscal rule described in equation (13), taxes do not adjust immediately, but the reduction in consumption taxes is nonetheless large. Clearly, it is accompanied by a much lower path of benefits.

As a voting procedure we employ pure majority voting. Also, agents have no altruistic motives. Only agents living at the times of vote can do that. An agent is in favor of a given policy if her subsequent lifetime utility is higher than in the *status quo*. We operationalize utility from a policy change as consumption equivalent, discounted to the age of $j = 1$. Agents with negative consumption equivalents are not in favor of a policy change, thus the change is implemented if at least 50% of the living cohorts, weighted by the size of the cohort, benefit from a policy change.

The ordering of the votes is as follows. First, agents choose between the baseline scenario of no policy change and Policy 1. Then, agents vote between the winner of this vote and Policy 2. Finally, in the last vote agents choose between the winner of the previous vote and Policy 3, i.e. a combination of Policy 1 and Policy 2. We have tested explicitly if the preferences are transitive in the case of our set up. The sequence of voting has proven to be irrelevant for the final outcome, see also Dhami and al Nowaihi (2010). Given the schedule of voting, after each round we implement the policy which had the highest support vis-a-vis the alternatives.

3 Calibration and description of simulations

We calibrate the model to match the features of the Polish economy as an example of a country which implemented the partial privatization of the social security and continued with essentially unchanged features of the pension system for over a decade. To avoid bias due to the cyclical effects, we rely on averages for a decade prior to the pension system reform in 1999. We use the detailed demographic projection released by the Aging Work Group (AWG) of the European Commission to reproduce the arrival of new cohorts to the economy as well as annual survival probabilities for each cohort. The projection is

available until 2060. We take a conservative assumption that the population stabilizes after that, so as of 2140 there are no changes in the size, nor the age structure of the living cohorts. We also use the projection for the exogenous technological progress from AWG as of 2010, whereas for the years between 1999 and 2010 we use the actual data on the TFP growth estimated for the Polish economy. The AWG scenario for productivity assumes gradual convergence to the average EU level of 1.7% *per annum* between 2010 and 2040 and a stable growth at this rate thereafter. These assumptions are used in both the baseline scenario and for simulating the outcomes of the policy change.

The retirement age $\bar{J}$ is calibrated to the actual data on effective retirement age collected by the OECD and was assumed to increase gradually. Thus it equals 61 in 1999 and grows by one additional year in each decade until it reaches 67 in 2070. We use the actual data on employment rate from the Labor Force Survey to calibrate the preference for leisure ϕ. Subsequently, we seek the discount rate δ that would be consistent with an interest rate of approximately 7.5%, as observed in the economy in real terms between 1990 and 1999. This level prevailed also after the reform of 1999, as this was the average net rate of return recorded in the funded pillar between 1999 and 2012. We set the depreciation rate d that would be consistent with an investment rate of approximately 20% share in GDP, as observed in the data. Following the standard in the literature, we assume the $\alpha = 30\%$. The share of government expenditure in GDP is set at 20% to replicate the actual proportions. The capital income tax τ_k is set at *de iure* rate of 19%. The labor income tax τ_l was calibrated to replicate the ratio between the labor income tax revenues and the labor revenue in the national accounts, thus at its effective rather than nominal rate. The replacement rate in the PAYG DB system was set as to replicate the share of pensions in GDP prior to the reform of 1999. Knowing the replacement rates, we set the overall contribution rate τ to reproduce the pension system deficit as observed in the years prior to the reform at 1.5%. The split between τ^I and τ^{II} follows the proportions set by Polish legislation. We also assume that the initial and final government debt to GDP ratio equals 45%, which corresponds to the value of government debt in the late 90s in Poland.

Parameters are summarized in Table A.1.

The solution of an individual perfect foresight agent is computed recursively using the Gauss-Seidel algorithm. Once it is established for the initial steady state, it is also computed for the final steady states, depending on the policy option. Thus, there are four possible final steady states. In the baseline scenario of no policy change we set the transition path between the initial and the adequate final steady state. We guess the path of capital per worker in each period and recursively, using the Gauss-Seidel algorithm find equilibria for each period. We compute w and r. Subsequently y is computed and used to calculate variables related to pension system and government sector, such as G, T, S, D, Υ as well as the individual benefits $b_{1,j}$ and $b_{2,j}$. From the computation of policy functions, choice variables c_j, s_j and l_j are computed. Finally, k is updated in

order to satisfy market clearing. This procedure is repeated until the difference between k from subsequent iterations is negligible[8]. Once the equilibrium is reached, utilities are computed and discounted to reflect utility of the first generation in our model, i.e. 20-year old. We set the length of the transition path in order to assure that the new steady state is reached, i.e. last generation analyzed lives the whole life in the new demographic and policy steady state. The last voting takes place when all cohorts are already collecting pension benefits from the reformed system (i.e. 160 periods after the original reform of 1999), so the policy stabilizes at the latest in 2232. The population stabilizes in 2140. We thus set the length of the path to 450 periods.

In the case of the policy change scenarios, until each exogenously assumed policy vote date, we assume that the economy pursues the path from the previous voting. Before the first voting in 2012, we assume that the economy follows the baseline scenario. If the majority votes in favor of a given policy change, the voting over the other policy changes happens with reference to the *status quo* policy, not the one that already gained support. For example, in year 2012, the baseline scenario is always the original pension system reform. Thus, to adopt Policy 3, for example, it would have to have a higher level of support than Policy 1 and Policy 2, relative to the baseline. In other words, in subsequent voting in a given period agents do not update the baseline to incorporate the already supported policies, but always compare to the *status quo* of no policy change. We analyze these scenarios in the next section.

4 Results

The original pension system reform from 1999 seems to have been welfare enhancing in general. Hagemejer et al. (2015a) provide evidence that regardless of the model specification and the accompanying fiscal policy, the overall efficiency gain amounts to approximately 2-5% of lifetime income (obtained as a consumption equivalence). However, the moment when more than half of living cohorts gain from the reform may indeed be distant, see Figure A.1. Thus, the reform is clearly preferred by the benevolent government, but would not be feasible under majority voting. Notwithstanding, gradually, the share of gaining cohorts exceeds 50%, which implies that eventually political support for the previously adopted solution should be sufficient to preserve it.

The proposed policy alternatives, over which subsequent votes are held, are each welfare deteriorating. The overall welfare effect of Policy 1 is -0.32%, of Policy 2 is -0,20% and for Policy 3 amounts to -0.42% of permanent consumption.[9] Thus, they would not be chosen by a benevolent government. Yet, they may receive sufficient support among

[8]In each iteration, error is computed as the l_1-norm of the difference between capital vector in subsequent iterations.

[9]The values come from a sample voting round in year 14 of the reform. Detailed results from other years are available upon request.

the living cohorts in subsequent majority votes. The original pension reform takes place in 1999. Next, we check how support for dismantling the pension reform changes in time. We allow voters unexpectedly to vote on dismantling the pension reform. In the first simulation we assume that this voting takes place in 2012. We run simulations assuming that voting takes place in 2022, 2032 and 2042.[10] In order to develop intuition for our result we present more detailed analyzes of cost and benefits of such a policy change in case of 2012 and 2042 voting. We show what is the outcome of voting on the three alternative policies at 10 year intervals, as the population structure changes and the costs of the initial pension system reform materialize. We discuss in detail the welfare effects of the winning policies. We also show some of the macroeconomic effects of policy changes.

4.1 The effects of reforms on selected variables

The effect of all three policy changes on pensions, taxes and government debt in case of 2012 and 2042 voting are presented in Figure A.5. Policy 1 redirects contributions from the funded pillar to the PAYG pillar. This shift lowers pension benefits for two reasons. First, the return in the PAYG pillar equals to the payroll growth, which is lower than the interest rate in the funded pillar (see Figure A.4). This lowers the effective replacement rates. Second, pensions in the capital pillar are indexed with the interest rate and in the PAYG pillar with 25% of the payroll growth. At the same time shifts of contributions reduces the deficit in the public pension fund and results in lower consumption taxes (given our fiscal rule the government debt returns to the initial level, taxes remain lower forever). This shifts some of the burden of financing pensions of current generations on future generations and benefits current ones. In other words implicit debt (in the PAYG pillar) permanently increases. The benefits for current generations manifest in lower taxes. Interestingly, these effects are independent of the timing of voting (compare the effects of Policy 1 on Figure A.5).

Policy 2 means that accrued contributions in the funded pillar are shifted to the PAYG system and used to finance current pensions. This does not affect replacement rates at retirement, but this shift substantially lowers the indexation rate of pension benefits and results in lower average pension benefits. Differently than in case of Policy 1 the decline in pensions in case of 2012 voting is quite small comparing to the case of 2042 voting. This is because in 2012 the funded is operating for 15 years only, and for most voters share of pension coming from this pillar is small. However, in the case of 2042 voting the result is different. Since, by 2042, the funded pillar collects the contributions from an entire set of working cohorts, it contributes much larger share of pension benefits for most voters. At the same time this policy leads to smaller deficit in the PAYG pillar,

[10] Please note, that in 2042 all of the initial retirees are already deceased, i.e. there is no more costs of paying out pensions without contributions. Detailed results for subsequent votes in 2052 until 2152 available upon request.

shifting the burden of pension financing to the future generations. This benefits current generations as it allows to substantially reduce tax rates contemporaneously, although it leads to a higher implicit debt (in the PAYG system).

The effects of Policy 1 and Policy 2 add up in Policy 3. Pension benefits are lower, but the taxes drop even stronger and the fiscal burden of future pensions financing is shifted to the future generations (growth of an implicit debt). Similarly as in the case of Policy 2 the decline in pension benefits is much smaller if "unprivatization" is implemented in 2012 than in 2042.

All policy changes have little effect on macroeconomic variables. Lower consumption taxes create less distortions in the intra-temporal choice between consumption and leisure, so labor supply slightly increases, see Figure A.5. Dismantling of the funded pillar leads to lower aggregate savings and lower capital per worker, see Figure A.5. There is some initial increase in capital per worker in the first years after the reform, these are the transitory cohort responding with higher savings to lower future pensions facilitated with lower taxes today.

4.2 Voting results and welfare considerations

The results of subsequent votes on Policies 1, 2 and 3 are presented in Table A.2. Surprisingly, agents always want to dismantle some of the elements of the funded system. Initially, if voting takes place in 2012 or in 2022 they choose Policy 3, i.e. the combination of shifting the contributions and shifting the pensions to the PAYG pillar. If the voting takes place after 2022 they only want to shift contributions to the PAYG system (Policy 1). As expected, support for pensions shift declines with time and it turns out that if such a reform survives initial years voters would want to preserve the funded pillar. However, support for shifting contributions does not decline in time and agents always want to shift contributions from the funded to the PAYG pillar.

Interestingly, voters support it even though such a policy change lowers overall welfare - the aggregate consumption equivalent for all cohorts is negative, but for the living ones is positive. The reason for that is that even though all these policy changes deteriorate overall welfare they improve the situation of the largest fraction of agents living at the period of voting at the expense of future generations. Figure A.6 shows consumption equivalent of all three policy changes (against no policy change) in case of 2012 and 2042 voting. In the case of 2012 voting both considered policy changes benefit the living generations and disadvantage future generations (who cannot vote). In the case of 2042 voting only Policy 1 benefits the living generations (still deteriorating the welfare for the future generations who cannot vote), but Policy 2 and 3 do not.

Each policy change lowers the pension benefits in the future, but allows to lower taxes immediately, especially in the periods directly after the policy change. At the same time implicit debt increases as the burden of pension benefits financing in the future is shifted

on future generations. Note also that agents have perfect foresight and are fully rational – expecting lower pension benefits they are still able to make provisions for smoothening lifetime consumption by increased private savings. It is easier if contemporaneous taxes drop.

Clearly, the analyzed policies affect young and old living generations differently. Thus, there is an important difference in case of earlier versus later voting dates. Early, the funded pillar is relatively small. Therefore, Policy 2 only marginally lowers the average pension benefits. However, with increasing participation in the funded pillar, shifting pensions has bigger effect on welfare of the living generations, reducing the voters support, compare Figure A.6. Therefore, initially the effect of lower taxes prevails over the effect of lower pensions for all three policy changes, but as time passes it remains true only for Policy 1.

4.3 Sensitivity of the results

Given these results and their key drivers, the selected fiscal adjustment in the aftermath of the voting indeed plays an important role. In fact, one could think of a benevolent government more interested in explicit debt than in implicit debt, thus considering to revert the reform to strengthen fiscal stability of an economy. We thus consider alternative fiscal closures. Notably, we allow the government to predominantly use up the stock of savings captured from the pension system to reduce the outstanding public debt and only then adjust taxes downward. The advantage of this closure is that it makes it also less appealing to the voting cohorts, who cannot claim immediate gains from reverting the pension system reform. To make this fiscal adjustment clearly discernible from the original, we also lower the final steady state value of debt share in GDP to 15%. This scenario is thus of particular interests for two reasons. First, it is not obvious if unprivatizing social security is still going to be politically attractive for a majority of living cohorts. Second, it relaxes our initial assumption that a benevolent government is replaced by a democratic vote: in fact it is a change of weights attributed to explicit and implicit debt.

In practice, in the initial approach we allow taxes to be reduced for as long as debt does not exceed 55% of GDP. To avoid sudden shifts in the value of debt (or taxes) we impose a fiscal rule of partial adjustment in both, with clear preference for reducing the tax rate, see equation (13). It is only in year 2462 that we impose gradual convergence of debt share in GDP to 45%. In this sensitivity analysis we rely on the opposite logic. We remove the fiscal rule and put a 100% priority on reducing the public debt. This continues until debt share in GDP reaches a final steady value of 15%, only then we allow taxes to decrease.[11] This type of fiscal rule clearly postpones the potential gains

[11] Technically, when debt share in GPD hits 14% threshold, a fiscal rule for very slow exponential convergence to 15% is triggered.

from shift of contributions and/or pensions and reduces them substantially for the living cohorts. It is also characterized by long-term benevolence in a sense that the final tax rate is lower if the pension system is unprivatized than the *status quo*. Yet, it is still welfare deteriorating in aggregate terms.

The paths for adjustment in taxes and debt share in GDP are displayed in Figure A.7 in the Appendix. Indeed, the discounted downward adjustment in taxes is about 40%[12] of what it was in the original simulations. Despite delaying the gains and reducing their size, it is still preferable to revert the pension system reform. Indeed, the gains from slightly lower taxes still overweight the loss from lower pension benefits, even if the government responsibly uses the captured assets to reduce the public debt. In fact, such reverting of the reform continues to be welfare deteriorating, see Table A.3 Yet, they gain majority political support. Clearly, these effects appear only with later voting – the amount of assets accumulated in the pre-funded system needs to be sufficient to finance a reduction in debt and still permit the cut in taxes. This is why the funded pillar is politically stable in 2012 (unlike the initial specification), but privatization is reverted already in 2022.

This sensitivity analysis seems to corroborate our initial finding that the pension system reforms from a PAYG system to a funded system are inherently politically unstable. We show that even though the reverting of the reform is mildly welfare deteriorating, it gives the living (and thus voting) cohorts immediate gains at the expense of future generations. This gain is sufficient even in the case of a relatively large reduction in debt accompanied by a relatively minor reduction in taxes.

5 Conclusions

The literature on the effects of privatization of social security with aging population is extensive. It mostly finds that even if such a reform is welfare improving, it benefits mostly future generations while cohorts working during transition usually incur a welfare loss. It means that as time passes the fraction of living agents benefiting from the reform is increasing. Hence an intuition that support for such a reform increases in time and at some point it should become politically stable. In our paper we show that this intuition is not actually true.

We develop an OLG model with an exogenous pension system reform in period 2, which introduces a partially funded two-pillar defined contribution system in the place of a pay-as-you-go defined benefit system. Because in the model the obligations associated with the pension benefits of the initially old generations are honored, the reform introduces a large welfare cost to most of the living cohorts. While we allow the public debt to increase in response to the reform, taxes also need to adjust, thus making the

[12] Computed numerically as a present value of differential between the two intergrals (time path of tax rates).

living cohorts pay not only their own pension contributions, but also finance partially the inherited DB pension benefits. As the initial retirees die, the pension system reform becomes beneficial to all living cohorts. On exogenously chosen dates we allow the agents to vote over shifting the contributions and/or the pensions away from the funded pillar towards the PAYG pillar. We gradually shift the date of the voting on these three options more and more towards the future. We find that the political support for the shift of pensions decreases as the role of pensions from the funded pillar grows. However, even 150 years after the initial reform, there is still sufficient political support to shift the contributions away from the capital pillar and towards the PAYG pillar. In fact, this support is high and constant in time. Shifting contributions results in lower pension benefits in the future, but provides an immediate fiscal relief via lower taxes. Also the accumulating deficit in the pension system will burden the future generations, who cannot vote – it is implicit rather than explicit. Thus, if allowed to vote, the living cohorts will always acquire this short-term welfare gain at the expense of the future generations.

One possible interpretation of these findings is that the contribution rate to the capital pillar has been set at excessively high level, so rational agents adjust it downwards to the preferred levels. However, the net welfare effect of shifting the contributions away from the funded pillar is negative – it is positive only for the living cohorts. Thus, our findings should rather be interpreted as an evidence that pension system reforms following the guidelines of The World Bank from 1990s and early 2000s may suffer from the credibility shortage. In fact, even if they last for as long as a generation, they only become immune to the risk of shifting the pensions. The risk of shifting the contributions is permanent and thus should be taken into account when designing pension system reforms. Notably, if pensions and/or contributions are shifted away from the capital pillar, such unstable reform generates only welfare costs, because the welfare gains do not materialize.

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Appendix

Table A.1: Calibrated parameters

α	capital share	0.30
τ_l	labor tax	0.11
ϕ	preference for leisure	0.53
δ	discount factor	0.98
d	depreciation rate	0.055
τ	soc. security contr. rate	0.0645
ρ	replacement rate	0.305
		resulting
dk/y	investment rate	0.21
D/y	debt to GDP ratio	0.45
r	interest rate	0.075

Table A.2: Political support for the three analyzed policy scenarios

	2012	2022	2032	2042	2052
Winning scenario	3	3	1	1	1
Welfare effect	-0.42	-0.32	-0.24	-0.20	-0.16
Political support			against *status quo*		
for Policy 1 in %	99	99	99	99	99
for Policy 2 in %	82	74	47	48	26
for Policy 3 in %	99	99	99	62	50

Note: detailed results for subsequent voting rounds available upon request. Welfare effects in % of permanent consumption.

Figure A.1: Share of living population gaining from the reform, weighted by cohort size, based on Hagemejer et al. (2015a)

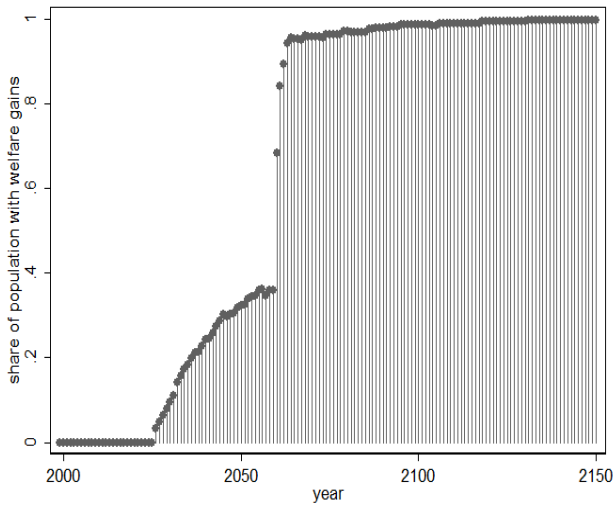
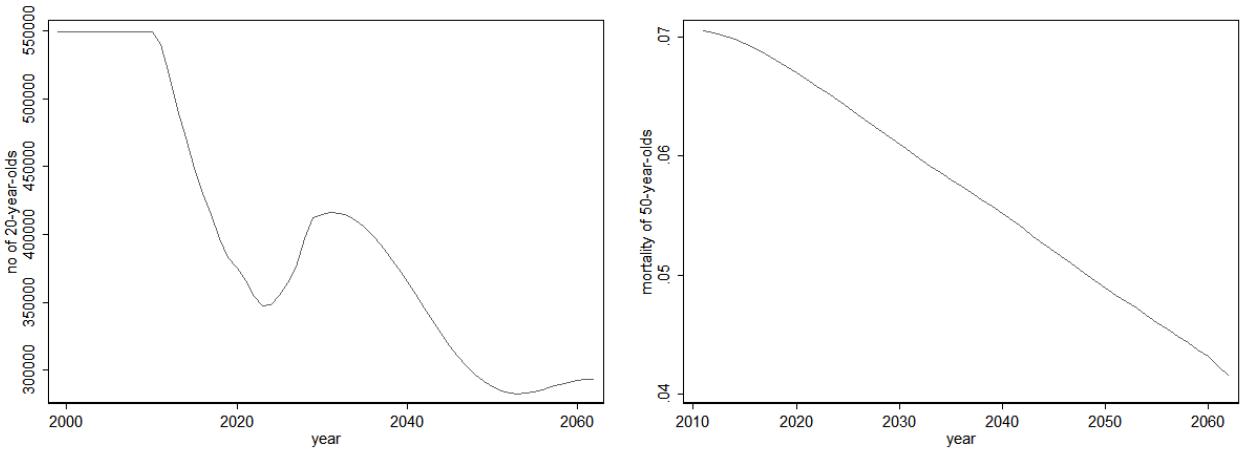
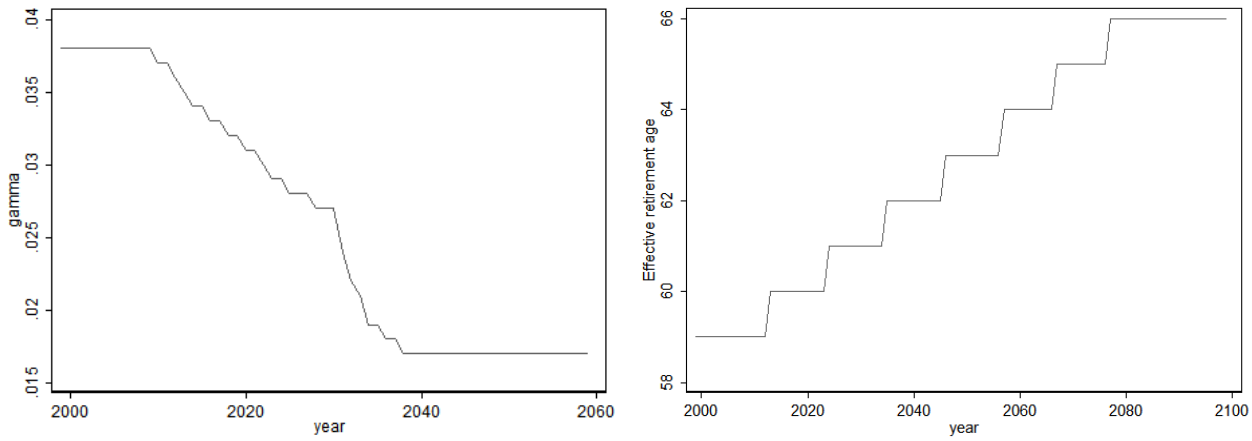


Figure A.2: No of 20-year-olds arriving in the model in each period (left) and mortality rates across time for a selected cohort.



Source: EUROSTAT demographic forecast until 2060

Figure A.3: Labor augmenting productivity growth rate projection (left) and actual retirement age in economy, past values and forecasts.



Source: technological progress rate following European Commission & effective retirement age based on OECD, afterwards it is an assumption.

Figure A.4: Interest rate and payroll growth rate in no policy change scenario.

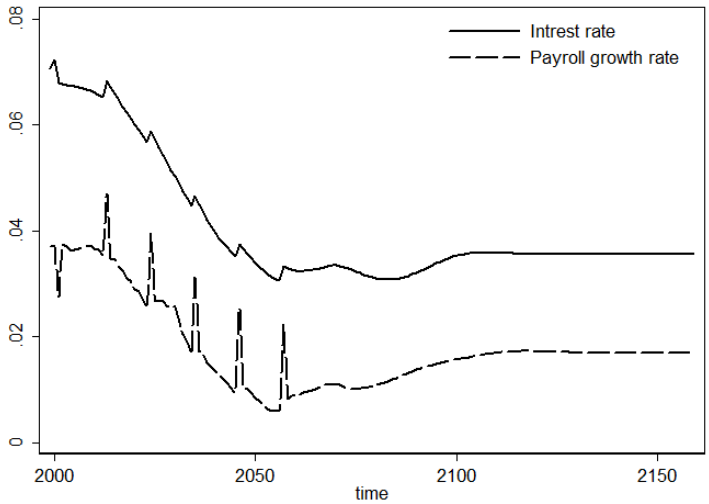
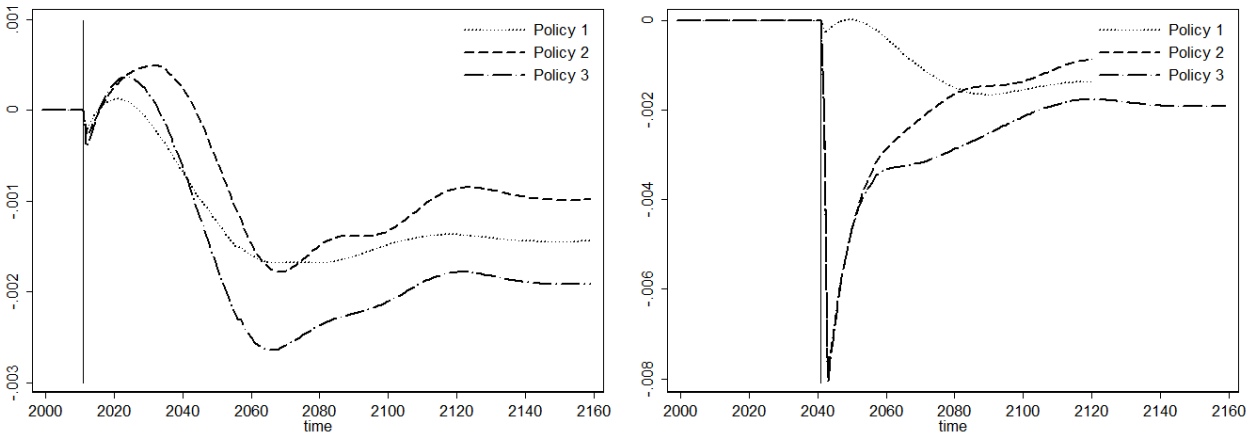
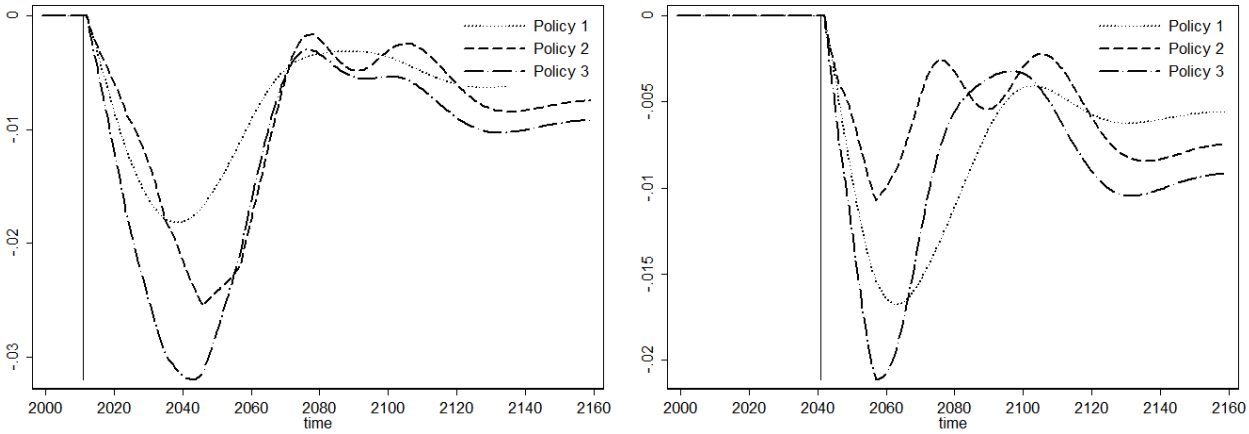


Figure A.5: The effect of the policies on selected variables in case of 2012 (left) and 2042 (right) voting.

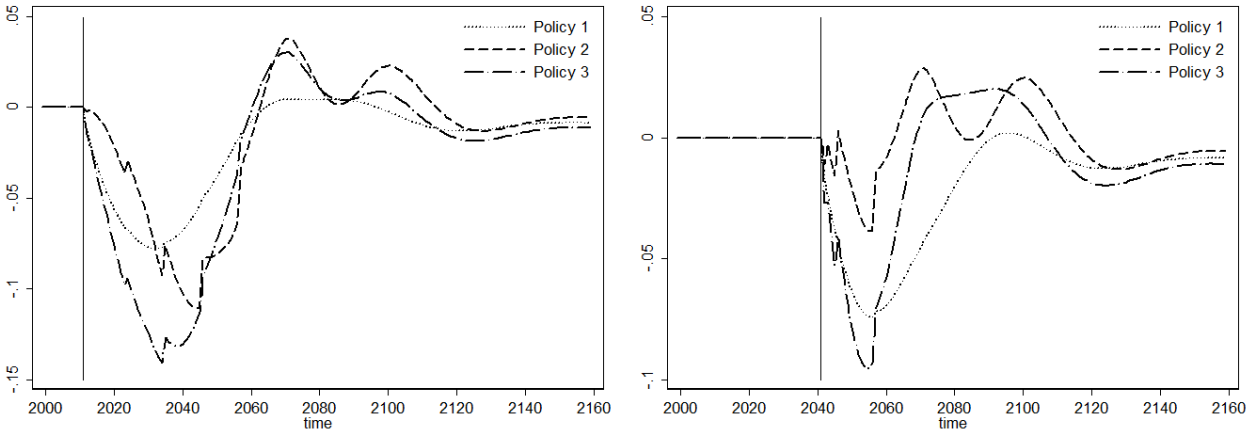
(a) Ratio of average pensions after policy change to average pension with no policy change



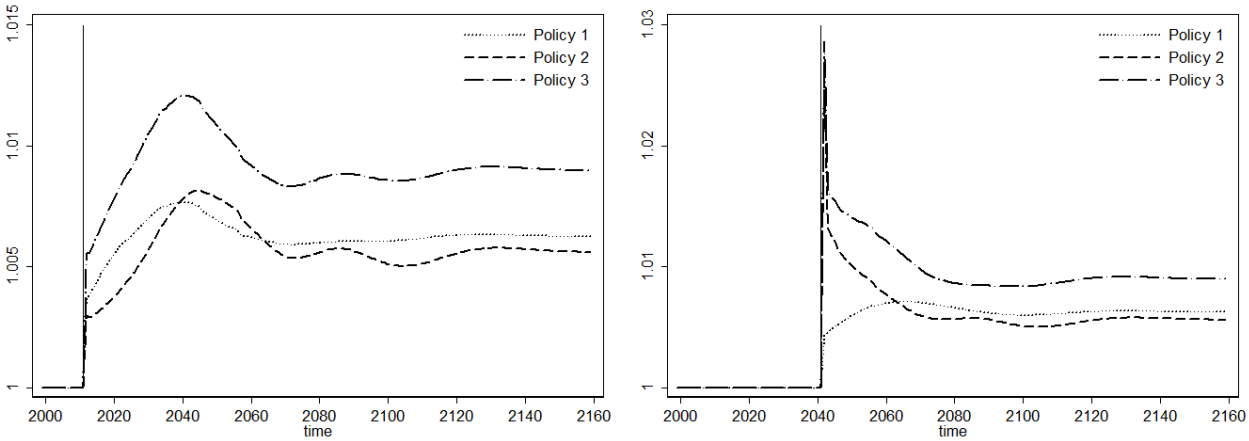
(b) Difference in tax rates after policy change and with no policy change



(c) Difference in debt to GDP ratios after policy change and with no policy change



(d) Ratio of total labor after policy change to total labor with no policy change



(e) Ratio of capital after policy change to capital with no policy change

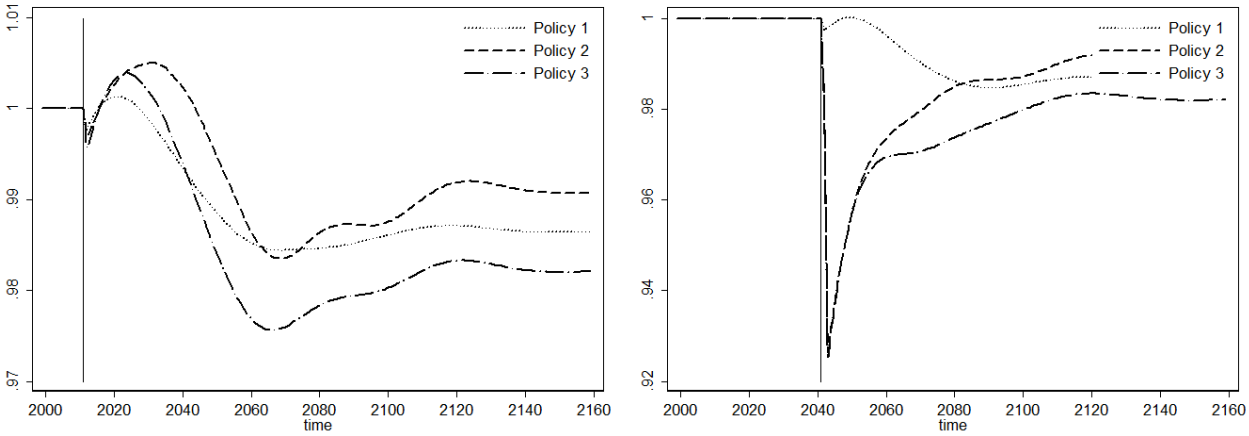
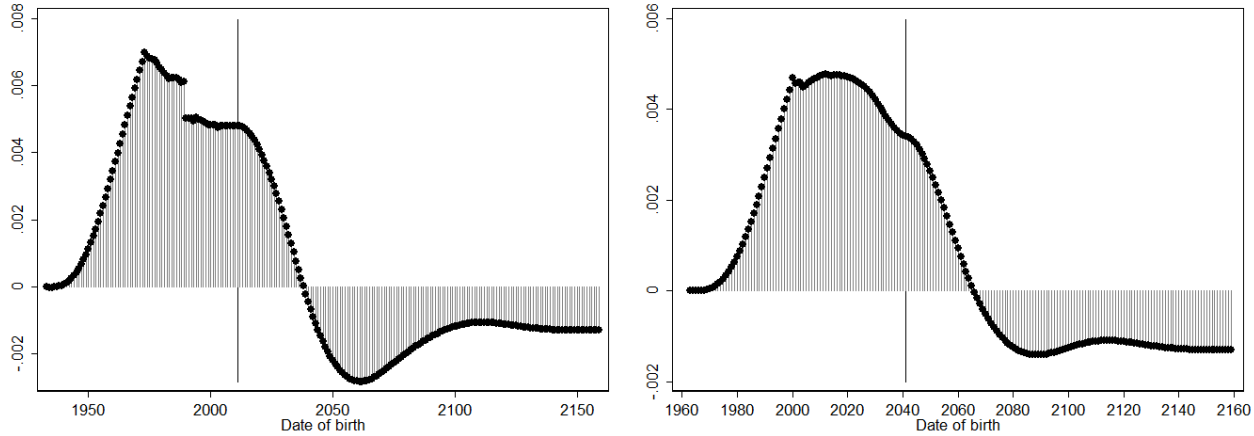
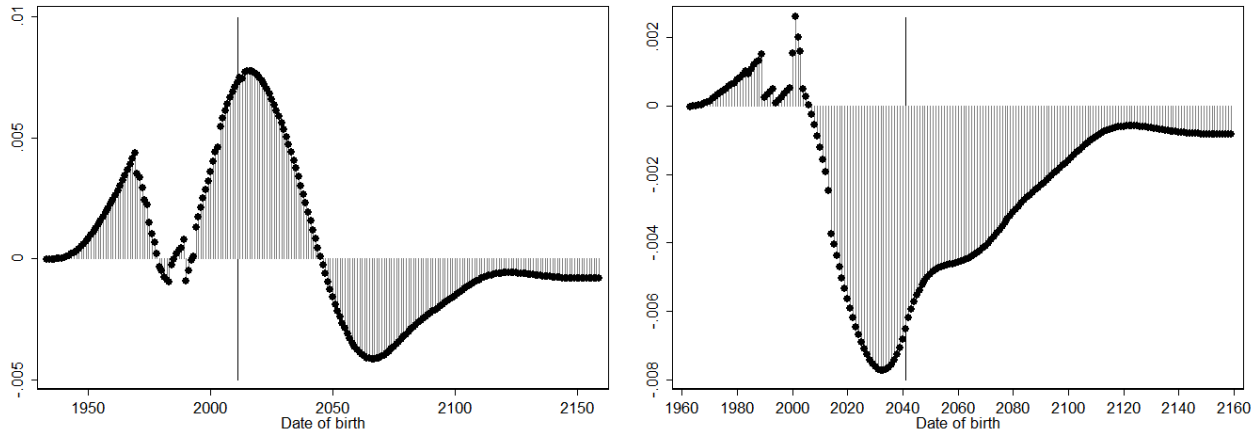


Figure A.6: Consumption equivalent of the three policies in 2012 (left) and 2042 (right) voting.

(a) Policy 1



(b) Policy 2



(c) Policy 3

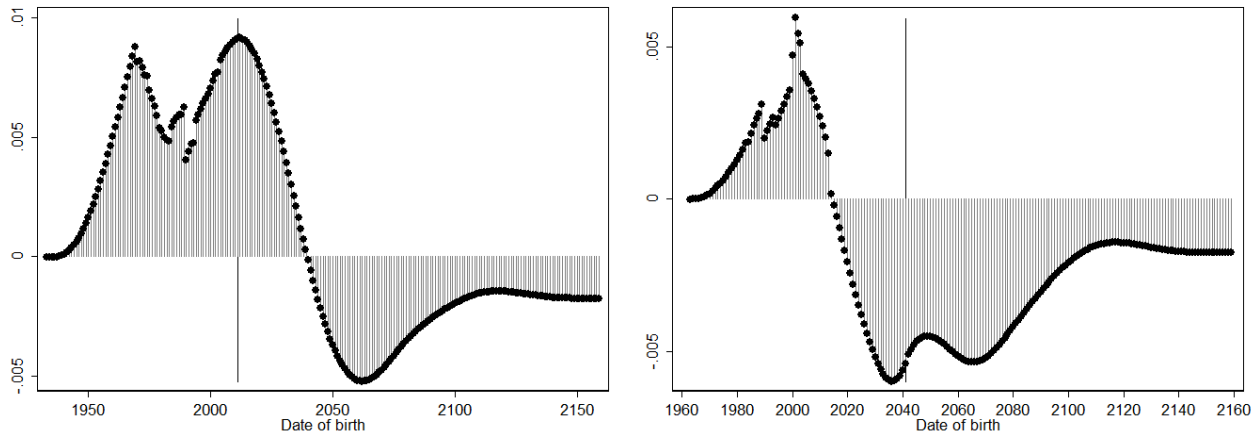


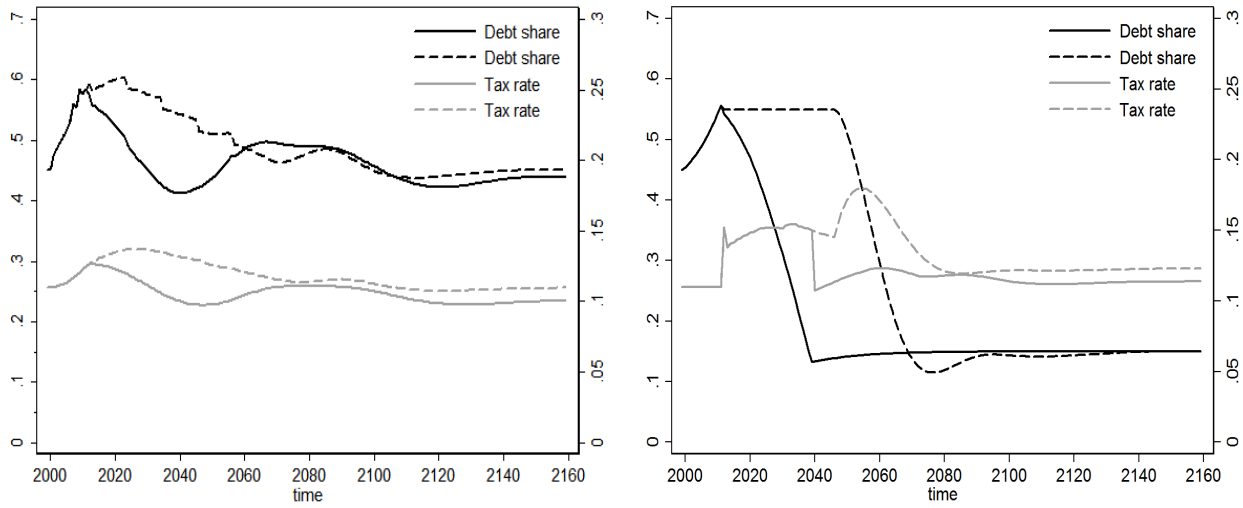
Table A.3: Sensitivity analysis (alternative fiscal adjustment) - political support for the three analyzed policy scenarios.

	2012	2022	2032	2042	2052
Winning scenario	0	3	1	1	1
Welfare effect	0.00	-0.002	-0.002	-0.002	-0.002
Political support			against *status quo*		
for Policy 1 in %	25	48	80	90	95
for Policy 2 in %	21	48	43	7	21
for Policy 3 in %	30	57	64	53	40

Note: detailed results for voting in subsequent rounds available upon request. Welfare effects in % of permanent consumption

Figure A.7: The effect of two fiscal adjustments: initial fiscal rule (left) and debt reducing (right) - status quo (dotted lines) and winning scenario (solid lines).

(a) Voting on unprivatizing the social security in 2012



(b) Voting on unprivatizing the social security in 2022