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The Impact of Introduction of Funded Pension Schemes on Intragenerational Inequality in Estonia

A Cohort Microsimulation Analysis

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The impact of introduction of funded pension schemes on intragenerational inequality in Estonia: a cohort microsimulation analysis[1]

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Abstract

This paper uses a cohort microsimulation model to analyse intragenerational distributional effects of a shift from a defined benefit pay-as-you-go pension system that includes flat rate component and length of pensionable service component to a pension system with contribution based insurance components in the PAYG scheme and an additional compulsory funded pension scheme. Estonia was among the first European countries to shift partially from a pure PAYG scheme to fully funded financing in 2002. In addition, contribution points reflecting total life-time earnings were introduced into the PAYG scheme in 1999.

We use the contribution history for 1999-2010 and information on the participation in the funded pension scheme of a full cohort of men, born in 1980, from the Estonian National Social Insurance Board to simulate the distribution of future pensions under alternative pension schemes taking into account economic and demographic changes. Our results show that in case of large inequality of labour earnings and high long-term unemployment rates, such as in Estonia, introduction of very strong link between contributions and future pensions leads to considerably higher inequality of pensions. Simulation results suggest that the inequality of old-age pensions more than doubles when the reforms mature. The inequality in replacement rates on the other hand decreases.

JEL Classification: H55, J26

Keywords: pension, microsimulation

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1. Introduction

Many developed countries are increasing individual responsibility for saving for retirement by shifting from defined benefit (DB) to defined contribution (DC) schemes or establishing mandatory funded pillars as a consequence of population ageing and pressure on government budgets. Orenstein (2011) summarizes several studies with more than thirty countries that fully or partially replaced their pay-as-you-go (PAYG) schemes with ones based on individual, private pension savings accounts in 1981-2007. He concludes that although the recent financial crisis has slowed down the trend, it has not gone away. Governments cannot afford generous pensions based on pay-as-you-go systems and the role of defined contribution schemes is increasing as a result (van Vliet et al. 2012; OECD 2014). For a dozen of European countries the share of occupational and statutory funded pensions in the total replacement rate is expected to increase substantially between 2006 and 2046 (European Commission 2010a, fig. 10).

PAYG and DB pensions systems usually involve redistribution within generations and hence shifting to quasi-actuarial DC schemes causes changes in the inequality in old-age pensions (Lindbeck and Persson 2003). Intragenerational equity has two aspects. Horizontal equity requires that individuals have similar internal rates of return from the pension system. Vertical equity requires that people with different characteristics are treated differently, to avoid them falling into poverty in old-age, such as low-wage earners (Clements, Eich, and Gupta 2014). Several studies have analysed the potential effects of intragenerational inequality of pension systems and their reforms (see for example Karayel 2006; Lefèbvre 2007; He 2008; Bonenkamp 2009; Klazar and Slintáková 2012; van Vliet et al. 2012; Aubert, Duc, and Ducoudré 2013).

Currently Estonia has one of the lowest income inequality rates among old-age people in Europe. According to Eurostat SILC data the quintile share ratio among people older than 65 was 3.1 in Estonia, while the EU-28 average was 3.9[2]. However, low inequality of pensioners' income is subject to change as the impact of past reforms gradually materializes. The key question of this paper is how much will be the inequality of pensions in the future, after all the reforms that link pensions more strongly with personal contributions will be realized.

[2] S80/S20 Income Quintile Share Ratio by Sex and Selected Age Group (source: SILC) 2015. Eurostat

This paper uses a cohort microsimulation model to analyse intragenerational distributional effects of Estonian pension reforms in 1999-2009. These reforms consisted of a shift from a defined benefit PAYG system, which included only a length of pensionable service component, to a pension system with contribution based insurance components in the PAYG scheme and additional compulsory and voluntary funded DC pension schemes. In this paper we show how introduction of contribution based insurance components and compulsory DC schemes increase pension inequality. We rely on micro level population data of Estonian men born in 1980 (total about 10 thousand men) and we simulate the effect of the recent reforms on their pensions at the statutory retirement age in 2045. We compare the distribution of pensions from the PAYG scheme and compulsory funded pension scheme before and after the reforms.

Previously, the impact of Estonian pension reforms has been analysed by using numerical calculations of a stylised person or comparing expected pensions of different age groups by the Estonian Ministry of Finance[3] or by Praxis Center for Policy Studies (Aaviksoo et al. 2011), but there are no studies which had analysed the intragenerational effects of these reforms. There is not any proper microsimulation model to analyse the future distribution of the pensions in Estonia. Our current analysis is the first effort to fill this gap.

We find that as differences of unemployment experience and of lifetime earnings contribute much more to old age pensions than earlier, the variation of old-age pensions increases considerably and, hence, the risk of poverty among pensioners increase in the future, especially for those with lower earnings and longer unemployment spells.

This rest of the article is organised as follows. In Section 2 we introduce the Estonian pension system and recent reforms. Section 3 describes data and our simulation approach. In Section 4 we present our results and some sensitivity tests. Section 5 concludes.

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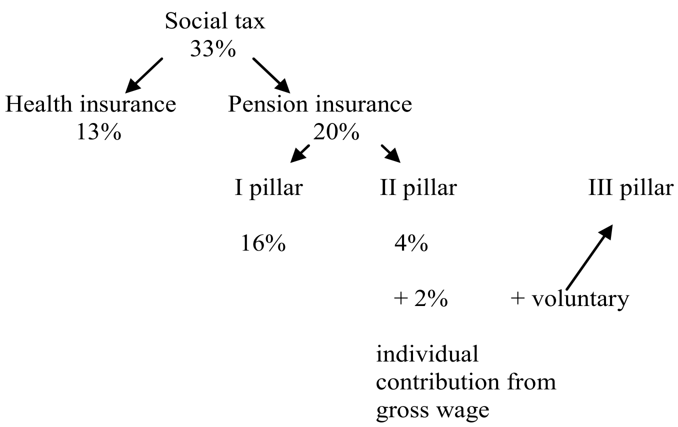
[3] Interactive pension calculator is available at http://www.minuraha.ee/kasulikud-abivahendid/?popup=pensionikalkulaator_tulevik, which is run by Finantsinspektsioon (*Financial Supervision Authority*).

2. Overview of the Estonian pension system[4]

The Estonian pension system consists currently of three pillars: a state pension insurance scheme (a pay-as-you-go system with defined benefit); a compulsory funded pension scheme (defined contribution scheme); and a voluntary funded pension scheme (defined contribution scheme). The state pension insurance scheme provides protection against the risks of old age, invalidity and survivorship using mainly employment-based old-age, work incapacity and survivors' pensions There is also a very small flat-rate residence-based national pension, which purpose is to guarantee a minimum income for those who are not entitled to the employment-based pension. In addition to common old-age pensions, there are rules for special pensions and pensions under favourable conditions (e.g. pensions for the police, military, judges, artists, miners etc.), which allow retirement under special conditions.

The pensions are funded from the pension insurance part of the social tax (20%), a payroll tax, and additional contributions by employees. Part of the social tax (4%) is transferred to the compulsory funded scheme if the person has joined the scheme, and every person adds additional 2% from his gross wage. Additional contributions are possible to the voluntary pension scheme (III pillar).

Figure 1 Financing of pension schemes



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[4] This section draws heavily on and uses extracts of the following publications:

Estonian country profile published in European Commission. 2010. Joint Report on Pensions. Progress and key challenges in the delivery of adequate and sustainable pensions in Europe. Country profiles. http://ec.europa.eu/economy_finance/publications/occasional_paper/2010/pdf/ocp71_country_profiles_en.pdf.

Võrk, Andres, Paat-Ahi, Gerli. 2013. Pensions, Health and Long-term Care. Asisp Annual Report 2013.

Table 1 Main pension reforms that shaped the Estonian old-age pension system

State pension scheme (I pillar)	**Time**
Introducing a contribution-related element in the pension formula by linking the acquisition of new pension rights to social tax paid on behalf of the person	1999
Equalisation of the pensionable age for men and women at 63 at 65	Men 2001, women 2016 both by 2026
Introduction of pension indexation: both pensions in payment as well as components determining the amounts of newly granted pensions. Index: 50% Consumer Price Index (CPI) +50% increase of revenues of the pension insurance part of social tax	2002
Change in the indexation formula (20% CPI + 80% increase of revenues of the pension insurance part of social tax) Differential indexation of base component and pensionable service and insurance component	Implemented in 2008
Ad hoc changes in the pension indexation during the economic crisis	2009-2014
Compulsory funded pension scheme (II pillar)	
Introduction of compulsory funded pensions Window for voluntary joining for persons born between 1942-1982; the end year of the window depends on person's birth year	2002 2002-2010
Additional contributions on behalf of those receiving parental benefit (2004-2012) or with children below 3 years old (2013 onwards), paid by the general government	2004-2012 (1%) 2013 (4%)
Suspension of payments during the economic crisis and the following compensation mechanism	2009-2010; 2014-2017
Voluntary funded pension scheme (III pillar)	
Legal framework for the scheme	1998
Changes in limits to tax-free contributions to the voluntary pension scheme Employers' contributions allowed	2012

Source: Leppik 2006, European Commission 2010b, Võrk and Paat-Ahi 2013

First pillar

The coverage of the state pension insurance system (I pillar) is practically universal. Old-age pensions (P) are comprised of three components: the flat rate base amount (B), the pensionable length of service component (s), covering periods up to 1998, and the insurance component that is based on individual social tax payments to the state pension scheme ($\sum K$), covering periods from 1999 onwards. Each year individual social tax payments are converted into points (K) using comparison with the average payment of the pension insurance part of the social tax. Both the length of service component and points are multiplied by the cash value (V).

$$P_t = B_t + s \times V_t + \sum K \times V_t$$

The old-age pension is redistributive through the flat rate base amount (B), which on 1 April 2013 comprised about 38% of the average old-age pension. In addition, the length of service component (s) is strongly redistributive, but as this takes into account only employment periods up to 1998, its role is gradually diminishing for new pensioners. Redistribution is also achieved through crediting pension rights for some non-active periods (incl. caring for children and military service), either adding values to s when people retire or by paying social tax (i.e. contributing to $\sum$K) on behalf of some socio-economic groups.

Both the base amount (B) and the cash value (V) of one year of pensionable service and the pension insurance coefficient are indexed annually. The pension index (PI) is a weighted average of past consumer price indices (CPI) and past growth of social tax revenues (STR) to the pension insurance system (in a 20-80 proportion since 2008).

$$PI_t = 0.2 \times CPI_{t-1} + 0.8 \times STR_{t-1}$$

Until 2007, the weights in the formula were 50-50.

Since 2008, a differential indexation of the flat rate base component and the pensionable service/insurance component is applied. The index is 10% higher for the base component and 10% lower for the cash value (V) of one year of pensionable service and the pension insurance coefficient.

$$B_t = B_{t-1} \times [(PI_t - 1) \times 1.1 + 1)]$$

$$V_t = V_{t-1} \times [(PI_t - 1) \times 0.9 + 1]$$

During the recent economic crisis in 2009-2013, a few ad hoc changes to the indexation rule of pensions were made. The changes allowed smoothing the value of nominal pensions during the crisis without having any long-term impact on the sustainability or adequacy of pensions.

Second pillar

The pay-as-you-go state pension insurance scheme is supplemented by a compulsory funded defined-contribution (DC) scheme (II pillar) that was introduced in 2002 by diverting a portion of contributions from the statutory PAYG scheme into private funds and introducing additional contributions by employees. The contribution rate is 6% of gross wages – the employee pays 2% from the gross wage and the employer another 4% (as part of the total 20% pension insurance contribution). The amount of pension benefits depends on total contributions over the working career and yields of pension funds. The scheme covers the risk of old age, but not invalidity.

Participation in the scheme is mandatory for cohorts born in 1983 or later, whereas cohorts born in 1942-1982 had the option to join the scheme voluntarily. In 2010, last cohorts, born in 1980-1982, had to make a choice whether to participate in the pension scheme. By the end of 2013, the scheme covered about 81% of the population aged 18 to 63. At the end of 2013 60% of the participants contributed. The funded scheme is run by private fund managers. When people reach pension age they can withdraw their accumulated assets. Currently, the accumulated assets are rather small as the scheme has not matured yet.

At the end of 2014, the average gross old-age pension from the I and II pillar was about 348 EUR per month, the II pillar pension added only about 50 cents on average, as only 1% of current old-age pensioners have pension insurance contract from the funded pension scheme. The average pension of the latter group from the I and II pillar together was about 412 EUR. The average gross old-age pension comprised about 34.6% of the average gross wage of a full-time worker in the end of the 2014. The average net replacement rate is about 38-43%, depending whether a pensioner is working or not during retirement.

Third pillar

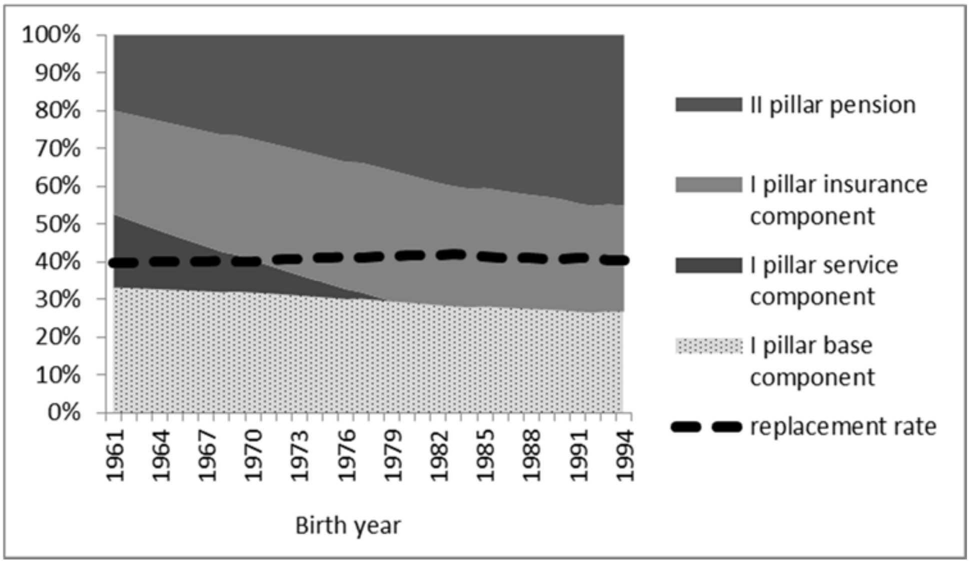
Voluntary funded pension scheme (the third pillar) plays a minor role in Estonia so far and therefore we do not take the third pillar into account in this paper. The voluntary funded pension contracts can be made by acquiring pension fund units from fund managers or with life insurers as pension insurance. There are two types of pension insurance contracts: pension insurance with guaranteed interest and pension insurance with investment risk. The scheme had about 43,400 participants (6% of people aged 18–62) with assets about EUR 117 million (about 0.6% of GDP) at the end of 2014. There were additionally about 64,000 contracts in the form of life insurance at the end of 2014.

Contributions to voluntary pension system can be deducted from the taxable income up to 15% of the employee's taxable income. The income tax rate on pension payments is also lower if conditions regarding investment duration and investor's age at the time of withdrawal are fulfilled.

Structure of old-age pensions in the future

The structure of the old-age pension form the first and second pillar will change considerably for the future retirees. For example, the cohort born in 1961 and retiring in 2026 at age of 65 have 80% of their old age pension from the PAYG scheme (the first pillar), which still includes considerable part of the length of service component before 1999. The cohort born in 1983, the first cohort that was obliged to participate in the compulsory funded pension scheme, is expected to receive already about 40% of their pension from the funded pension scheme (DC scheme). In addition, on average about 30% of their pensions depend on the insurance component of the PAYG scheme. Old-age pension components that depend on individual contributions will therefore increase from 47% in 2026 to 70% in 2048 if the system remains unchanged. In our analysis we use the cohort of men born in 1980. The replacement rate would be around 42% for a worker from this cohort with 44 years of working full time at average wages, with funded pensions constituting more than third (37%) of the total pension.

Figure 2 The components of the old-age pension and theoretical replacement rate



Source: Praxis Center for Policy Studies, simulation model, details available from authors
Notes: The figure assumes a person employed at average wage for 44 years, retiring at statutory pension age.

In addition to the state PAYG scheme and compulsory funded pension scheme, the voluntary pension scheme will add additional dependence on the individual contributions.

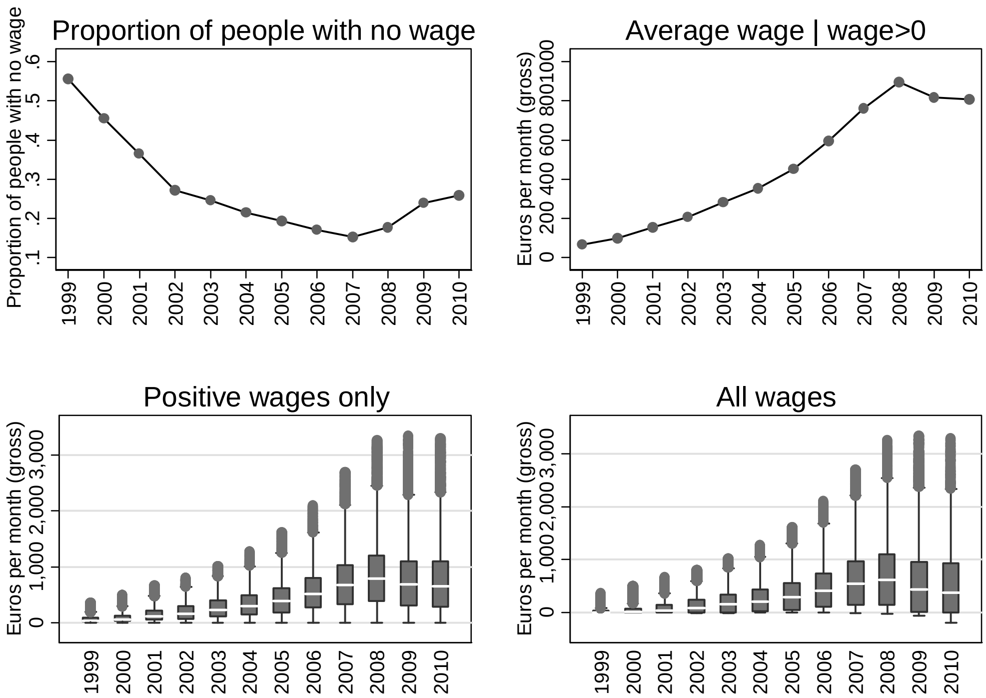
3. Data and simulation of reform scenarios

In our analysis we use microlevel population data for men born in 1980 from the Estonian National Social Insurance Board. Data consists of 10,286 men.[5] We have information on their earnings in 1999–2010, date of joining the compulsory funded pension scheme (note that this cohort could choose whether to participate in the second pillar or not). We also have information on temporary decisions on whether to continue to contribute to the funded pension scheme also in 2010, when government stopped the transfers to the II pillar due to the crisis. While we can derive individual contributions to the first and second pillars in 2002-2010, we do not have data on individual choices of pension funds and, hence, their historical rate of returns and accumulated assets. In our calculations we use the average rate of return of the pension funds for 2002-2013 and assume a constant real rate of return for the future all individuals (2.5% + CPI). We also test sensitivity of our results with lower real rate of return (0.5% + CPI).

The historical labour market characteristics of these men are described in Figure 3. By the age of 25, most of these men had labour earnings. Still, even in 2007, at the time of economic boom, 15 percent of men born in 1980 did not have any (declared) earnings in Estonia. In 2008-2010, the economic downturn caused increase in unemployment and also decreased average earnings. The wage distribution widened until 2007-2008 and remained stable afterwards.

[5] We do not use women in this analysis to keep the model simple. Adding women would require actual and simulated data on children, as staying on parental leave and raising children affect pension rights.

Figure 3 The development of the wage and its distribution of men born in 1980



Source: Estonian National Social Insurance Board, own calculations

Note: top 1% of the observations are censored for better representation of the graph.

We use two scenarios for future individual wages for years 2011-2045: 1) constant relative wage compared to the average wage and 2) wages that follow a random process derived from a age-dependent Markov transition matrix.

In the first case, future wages are predicted for each individual as follows. For each individual the ratio between past individual five year average (2006-2010) wage and economy-wide average wage is calculated and this ratio is assumed to be fixed for the forecasting period 2011-2045.

$$wage_{it} = \frac{\sum_{\tau=2006}^{2010} wage_{i\tau}}{\sum_{\tau=2006}^{2010} average\ wage_{\tau}} \times average\ wage_{t} \quad if \ \ t > 2010$$

Effectively it means that wage distribution for that cohort is unchanged and is based on the most recent five years' data available. The estimates that we get this way likely overestimate the pension inequality due to wage inequality, as in real life people move within wage distribution. This approach will give us an upper bound of the inequality in pensions.

In another approach we allow people to change their positions in the wage distribution. At each age people have both different transition probabilities between wage groups and different relative wages with respect to national average. Transition probabilities are based on first order Markov process that is derived from register data of all men aged 30-63 in years 2000-2008. We exclude the crisis years 2009-2010, as these were exceptional and we do not forecast any such crisis for the future.

In the second approach, we divide all wage data into 20 groups for each age $Q_{k,age}$ for each year: one group for the unemployed people with no wages and additionally 19 quantiles for positive wages.[6] Then we estimate a matrix of annual transition probabilities $p_{jk,age}$ between these wage groups for each age averaged over the period 2000-2008. Consequently for the period 2011-2044 each person A_i in our cohort of men born in 1980 is randomly assigned to wage group $Q_{k,age}$ depending on its previous wage group $Q_{j,age-1}$ (starting from 2010 wage level) and estimated transition probabilities $p_{jk,age-1}$.

$$\Pr(A_{i,age} \in Q_{k,age}) = p_{jk,age-1} \quad if \ A_{i,age-1} \in Q_{j,age-1}$$

Note that for age groups 63-65 we needed to extrapolate historical labour market transitions, as pension age increases from current 63 to 65 for the cohort born in 1980. We assumed that people behaviour near the retirement age in the future is similar to the behaviour that we observed in the past.

Individual wages are then set equal to the product of the predicted economy-wide average wage times the 2000-2008 average of median ratio of wages to the economy-wide average wage of all people who were at that particular wage group at the same age that our 1980 cohort.

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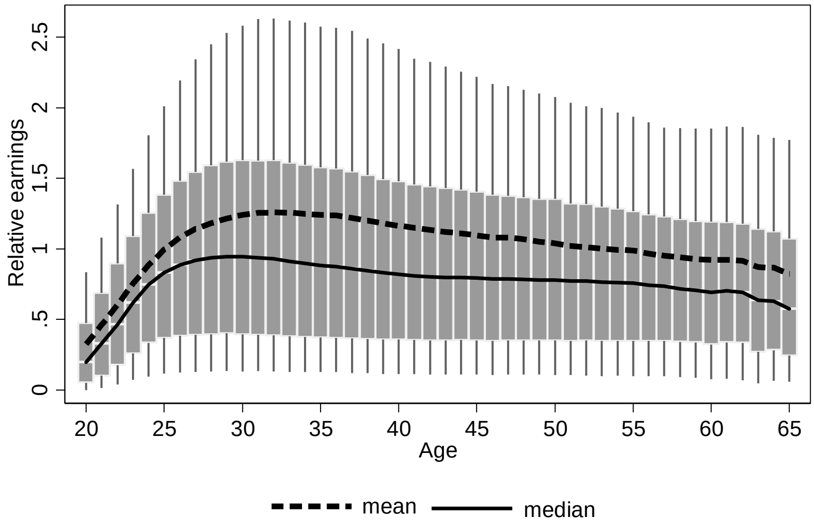
[6] Note that this is also the way how we implicitly model unemployment for every age group. We do not distinguish between unemployment and inactivity; both are defined as situations with no labour earnings. Unemployed people do not collect any pension rights in Estonia and few men take child care leave, which would give some pension rights when inactive. Hence, this simplification of equalizing unemployment and inactivity should not affect much our main results.

$$wage_{it} = average\,wage_t \times \frac{1}{9}\sum_{T=2000}^{2008}\left(\underset{l \in Q_{k,age}}{median}\left(\frac{wage_{l,T,age=T-1980}}{average\,wage_T} \right) \right) \; if \; A_{i,age=t-1980} \in Q_{k,age}, t > 2010$$

The relationship of age and wage distribution for men that was used to generate age-dependent wage groups is given in the following graph. The median relative wage level is the highest at around 30s and then starts to decline, the average relative age peaks slightly later. On the other hand, the 1st quartile is almost unchanged within age band 25-62. On average, it means that wages decline for our cohort and the wage distribution gets narrower.

Figure 4 Age-earnings profile, 2000-2008



Source: Estonian National Social Insurance Board, own calculations
Notes: Grey area shows interquartile range, vertical lines indicate 10th and 90th percentiles and solid line connects medians and dashed line means. Data include zeroes for non-workers.

To sum up, we have two scenarios for the cohort born in 1980:

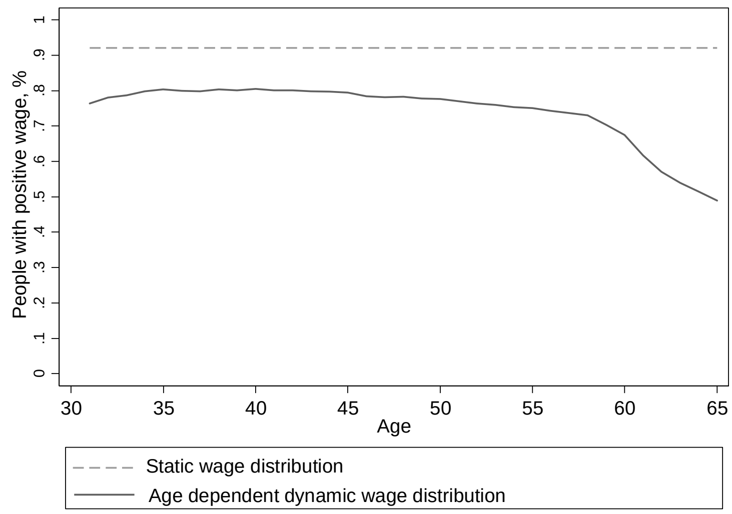
a) Holding their position unchanged in the relative wage distribution, which was estimated based on their own data for 2006-2010;

b) Allowing movements in the wage distribution, both via changing transition probabilities and changes in the wage groups depending on their age. The transition probabilities and wage distributions were estimated based on 2000-2008 data for all men in age group 30-63.

From predicted wages we derive contributions both to the state pension scheme (I pillar), which are used to calculated individualized insurance coefficients, and mandatory funded pension scheme (II pillar).

These two different scenarios lead to different proportions of employed people over time. In the first scenario more than 90% of men are employed, though many of them with less than minimum wage, e.g. in part-time jobs. In the second scenario, employment rates decline with age, more rapidly near the retirement age, allowing thus for early retirement. The second approach introduces additional volatility in earnings, which most likely overestimate the volatility in wages, giving this way the lower bound in pension inequality.

Figure 5 People with positive wage with different wage scenarios



We also model the effects of early retirement on pension size by "retiring" those people who had simulated labour earnings zero up to three year(s) before statutory pension age (see Table 2). According to the current legislation[7] it is possible to retire up to 3 years before the statutory retirement age but in that case old-age pension will be decreased for every month 0.4% (i.e. retirement three years earlier means 14.4% lower pension). Currently, about one fifth of people use early retirement in Estonia. On the other hand, we do not take into account deferred retirement because its use is rather marginal in Estonia (less than 1% of all pensioners).

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[7] Source: Riigi Teataja (2001) State Pension Insurance Act.
https://www.riigiteataja.ee/en/eli/ee/504072014011/consolide/current

Table 2 Pension reduction in case of early retirement.

Presence of simulated earnings before statutory pension age			**Assigned early retirement and corresponding reduction in state pensions (the I pillar pensions)**
3 years	**2 years**	**1 year**	
Yes	Yes	No	One year (12 x 0.4% = 4.8% reduction)
Yes	No	No	Two years (24 x 0.4% = 9.6% reduction)
No	No	No	Three years (36 x 0.4% = 14.4% reduction)
No	Yes	Yes	No early retirement
No/Yes	No	Yes	No early retirement

Finally, we assume that all men who are alive in 2010 will survive at least until retirement at the statutory pension age 65 in 2045. After that they have average life expectancy based on Eurostat population forecasts, which for that cohort is about 20 years after statutory retirement age (65).[8] Economy-wide average wage, inflation and social tax revenues, which all influence pensions from the first pillar and second pillar, are based on the official estimates of the Ministry of Finance in autumn 2013[9].

Reform scenarios

We compare the distribution of simulated old-age pensions under four different reform scenarios (see Table 3), which all reflect some reform phases of the Estonian pension system.

<u>The first scenario</u> is the situation before year 1999, when the pension from the state pension system depended only on the flat rate base component and length of service component (reform abbreviation *payg_serv*). In this scenario the old-age pension is calculated in that case as:

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[8] Eurostat 2013 population forecast gives 19.2 for men and 23.6 for women.
Source: "Life expectancy by age and sex". Table proj_13nalexp. 2014. Eurostat, accessed on 29 June 2015 at http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=proj_13nalexp

[9] File "Prognoos_kuni_2060_09.10.13.xlsx", accessed on 15 March 2014 at www.struktuurifondid.ee/file.php?10147208

$$First\ pillar\ pension_{i,2045} = B_{2045} + V_{2045} \times \sum_{t=1999}^{2045} \min(\frac{wage_{i,t}}{\min\_wage_t}, 1)$$

where B_{2045} is the predicted flat rate part of the pension, V_{2045} is the value of length of service and insurance coefficient in 2045 and min_wage_t is the minimum wage required to receive one year of contributions. For each year when the wage is higher than minimum wage, a person receives one additional year of length of service component; otherwise the person receives only a fraction of that. Both B and V are indexed using 50/50 weights of increase of social tax revenues and CPI.

Table 3 Reforms scenarios

Description	Base amount	Length of service component	Insurance component	Indexation formula*	Mandatory funded scheme	Actual years
1. PAYG + service component	Yes	Yes	No	50/50	No	…–1998
2. Introduction of the insurance component into PAYG	Yes	No	Yes	50/50	No	1999–2002
3. Introduction of the II pillar	Yes	No	Yes	50/50	Yes	2002–2008
4. Change in indexation in the PAYG scheme	Yes	No	Yes	20/80 + quicker indexation of the base	Yes	2008–…

* - the first number refers to the weight of growth of consumer price index and the second number to the growth of social tax revenues

The second scenario introduces an insurance component in which case the old-age pensions from the first pillar depends on the individual contributions. This scenario describes the Estonian pension system in 1999-2002.

$$First\ pillar\ pension_{i,2045} = B_{2045} + V_{2045} \times \sum_{t=1999}^{2045} K_{i,t}$$

where $K_{i,t}$ are insurance coefficients. The latter depends on relative wage compared to average wage. People with higher wages receive higher insurance coefficients.

$$K_{i,t} = wage_{it}/average\ wage_t$$

The indexation of B and V is the same as in the first scenario.

Note that we assume that the cohort born in 1980 did not have any work experience before 1998 and, hence, the length-of-service component does not enter into the first pillar pension formula in this and the following scenarios.

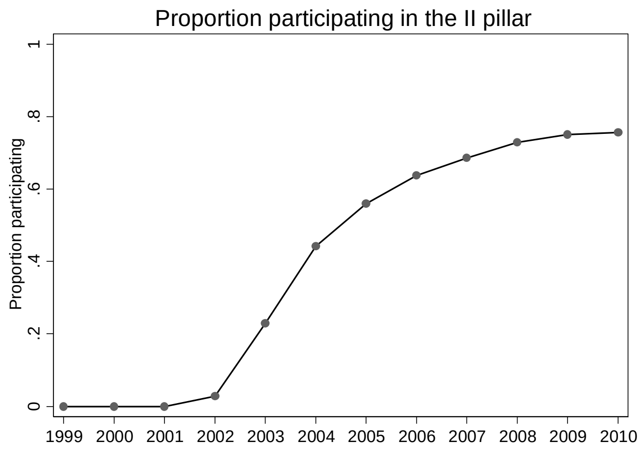
<u>The third scenario</u> introduces a funded pension scheme, optional for the cohort born 1980. For those participating in the funded scheme, 4% of the pension insurance part of the social tax is transferred to scheme, complemented by additional 2% by the participant. As a result the insurance coefficient of the first pillar will be smaller.

$$K_{i,t} = wage_{it} \times (20\% - transfer\ rate\ to\ II\ pillar_{it})/(average\ wage_t \times 20\%)$$

The transfer rate to the II pillar is 4% in general, but in some years during the crisis period (2009-2011) and its aftermath (2014-2017), it can be different (from 0% to 6%).

Because not all men are participating in the scheme (about 75% by 2010, the last year when it was possible to opt into the scheme), then we have additional variation in pensions caused by additional savings and our assumptions on the relative performance of the state PAYG pension scheme and the funded second pillar.

Figure 6 The proportion of the 1980 cohort of men who participate in the funded pension scheme (II pillar)



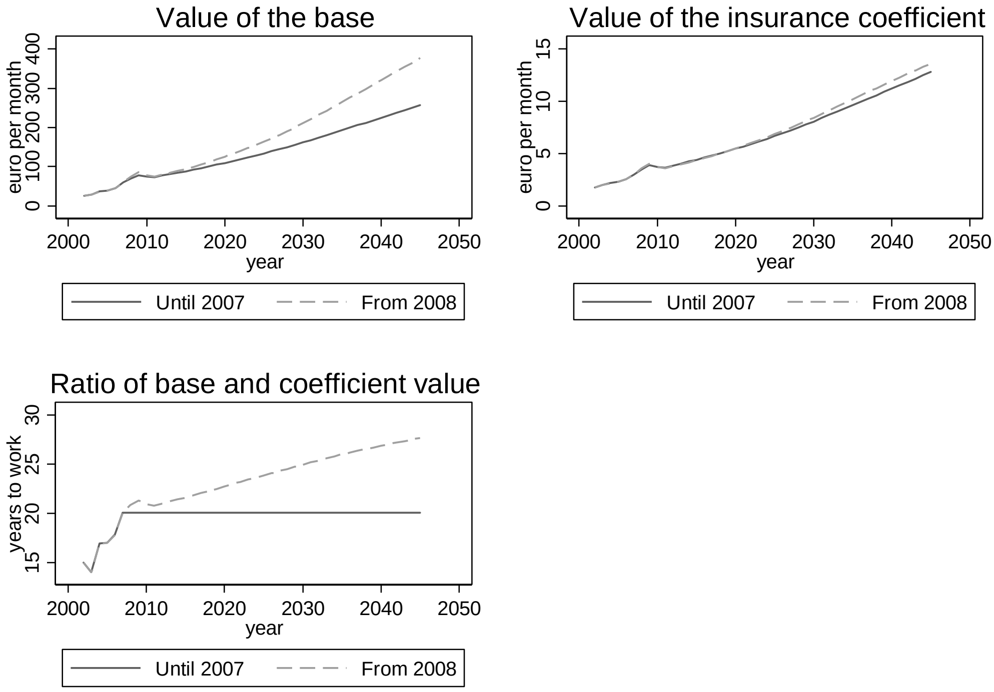
Source: Estonian National Social Insurance Board; own calculations

The accumulated savings from the second pillar depend on personal savings each year (gross wage multiplied by the transfer rate from the social tax and additional contributions by employee) and the rate of return of these savings, which are set equal to all persons 2.5% plus CPI. We present also main results with a lower rate of return. At the of retirement all savings are converted into annuities, assuming 3% nominal interest rate (the maximum set by the Estonian legislation) and life expectancy 20 years. We also present our results when nominal interest rate for annuities is 1%.

Finally, the fourth scenario describes the situation in the I and II pillar from 2008 onwards. Compared to the previous scenario, we introduce two changes to the indexation of pension rights. First, the weights of the index change from 50/50 to 20/80 for CPI and social tax revenue growth, respectively. That increases first pillar pensions faster compared to the previous scenario. Second, from 2008 the value of the base component of the first pillar pensions will increase faster than the value of the insurance component.[10] This will reduce inequality in state pensions as the proportion of flat part increases. The following graph compares the development of the base and insurance coefficient before and after the change in legislation in 2007.

Figure 7 Development of the value of the base and insurance coefficient before and after 2008 reform

[10] Each year the base value has about 22.2% (1.1/0.9) higher growth rate than the value of the insurance component.



According to 2007 legislation the base component was worth 20 years of working with average wage. The changes in indexation in 2008 will cause an increase to 27.7 by 2045.

4. Results

We calculate old-age pensions for the four different scenarios under two different assumptions of wage distribution (constant distribution and changes of wages according to Markov transition probabilities). The inequality of pensions and the impact of reforms are described both graphically and using changes in Gini index. The distributions of pensions according to four scenarios are described in Figure 8. The Gini index, presented in Table 4, summarizes changes in the inequality in the pension distribution.

The results clearly illustrate that pensions before the introduction of insurance coefficients were homogenous. Gini index of simulated pensions is about 0.10-0.11. This is close to the value of actual old-age pensions from the first pillar in 2013, which was 0.09.[11] Both these are

[11] Source: Ministry of Finance (2014) Riikliku vanaduspensioni, kohustusliku kogumispensioni ja vabatahtliku kogumispensioni statistika, as of 31.12.2013.

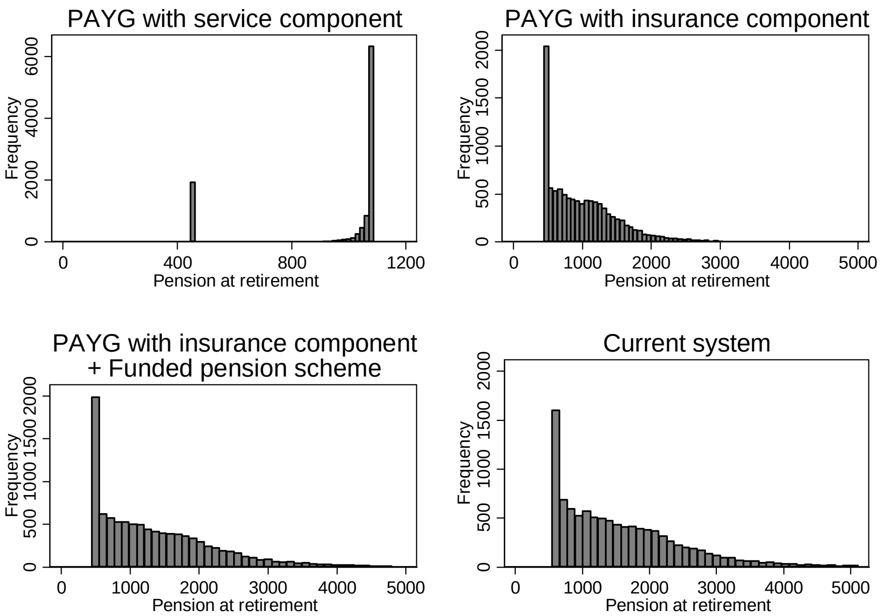
considerably lower than the average Gini index of wages of the 1980 cohort that was 0.485 on average in 2006-2010 or 0.375 for the whole period 2006-2044 when allowing transitions within the wage distribution.

The main increase of inequality in future pensions was caused by the introduction of the insurance component in 1999, which increases Gini index of pensions 2-3 times, depending on our assumptions (see row (2) in Table 4). If we assume a constant wage distribution, then the Gini index increases to 0.29. If we allow people to change positions in the wage distribution, then the Gini of pensions increases to 0.24.

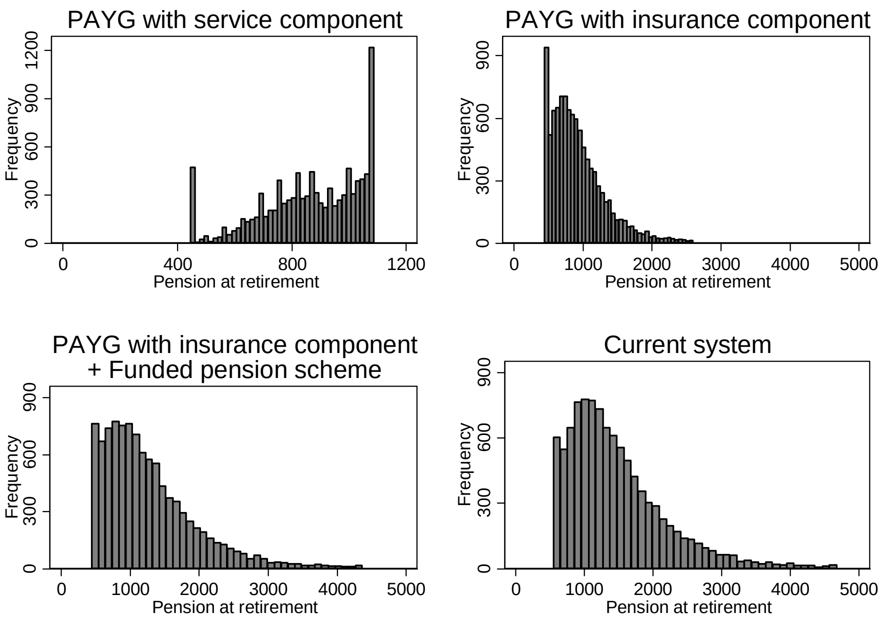
Introduction of the funded pension scheme (row (3) in Table 4) increases inequality of future pensions further, as there is no redistribution in that scheme (except unisex mortality tables, but these do not have any influence in our cohort of males). The upper and lower bounds of the value of Gini indexes rise further to 0.354 and 0.295. As part of social tax contributions is transferred from the first pillar to the second pillar, then inequality of pensions in the first pillar actually declines slightly.

Figure 8 The distribution of simulated old-age pensions according to four scenarios

Static wage distribution



Changing wage distribution



Source: own simulations

Note: top 1% of the observations are censored for better representation of the graph. Spikes at the low end of the pension distribution are a result of national pensions (minimum pension in case of insufficient pension rights).

Table 4 Gini index of pensions according to different reform scenarios*

		Static wage distribution (upper bound)			Dynamic wage distribution (lower bound)		
		I pillar pension	II pillar pension	I + II pillar	I pillar	II pillar	I + II pillar
(1)	PAYG with service component (until 1998 system)	0.108		0.108	0.113		0.113
(2)	PAYG with insurance component (1999-2002 system)	0.290		0.290	0.238		0.238
(3)	PAYG with insurance component and funded pension scheme (2002-2007 system)	0.271	0.437	0.354	0.223	0.388	0.295
(4)	Current system PAYG with insurance component, with changed indexation, and funded pension scheme	0.246	0.437	0.326	0.202	0.388	0.270
(5)	Gini of average wages over 2006-2044	0.485			0.375		
(6)	Gini of wages in 2044	0.485			0.741[+]		

* Gini index of funded pensions is calculated using only those people who have joined the second pillar, i.e. zeroes are excluded.
[+] High value of the Gini index is caused by almost half of people not working just before retirement

As a reaction to predicted increase in inequality of future pensions due to introduction of the funded pension scheme, the changes in the indexation of the first pillar state pensions from 2008 onwards were meant to counterbalance this. Indeed, we find that these measures contribute to a moderate decline in inequality in the first pillar pensions (see row (4) in Table 4), but the effect is quite small, compared to the overall predicted inequality.

While the reforms increase inequality in old-age pensions, they reduce inequality in replacement rates, as individual pensions and life-time wages are more correlated when personal insurance components and funded pensions are introduced into the pension system (see Table 5). Because of the flat rate part of the first pillar pensions, the coefficient of variation of replacement rates were the highest in the pure PAYG system with length of service component only (row (1) in Table 5). The coefficient of variation and Gini index of replacement rates was smallest in the case of policy rules valid in 2002-2007, when pensions depended on individual contributions to the largest extent. In addition, we see that later reforms have increased average and median replacement rates, because of additional contributions to the funded pension scheme and higher average indexation of the state pensions.

Table 5 Descriptive statistics of individual gross replacement rates, dynamic wages

	Scenario	Average	Median	Standard deviation	Coefficient of variance	Gini index
(1)	PAYG with service component (until 1998 system)	34.1	27.9	23.0	0.68	0.53
(2)	PAYG with insurance component (1999-2002 system)	31.8	26.9	17.1	0.54	0.46
(3)	PAYG with insurance component and funded pension scheme (2002-2007 system)	41.1	37.3	17.8	0.43	0.39
(4)	Current system PAYG with insurance component, with changed indexation, and funded pension scheme	48.4	42.9	22.4	0.46	0.41

* Replacement rates were calculated as pensions at retirement age divided by lifetime average wages. Top 1% of replacement rates were excluded from calculations, because of the extreme values of replacement rates arising from very low life-time wages and flat rate minimum pensions.

Sensitivity of results to assumptions

We test the sensitivity of results with respect to the rate of return of funded pension scheme, guaranteed rate of return of annuities and changes in life-expectancy. First we lower the annual real rate of return of funded pension scheme from 2.5% to 0.5%, which is more consistent with the average return since the beginning of operation of pension funds in Estonia. Second we increase life expectancy at age of 65 from 20 years to 25 years. Finally, we lower the nominal rate of return for annuities from 3% to 1%. In all cases we use the dynamic approach to wage distribution, which should give us more realistic estimates of pension inequality. All these changes in our assumptions impact only pensions from the funded pension scheme, which on average was 34% of total pension.

Table 6 Gini index of pensions according to different reform scenarios

	Unchanged	Baseline dynamic wage distribution		Lower real rate of return of funded pensions (from 2.5% -> 0.5%)		Longer life expectancy at retirement (from 20 -> 25 years)		Lower nominal rate of return of annuities (from 3% to 1%)	
	I pillar pension	II pillar pension	I + II pillar	II pillar pension	I + II pillar	II pillar pension	I + II pillar	II pillar pension	I + II pillar
PAYG with insurance component and funded pension scheme (2002-2007 system)	0.223	0.388	0.295	0.395	0.276	0.388	0.286	0.388	0.284
Proportion of II pillar pensions in total pension			33.7%		26.0%		30.3%		29.6%
Mean of pension replacement rate to average wage	18.8%	9.6%	28.4%	6.7%	25.5%	8.2%	27.0%	7.9%	26.7%
Current system PAYG with insurance component, with changed indexation, and funded pension scheme	0.202	0.388	0.270	0.395	0.252	0.388	0.261	0.388	0.259
Proportion of II pillar pensions in total pension			29.5%		22.5%		26.3%		25.8%
Mean of pension replacement rate to average wage	22.9%	9.6%	32.5%	6.6%	29.5%	8.2%	31.1%	7.9%	30.8%

Lower rate of return of funded pension scheme or annuities or increased life expectancy do not affect the inequality of funded pensions (marginal change from 0.388 to 0.395 in case of lower real rate of return is due to randomness of wage). However, the overall inequality of old-age pensions is lower because of smaller share of funded pensions in total pension. Increased life expectancy by 5 years will reduce the share of funded pensions in old-age pension about 3 percentage points; declining real rate of return reduces the share by 7 percentage points. The resulting overall decline in Gini index is about 0.01-0.02 points. Lower rate of return of pension annuities does not affect inequality of funded pensions, but as the share of funded pensions in overall pension is smaller again by 4 percentage points, the overall pension inequality declines about 0.01 points.

Of course, there is also uncertainty about first pillar pensions due to changes in key macroeconomic variables, such as CPI, real wages, employment rate, all of which affect consumer prices, aggregate social tax revenues and hence pension index. However, these variations would have smaller effect on the future distribution of pensions than potential changes in policy rules (e.g., accrual of rights, indexation, and pension age).

5. Conclusion

Estonia was one of the first European countries that adopted the World Bank multi-pillar pension approach. The three pillars were meant to increase savings for retirement and to diversify demographic and macroeconomic risks associated with pension systems. Creating stronger link between individual contributions and pensions were supposed to reduce undeclared work, increase acceptance of the reforms by high wage earners.

Current pension inequality among Estonian pensioners is very low (Gini is about 0.1) and average gross replacement rate modest (about 40%). Our results indicate that simultaneous introduction of the insurance coefficients into the public PAYG pension scheme in 1999 and creation of fully funded pension scheme in 2002 will considerably increase inequality of future pensions in Estonia. Predicted inequality of pensions will more than double when measured by Gini index, from 0.10 to around 0.27-0.33 by 2045, depending on assumptions on the persistence of wage distribution and other key variables. The latest reform in 2008 that increased flat rate part of the pensions reduces inequality of pensions, but its effect is small (about 0.02). On the other hand, the inequality of individual replacement rate has decreased, as pensions depend more on people's own contributions. Sensitivity analysis showed that the lower real rate of return of funded pensions, longer life expectancy at retirement age, or lower nominal rate of return of annuities would reduce Gini index by 0.01-0.02 and simultaneously decrease average replacement rate up to 3 percentage points.

Our results show that in case of large inequality of labour earnings, high unemployment rates and substantial early retirement, such as in Estonia, introduction of very strong link between contributions and future pensions may lead to undesirably high inequality of pensions. The simplest way to reduce that inequality would be larger redistribution in the state pension scheme (the first pillar) by either higher indexation of or ad hoc increases of the flat rate component.

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