CASE Network Studies & Analyses

The impact of pension system reform on projected old-age income: the case of Poland

Elena Jarocinska
Anna Ruzik-Sierdzińska

Nr 482 (2016)

WARSAW BISHKEK KYIV TBILISI CHISINAU MINSK

Materials published here have a working paper character. They can be subject to further publication. The views and opinions expressed here reflect the author(s) point of view and are not necessarily shared by the European Commission or CASE Network, nor does the study anticipate decisions taken by the European Commission.

This report was prepared within a research project entitled MOPACT, which received funding from the European Union's 7th Framework Programme for research, technological development and demonstration under grant agreement no 320333.

CASE – Centrum Analiz Społeczno-Ekonomicznych
CASE – Center for Social and Economic Research

The CASE Network is a group of economic and social research centers in Poland, Kyrgyzstan, Ukraine, Georgia, Moldova, and Belarus. Organizations in the network regularly conduct joint research and advisory projects. The research covers a wide spectrum of economic and social issues, including economic effects of the European integration process, economic relations between the EU and CIS, monetary policy and euro-accession, innovation and competitiveness, and labour markets and social policy.

The CASE Network consists of:
- CASE – Center for Social and Economic Research, Warsaw, est. 1991, www.case-research.eu
- CASE – Center for Social and Economic Research – Kyrgyzstan, est. 1998, www.case.jet.kg
- Center for Social and Economic Research - CASE Ukraine, est. 1999, www.case-ukraine.com.ua
- Foundation for Social and Economic Research CASE Moldova, est. 2003, www.case.com.md
- CASE Belarus - Center for Social and Economic Research Belarus, est. 2007, www.case-belarus.eu
- Center for Social and Economic Research CASE Georgia, est. 2011

Keywords:
pension benefits, inequality, replacement rates, microsimulation

JEL Codes:
H55, J26

Graphic Design:
Katarzyna Godyń-Skoczylas | grafo-mania

EAN 9788371786365

Publisher:
CASE-Center for Social and Economic Research on behalf of CASE Network
al. Jana Pawla II 61, office 212, 01-031 Warsaw, Poland
tel.: +48 22 206 29 00, 828 61 33, fax: +48 22 206 29 01
e-mail: case@case-research.eu
www.case-research.eu

Contents

List of figures

List of tables

The Authors

Elena Jarocinska, PhD – CASE Fellow and researcher, holds a PhD in economics from Universitat Pompeu Fabra, Barcelona. Her expertise includes pension economics, public policy, fiscal federalism and regional policy. She has collaborated with the CASE Foundation since 1998. She has coordinated and participated in a number of projects on welfare issues for the European Commission and other international organisations.

Anna Ruzik-Sierdzińska, PhD – CASE expert and author of publications in the field of pension reform, ageing and elderly. She is assistant professor at the Institute of Labour and Social Studies in Warsaw. Between 2002 and 2006, Mrs. Ruzik was a World Bank consultant. She cooperated with CASE Foundation in various projects from the areas of social policy, pension systems and labour market. From September 2002 until March 2003 she was a Marie Curie Fellow at the Center for Economic Research (CentER) in Tilburg, NL.

Abstract

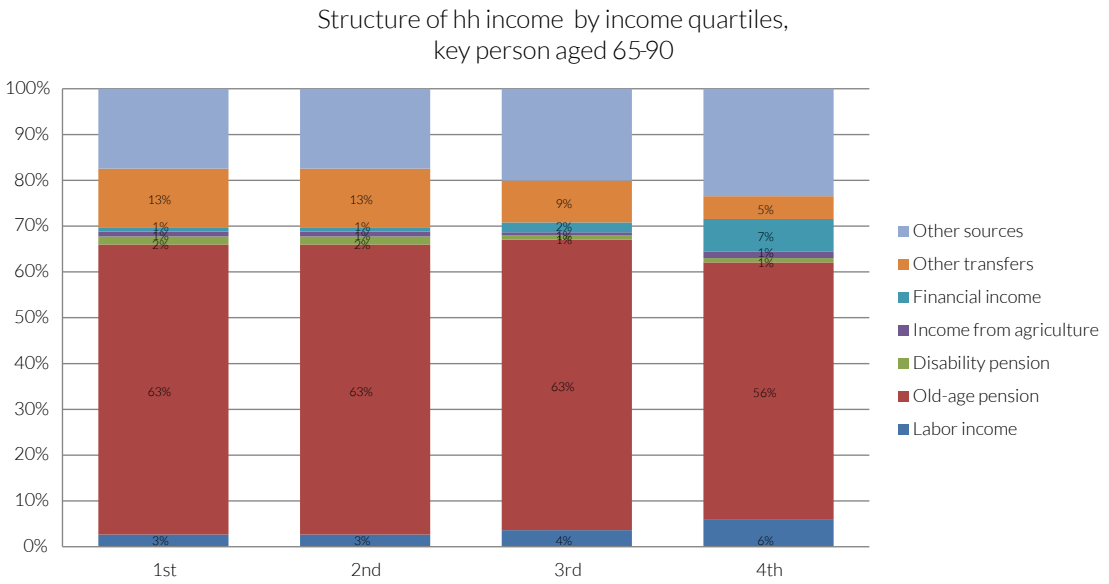
This paper analyses the distributional effects of the Polish old-age pension reform introduced in 1999. Following a benchmark Mincer earnings equation, and using a newly developed microsimulation model we project future pension benefits for males born in years 1969–1979. We find that inequality of predicted first pension benefits measured by the Gini coefficient increases from 0.119 to 0.165 for cohorts of men retiring between 2036 and 2046. The observed increased inequality of pension benefits is due to the decreasing share of initial capital that is based on a more generous DB formula in the total accumulated pension capital. At the same time, inequality in replacements rates decreases due to a stronger link between contributions paid through the entire working life and pension benefits.

1. Introduction

Most developed countries are expecting decreases in replacement rates (RR) as a result of recent pension reforms (see OECD, 2013). Poland stands out among other countries as it exhibits one of the largest drops in RR among the EU-27 in the years 2010–2050 of 35 percent for an average income earner with a 40 year career (EC, 2012) due to a shift from the defined benefit (DB) to the defined contribution (DC) pension system.

Today, old-age pension is an important source of income in elderly households in Poland (see Figure 1). In order to maintain a similar standard of living after retirement, the average individual will need to complement public pension benefits with private pensions and other savings. According to the World Bank (2014) study, in Poland currently working cohorts aged 20–50 should save additionally about 10 percent of their annual earnings to guarantee them current replacement rates. Low-income earners, persons with short tenure and other vulnerable groups might find it difficult to save for retirement. Therefore, as standards of living of the elderly are likely to decrease, policymakers require in-depth knowledge about the income distribution of current and future retirees, so that they can target the most vulnerable in their social policies.

Figure 1. Structure of household per capita income by income quartiles for the age group 65–90 in 2012



Source: Own calculations based on the Polish HBS individual data.

This paper studies distributional effects of the Polish pension reform based on the micro data from the Polish Household Budget Survey (PHBS). Following a benchmark earnings equation[1], and using a newly developed microsimulation model we project pension incomes for males born in years 1969–1979. We compare the projected pension benefits, RR and Gini coefficients for different cohorts. By analysing projected pension incomes of individuals from different cohorts, we can study the effects of the 1999 pension reform which materializes only gradually. We find that inequality of predicted pension benefits increases for younger cohorts, driven by an increase in inequality in the upper part of the distribution. At the same time, inequality in replacements rates decreases somewhat.

As a result of the 1999 pension reform in Poland, the more generous and redistributive DB formula has been replaced with the DC formula that takes into account life expectancy at retirement age (see Section 2 for details). While the new pension system has improved its long- term sustainability, it has been achieved through reductions in future pension adequacy. From a policy perspective, pension adequacy can be measured in replacement rates (i.e. comparing pension benefits to individual's wages) or in euro amounts. The latter objective is achieved

1 See e.g. Heckman et al. (2003) and Lemieux (2006).

in many countries through minimum income provisions which mainly aim at preventing old-age poverty by securing a minimum, basic level of standard of living at retirement (EC, 2012). A shift to DC formula results in a smaller inequality in terms of replacement rates given that DC formula is more linked to individual contributions, but in a larger inequality in absolute pension amounts because of a wider distribution of wages as compared to pension benefits. Several studies have analysed the impact of pension systems on the income distribution of the elderly (see for example, Knoef et al. 2012; van Vliet et al. 2012; Vork et al. 2015), and in particular studied groups of retirees within age cohorts (see e.g. Ervik and Linden 2013 and OECD 2013). To our knowledge, this paper is the first that analyses the distribution of future pension incomes of the Polish elderly within cohorts i.e. intra-generational inequality. Previous studies on Poland that predict future pension benefits do not investigate the whole income distribution. Most of the previous studies predict future pension benefits for a hypothetical worker (e.g. Määttänen et al. 2014; EC 2012; OECD 2013) or for year cohorts, with the latter focusing on the intergenerational differences (see Jabłonowski and Müller 2013; Egert 2012; Leifels et al 2010). These studies find large drops in projected RR, especially for people with career breaks and short careers as well as low earners. Määttänen et al. (2014) also show that the impact of working longer on projected RR is stronger than the estimated effect of an increase in life expectancy.

By contrast, Lachowska and Myck (2015) make predictions of pension benefits for households based on the micro data, but they do not study the distributional effects of pension reforms within the elderly cohorts. They focus instead on the crowd-out effects of public pension benefits on private savings. Another approach is to use the data on the distribution of current pensioners by wage and tenure (Chloń- Domińczak and Strzelecki, 2013). They find that under the current indexation rules the projected minimum pension guarantee would only amount to 15 percent of the average wage (as compared to the current level of 22 percent) which would increase the risk of poverty for future retirees.

The plan of the paper is as follows. In section 2 we briefly characterize the Polish pension system. In section 3 we describe the data and empirical methods to project pension incomes and replacement rates for individuals in selected cohorts. Section 4 describes the results, section 5 analyses sensitivity of results and the last section concludes.

2. Overview of the Polish pension system

In this Section we briefly describe the pension system for employees and the self- employed that is managed by the Social Insurance Institution (ZUS). There are three separate old-age pension schemes in Poland and ZUS pension system is the largest one. ZUS pension system covers vast majority of working population and retirees (around 80 percent)[2]. It was reformed in 1999.

The reformed pension system for employees and the self-employed consists of three pillars:

1. The mandatory notional-accounts defined contribution (NDC) scheme. The notional rate of return is defined as 100 percent of the growth of the wage bill (75% before 2004). At retirement, the value of an individual notional pension account is converted into annuities using unisex period life expectancy tables published annually by the Central Statistical Office.
2. The second pillar is a funded defined contribution (FDC) scheme. Contributions paid into the second pillar are indexed with the rate of return on pension funds investments.
3. The third pillar consists of voluntary, private pension plans with rather weak tax incentives.

The first and second pillars are financed through individual contributions (19.52% of gross wages) that originally (until 2014) were obligatory split between the 1st (12.2%) and the 2nd (7.3%) pillars. The annual ceiling to these contributions is set at 30 times average monthly earnings projected for a given year.

In 2013, a part of contributions paid into the second pillar was moved to the first pillar and indexed by an average GDP growth from 5 years before indexation. Furthermore, the reform of 2013 established that the first pillar Social Insurance Institution (ZUS) will handle the pension funds retirement plans, with the accumulated funds transferred incrementally 10 years before the statutory retirement age.

In addition to mandatory pillars, it is possible to save for retirement voluntary in occupational and individual pension plans. However, their role in old-age income provision is still marginal, mainly due to weak tax incentives and penalties for early withdrawal of savings.

2 The other two are the pension scheme for farmers and the pension scheme for the armed forces, judges and prosecutors.

The pension reform implemented in 1999 in Poland changed old-age pension formula from the defined benefit (DB) to the defined contribution (DC). The effect of the reform depends on the age of the insured. The old, DB pension scheme applies to people born before 1949 and – in the transitory period until 2008 – to younger ones that did not choose the funded pillar and fulfilled all requirements to retire under old rules before 2009. Initially, all insured born after 31st December 1968 had their pension contributions split between two obligatory pillars: NDC (managed by public Social Insurance Institution ZUS) and FDC (one of the open pension funds managed by private entities). However, since 2013 it is possible to resign from paying contributions to an open pension fund and transfer the whole amount to ZUS only.

The retirement age before the 1999 reform was 60 years for women and 65 years for men with numerous possibilities of earlier retirement (usually at age 55/60). Since 2013 the statutory retirement age has been increasing until in 2040 it reaches 67 years for both men and women in order to increase future pension adequacy. However, the increase in statutory retirement age is still being debated in public with the majority of Poles against the increase to 67[3].

Partial pension benefits will still be possible for men with 40 years of contributions at age 65 and for women with 35 years of contributions at age 62.

Pension benefits in the old pension system were calculated according to the following formula: *Pension benefit = base amount * [0.24 + IB * (0.013 *CY + 0.007 * NCY)]*, where

- *base amount* equal to the average economy-wide wage at the time of calculating the first pension,
- *IB – individual base* stands for the relation of wages from the 10 best years of work out of the last 20 years before retirement to average wages in the economy in the same years (additional restriction was IB ≤ 250%),
- *CY* – number of contributory years,
- NCY – number of non-contributory years, e.g. military service, studies, maternity leave (additional restriction NCY ≤ 1/3*CY).

There were no additional deductions for early retirement or bonuses to make people postpone retirement. The old Polish pension system provided relatively higher replacement rates for low earners and lower for high earners.

3 Results of public opinion polls (CBOS, 2012) show that in April 2012 79% of respondents were against an increase in male retirement age and 86% against an increase in female retirement age.

The new pension formula is:

Pension benefit = pension assets accumulated in 1st and 2nd pillars/ LE (retirement age), where *LE (retirement age)* is the unisex life expectancy at the actual retirement age. Note that Poland implicitly uses a discount rate of zero because the calculation is based on life expectancy alone without any discounting[4].

To illustrate the differences in the old and new pension system, we take a hypothetical men with 25 CY and 5 NCY retiring at age 65, and earning average wage during his entire career. Retiring under the old system formula he could expect replacement rate of around 60%. According to the reformed formula, he would have replacement rate of around 30%, under the assumption of annual real rate of return on pension assets of 1 percent or replacement rate of 40% if the rate of return equals to 3 percent.

For persons that worked before 1999 ZUS estimated a so called initial capital in order to account for accrued pension rights in the previous system. The initial capital is a hypothetical old-age pension according to pre-reform DB formula multiplied by the life expectancy of a 62-year-old and using the adjustment factor. For men the adjustment factor has the following form:

$$p = \sqrt{\frac{age\ on\ 31\ Dec.1998 - 18}{65 - 18} * \frac{tenure\ on\ 31\ Dec.1998}{25}}$$

For persons with longer tenure before 1999 the initial capital is relatively more important for the level of future pension benefits than contributions paid since 1999. In other words, for older cohorts the initial capital has a larger impact on pension benefits than for younger cohorts. Due to the redistributive part in the pre-reform formula i.e. the base amount that accounted for 24% of the total one would expect that pension benefits of older cohorts will be more equally distributed compared to younger cohorts. On the other hand, because of the stronger link between wages and pension benefits in the new system one would expect more inequality in replacement rates for older cohorts with relatively large initial capital and more equality in replacement rates for younger cohorts.

4 See Queisser and Whitehouse (2006) for a discussion of different discount rates in existing NDC schemes.

3. Data and methods

Data and the sample

The data comes from the Polish Household Budget Survey (PHBS) collected by the Polish Central Statistical Office. The PHBS is an annual representative survey covering in 2012 over 37 thousand Polish households and over 105 thousand individuals. We use the most recent available data – the year 2012[5].

To project future pension benefits, we first need to make several assumptions. In PHBS we have information on individual net monthly earnings, but we do not know how many hours individuals work in a month. So, we limit our sample to employees that receive their income from permanent jobs and assume that two individuals in a similar permanent job work the same number of hours[6]. By restricting our sample to employees on permanent jobs we ensure that our predictions of lifetime labour earnings would depend on individual characteristics and not on the number of hours worked. However the existing heterogeneity in earnings is likely to be underestimated. For temporary jobs there is more uncertainty as to the number of hours worked. Moreover, temporary jobs can be in form of a civil contract that is exempted from the social security contributions so income from these jobs does not contribute to future pensions.

There are 31963 individuals who received income from permanent employment in 2012. In this version of the paper we limit our sample to males. We plan to incorporate females in the future analysis, assuming that they participate in the labour market for a shorter time due to career breaks for childcare or elderly care. We trim individual earnings below the 1st and above the 99th percentile in order to reduce the influence of outliers and avoid the impact from coding errors. The resulted regression sample consists of 16706 male individuals.

5 For earnings projections we would use panel data with at least several years of observations. But unfortunately, in PHBS panel data is only available for two consequent years, e.g. 2011 and 2012, and only for half of the sample e.g. in 2012 we observe individuals that we observed in 2011.

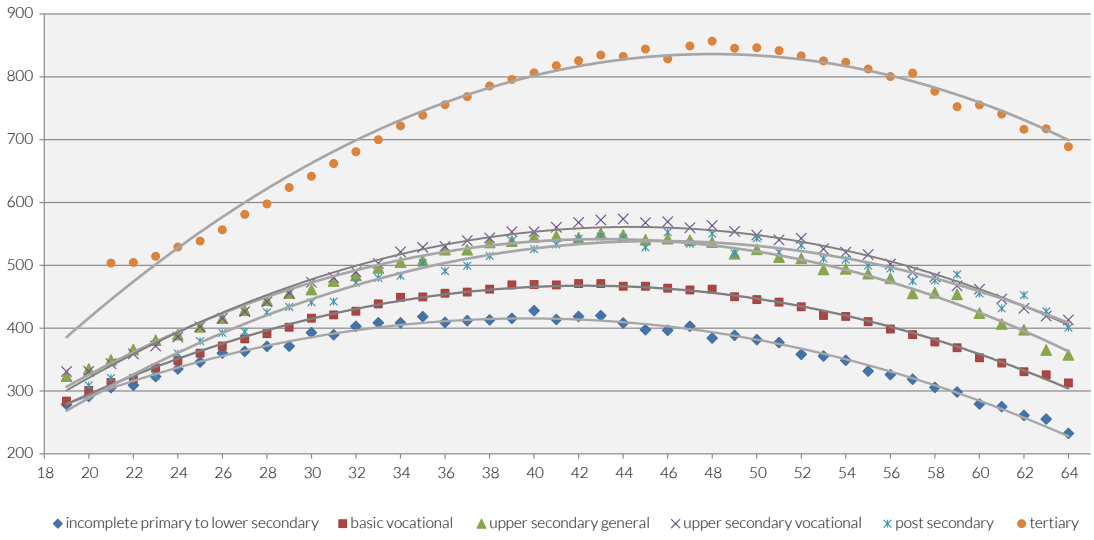
6 The corresponding variable in Polish is “Dochody z pracy najemnej stalej w kraju”.

To assess the pension benefits and replacement rates of *future* retirees we have developed a micro-simulation model[7]. Below we discuss the main assumptions and the steps used in this paper.

Earnings profiles

Following a benchmark Mincer earnings equation, see e.g. Heckman et al. (2003) and Lemieux (2006), we calculate the earnings profiles. We run an OLS regression of log monthly earnings on tenure, tenure squared, education level, and regional dummies (i.e. voivodships). Tenure is defined as age minus estimated years of schooling and minus seven. We group education levels as follows: 1) incomplete primary, primary and lower secondary, 2) basic vocational school, 3) upper secondary general, 4) upper secondary vocational, 5) post-secondary, and 6) tertiary. We group incomplete primary, primary and lower secondary in one group because there are only few observations in the first two groups. The predicted age-earnings profiles are presented in Figure 2.

Figure 2. The predicted age-earnings profiles for men aged 18–64 by education level, in euro



Note: Earnings are net monthly earnings in EUR 2012. Category 1: incomplete primary, primary and lower secondary education, 2: basic vocational, 3: upper secondary general, 4: upper secondary vocational, 5: post secondary, 6: tertiary. Own calculations based on 2012 PHBS.

7 We do micro-simulations in Visual Basics.

Pension benefits projections

We use the predicted earnings profiles to forecast earnings for male employees, given their characteristics, from the age they were in 2012 until they retire at the age of 67. We assume that, except for age, all the current characteristics, i.e. education level and region of living, are fixed and the profile only changes with tenure. We also assume that they all live and work until the statutory retirement age of 67. So we do not account for various mortality or disability patterns among persons from the same cohort.

For earnings projections we limit our sample to males aged 33–43 in 2012 i.e. born between 1969 and 1979. A cohort born in 1969 is the first cohort covered entirely by the new system, i.e. without any transitory rules allowing e.g. for early retirement on DB formula. Thus, we can exclude individuals that may retire earlier. Another reason to limit our sample to individuals in their mid-career is that wages are more stable during these and later years, thus making our predictions more reliable. From the literature we know[8] that there are large increases in wages at the beginning of the career, but after that they change much less. In addition, by this age people have stopped their formal education, so our assumption on fixed education level is more plausible. We end up with 5353 male observations in our sample.

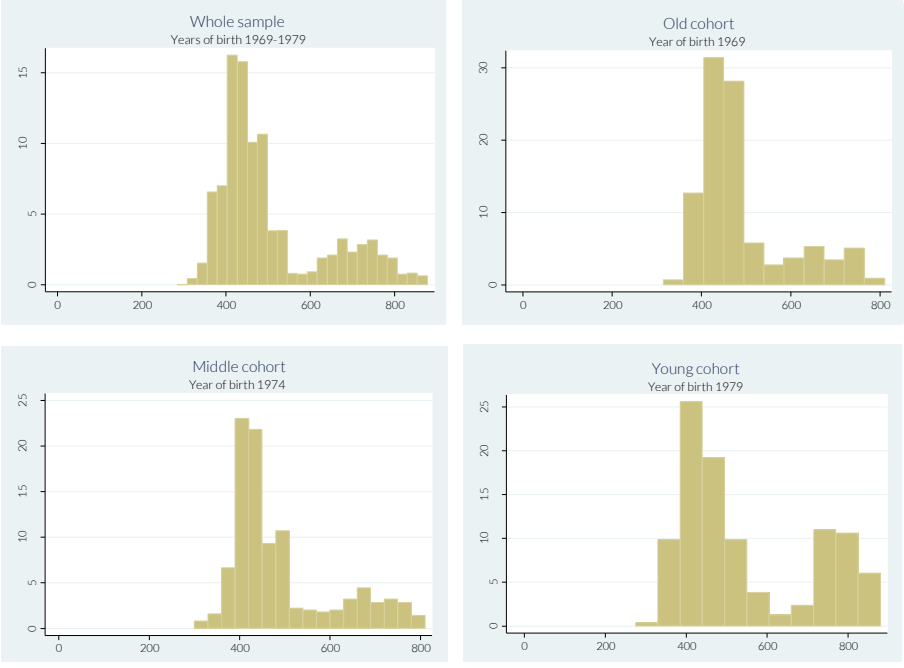
We discuss other assumptions for the *baseline scenario* in the Appendix. We check sensitivity of results to main assumptions in Section 5. We also discuss an *alternative scenario*, where people retire at the age of 65. By comparing the corresponding RR and Gini coefficients with the baseline scenario we can study the effect of an increase in years worked on future pension incomes. In addition, the alternative scenario is also realistic for Poland given that future governments might decrease again the retirement age because of the public pressure.

8 See e.g. Lemieux (2006).

4. Results

In the baseline scenario we have predicted first pension benefits and replacement rates for males aged 33–43 in 2012 that retire at 67 in years 2036–2046. Figure 3 presents the distributions of predicted monthly pension benefits at 67 for the whole sample and for selected years.

Figure 3. Distributions of predicted monthly pension benefits at 67, baseline scenario whole sample and selected years, in euro



Note: Here and in the tables below predicted monthly pension benefits are the first pension benefits at retirement age of 67 in euro (in the baseline scenario); the panels are for the whole sample, for the 'old' cohort (year of birth 1969), for the 'middle' cohort (year of birth 1974) and for the 'young' cohort (year of birth 1979).

Table 1. Predictions of net monthly pension benefits at 67 in euro, baseline scenario, 2036–2046

YEAR OF BIRTH	AVERAGE	p10	p50	p90	p90/p10	p90/p50	p10/p50	Gini
1969	€ 489	€ 399	€ 453	€ 669	1.68	1.48	0.88	0.106
1970	€ 477	€ 385	€ 449	€ 639	1.66	1.42	0.86	0.099
1971	€ 489	€ 386	€ 450	€ 673	1.74	1.50	0.86	0.113
1972	€ 489	€ 393	€ 448	€ 675	1.72	1.51	0.88	0.112
1973	€ 484	€ 376	€ 447	€ 673	1.79	1.51	0.84	0.118
1974	€ 491	€ 393	€ 446	€ 690	1.76	1.55	0.88	0.122
1975	€ 499	€ 380	€ 458	€ 710	1.87	1.55	0.83	0.130
1976	€ 505	€ 373	€ 458	€ 734	1.97	1.60	0.81	0.140
1977	€ 523	€ 395	€ 468	€ 755	1.91	1.61	0.84	0.144
1978	€ 539	€ 390	€ 470	€ 781	2.01	1.66	0.83	0.157
1979	€ 549	€ 383	€ 480	€ 799	2.08	1.66	0.80	0.164

Note: Depending on the birth year, projections of pension benefits are for 2036 (birth year 1969) up to 2046 (birth year 1979). Pension benefits are deflated here to EUR 2012.

Table 1shows the predicted first pension benefits in euro and inequality indices at retirement age of 67 by cohorts, starting from the oldest cohort in our sample i.e. year of birth 1969 and up to the youngest cohort of 1979. The Gini coefficient and the decile ratio p90/p10 show that inequality within cohorts will increase for younger generations. The Gini coefficient steadily increases from 0.106 for the 1969 cohort to 0.164 for the 1979 cohort. The observed increase in the inequality in pension benefits is a result of the 1999 pension reform. In particular, for younger cohorts the share of initial capital that is based on a more redistributive DB formula in accumulated pension benefits is lower than for older cohorts. As described in Section 2, notional initial capital – calculated for all individuals with contributions before 1999 – was based on the old DB pension formula that included a constant part. Average share of initial capital indexed until age 67 decreases from 34–36% for those born in 1969 to 0–1.5% for the cohort born in 1979. Vork et al. (2015) also find that a shift from DB pension system to DC pension system has increased inequality in old-age pensions in Estonia.

Focusing on the decile ratios p10/p50 and p90/p50, interestingly we find that for younger generations inequality increases only in the upper part of the distribution, while it decreases somewhat in the lower part of the distribution. In addition, predicted pension benefits of the

90th percentile are further away from the median of the distribution than the pension benefits of the 10th percentile. P90/p50 equals to around 1.6 and ratio of 10th to 50th percentile is not more than 0.8. From the policy perspective, increase in inequality only in the upper part of the distribution as a result of the shift from DB to DC pension system is less worrying as it does not contribute to relative poverty.

Table 2 presents descriptive statistics of individual replacement rates in the baseline scenario.

Table 2. Descriptive statistics of individual replacement rates at 67, baseline scenario

YEAR OF BIRTH	OBSERVATION S N	AVERAGE	STANDARD DEVIATION	p10	p90	GINI
1969	433	62%	9.83	46%	71%	0.089
1970	417	60%	9.02	45%	69%	0.082
1971	447	58%	9.14	45%	67%	0.088
1972	469	57%	8.93	44%	66%	0.087
1973	475	56%	8.73	43%	64%	0.088
1974	495	54%	8.03	42%	62%	0.083
1975	503	53%	7.31	41%	61%	0.078
1976	535	52%	6.93	43%	59%	0.075
1977	486	50%	5.96	43%	58%	0.067
1978	545	50%	5.36	42%	56%	0.060
1979	547	49%	4.67	43%	55%	0.053

Note: Replacement rates are calculated as a ratio of the first pension benefits to last earnings before retirement.

As expected, inequality in replacement rates measured by the Gini coefficient is much lower than inequality in pension benefits as under DC pension system pension benefits are closely linked to lifetime contributions. The average Gini coefficient of replacement rates amounts to 0.08 as compared to the average Gini coefficient of pension benefits of 0.13. Moreover, we find that inequality in replacement rates is decreasing over time, reflecting the fact that pension benefits of younger cohorts are stronger linked to earnings than pension benefits of the older cohorts.

In the alternative scenario we assume that the recent decision to increase retirement age is reversed and male retirement age will be 65 (see Table 3). Under our assumptions that would decrease future replacement rates but would not have a major impact on the Gini coefficients in various cohorts.

Table 3. Descriptive statistics of individual replacement rates at 65, alternative scenario

YEAR OF BIRTH	OBSERVATION S N	AVERAGE	STANDARD DEVIATION	p10	p90	GINI
1969	433	52%	8.10	39%	59%	0.087
1970	417	51%	7.44	38%	58%	0.081
1971	447	49%	7.52	37%	56%	0.087
1972	469	48%	7.34	37%	55%	0.086
1973	475	47%	7.17	36%	53%	0.086
1974	495	46%	6.59	35%	52%	0.081
1975	503	44%	5.98	36%	51%	0.076
1976	535	44%	5.64	36%	49%	0.073
1977	486	42%	4.82	37%	48%	0.065
1978	545	42%	4.30	36%	47%	0.058
1979	547	41%	3.70	36%	46%	0.050

Note: Replacement rates in the alternative scenario, where people retire at the age of 65.

The predicted median replacement rate at 65 amounts to 46. This is consistent with Lachowska and Myck (2015) who predict median replacement rate for individuals of the same age at 44[9]. Average replacement rates are decreasing for younger cohorts mainly because of decreasing replacement rates in the upper part of the distribution. This is due to lower projected benefits but also to the fact that the Mincer equation predicts a decrease in wages for all people in their 60s so wage at 65 (the denominator in RR) is higher than at age 67.

Vulnerable groups

Who are the most vulnerable groups in Poland in terms of projected future pensions? According to the predictions, people with the lowest pension benefits are characterized by low wages during their career, and consequently, by low contributions. Shorter tenure or temporary (but short) breaks in social insurance are less important if a person paid high contributions in other periods of professional life.

9 There are small differences between our predictions and Lachowska and Myck (2015). They predict replacement rates for the head of households, with 68% of them are men, while we predict them for men (see Table 4 in Lachowska and Myck, 2015).

Table 4 below shows the structure of education in the whole sample and in the lowest decile (p10) of the first pension distribution. As our estimations of age-earning profiles indicate, longer education is generally linked to higher wages at all ages and that results in higher pension benefits in the DC system. Those with pensions below the 10th percentile will probably have primary, lower secondary or basic vocational education. The negative impact of shorter education on predicted pension benefits is observed in each cohort of men born in years 1969–1979.

Table 4. Structure of education in the whole sample and 10th decile of the pension distribution

		FREQUENCY	%
whole sample	Incomplete primary, primary and lower secondary	111	2
	Basic vocational	1835	38
	Upper secondary general	316	7
	Upper secondary vocational	71	2
	Post-secondary	1213	25
	Tertiary	1268	26
	Total	**4814**	**100**
in 10th decile	Incomplete primary, primary and lower secondary	251	47
	Basic vocational	287	53
	Total	**538**	**100**

Another factor that drives low predicted pension benefits are low average wages in some Polish regions (voivodships). Over 40% of future retirees from less developed regions with relatively low wages, e.g. Eastern Poland, will be in the 10th decile of the whole pension distribution, while almost all retirees living in most developed regions, e.g. Mazovia region with the capital Warsaw, will be above the 10th decile. Of course standards of living of the elderly should be adjusted to the costs of living (usually slightly lower in poorer regions) but those with lower pensions can be more at-risk-of-poverty, especially when living alone in retirement.

As we only analyse men with income from permanent work due to data restrictions (see Section 3, data and the sample), we do not account for vulnerable groups that include people

on temporary work, short tenure and on contracts under civil law[10]. Previous studies for Poland (see e.g. Chłoń-Domińczak and Strzelecki 2013) show that groups with short tenure and career breaks will be at higher risk of falling below poverty line in retirement. Lewandowski et al. (2015) estimate that pension benefits for workers on contracts under civil law can be lower by 17% than in the case of standard employment contracts. Long periods on temporary contracts would negatively influence adequacy of future pensions in the Polish DC pension system.

10 Contracts under civil law stipulate low or zero contributions.

5. Sensitivity of results

To check sensitivity of our results to assumptions we compare the distribution of simulated old- age pensions in the baseline scenario (with retirement at age 67) to scenarios with lower/ higher rate of return, longer life expectancy and no-unemployment scenario.

First, we change the real rate of return in FDC and real annual indexation of accumulated pension capital in NDC from 2 percent to 1 percent (lower rate of return) and to 3 percent (higher rate of return). As we assumed the same rate of return in the funded and unfunded parts of the Polish pension system (see Section 3), changes in the rate of return will have an impact on the level of future pensions and replacement rates but not on predicted inequality of pensions measured by the Gini index (see Table 5).

Table 5. Gini index of pension benefits in different scenarios, whole sample and selected cohorts

	BASELINE	LOWER RATE OF RETURN	HIGHER RATE OF RETURN	LONGER LE	NO UNEMPLOYMENT
whole sample	0.133	0.132	0.132	0.133	0.124
old cohort – year of birth 1969	0.119	0.106	0.106	0.106	0.101
middle cohort – year of birth 1974	0.128	0.122	0.122	0.122	0.114
young cohort – year of birth 1979	0.165	0.164	0.164	0.164	0.150

Second, we increase life expectancy at 67 by 12 month from the current 236 months for those retiring in year 2036 (cohort born in 1969) and 254 months for retiring in 2046. Longer life expectancy results in a decrease in absolute benefits but no impact on pension inequality. Third, we drop our assumption of being unemployed with probability of the average unemployment rate in the economy and instead assume no unemployment. We find that this assumption has the strongest impact on the predicted results. In particular, without unemployment the expected

inequality in pension benefits decreases substantially for the whole sample and for all cohorts which is due to relatively longer contributory periods for lower educated individuals than in the baseline scenario. Thus, unemployment in our simulation model contributes significantly to the observed inequality in pension benefits.

6. Conclusions and discussion

This paper analyses the intragenerational distributional effects of the Polish pension reform. As an old-age pension from the obligatory system is the most important source of income in elderly households it is important to simulate distribution in both absolute levels of pensions and replacement rates.

Apart from a projected decrease in pensions or replacement rate, predicted by many previous studies, we found that inequality of predicted first pension benefits will increase within younger cohorts as pension capital from accumulated contributions will have a higher share in pension benefits and pension capital from the initial capital (based on a more generous old DB formula) will be less important. On the other hand, inequality in replacements rates will decrease due to a stronger link between contributions and pensions. The sensitivity analysis suggests that unemployment in our simulation model contributes significantly to the observed inequality in pension benefits.

When interpreting results one has to remember that we simulate pension benefits for a part of the population, i.e. men retiring according to the post reform regulations. That means omitting women with more career breaks and lower wages, as well as pensions of miners and armed services that retire according to more generous pension formulas. Adding these groups to the analysis would probably increase intragenerational inequality.

Our results show that policy makers should try to identify potentially vulnerable groups of people (i.e. with low expected future pensions) in every cohort and implement policies that allow individuals for accumulating enough pension capital to have adequate pension income in future.

References

CBOS (2012). Nadal nieprzekonani – Polacy o podniesieniu wieku emerytalnego, *in Polish*, com. BS/57/2012, Warsaw. http://www.cbos.pl/SPISKOM.POL/2012/K_057_12.PDF.

Chłoń-Domińczak, A. and P. Strzelecki (2013). The minimum pension as an instrument of poverty protection in the defined contribution pension system – an example of Poland, *Journal of Pension Economics and Finance* 12, 03, 326–350.

Égert, B (2013). The impact of changes in second pension pillars on public finances in Central and Eastern Europe: The case of Poland, *Economic Systems*, Elsevier, vol. 37(3), pages 473–491.

Ervik, R. and Lindén, T.S. (ed.) (2013). *The Making of Ageing Policy: Theory and Practice in Europe*. Edward Elgar Publishing.

European Commission (2012). Pension Adequacy in the European Union 2010–2050, *Report prepared jointly by the Directorate-General for Employment, Social Affairs and Inclusion of the European Commission and the Social Protection Committee*, European Union.

Heckman, J, Lochner, L., and P. Todd (2003). Fifty Years of Mincer Earnings Regressions, *NBER Working Paper No. 9732*, NBER.

Jablonowski, J. and C. Muller (2013). 3 sides of 1 coin - Long-term fiscal stability, adequacy and intergeneraEonal redistribuEons of the reformed old-age pension system in Poland, NBP Working paper No. 145, Warsaw.

Knoef, M., Alessie, R. and A. Kalwij (2013). Changes in the Income DistribuEon of the Dutch Elderly between 1989 and 2020: a Dynamic MicrosimulaEon, The Review of Income and Wealth, vol. 59(3), pages 460–485, September 2013.

Lachowska, M. and M. Myck (2015). The Effect of Public Pension Wealth on Saving and Expenditure, *IZA Discussion Papers 8895*, Institute for the Study of Labor (IZA).

Leifels A., C. Müller and B. Raffelhüschen (2010). Mind the pension gap. On the relationship between future pensions and pre-retirement consumption in Poland, *Working paper of the Study of the Research Center for Generational Contracts*.

Lemieux, T. (2006). The "Mincer Equation" Thirty Years After Schooling, Experience, and Earnings. In: Grossbard, S. (Ed.). *Jacob Mincer A Pioneer of Modern Labor Economics*, Springer International Publishing AG.

Lewandowski, P., Stronski, K. and Keister R. (2015). "Labour market segmentation and pensions in the Polish defined-contribution scheme," IBS Working Papers 9/2015, Instytut Badan Strukturalnych.

Määttänen N., Võrk A., Piirits M., Gal R., Jarocinska, E., Ruzik-Sierdzińska, A., and T. Nijman (2014). The Impact of Living and Working Longer on Pension Income in Five European Countries, *Netspar Discussion paper* DP 08/ 2014–036.

OECD (2013), Pensions at a Glance 2013, Paris: OECD.

Queisser, M. and E. Whitehouse (2006). Neutral or Fair? Actuarial concepts and pension-system design, *OECD Social, Employment and Migration Working Papers 40*, OECD.

Van Vliet, O., Been, J., Caminada, K., and K. Goudswaard (2012). Pension Reform and Income Inequality among Older People in 15 European Countries. *International Journal of Social Welfare* 21: S8–29.

Vork, A., Piirits, M., and E. Jõgi (2015). The impact of introducEon of funded pension scheme on intrageneraEonal inequality in Estonia: a cohort based analysis, Praxis Center for Policy Studies, Estonia, mimeo.World Bank (2014). Poland: Saving for Growth and Prosperous Aging, Country Economic Memorandum, June.

Appendix: Pension benefit projections

Additional assumptions for the baseline scenario include:

- In the future individual real wages will grow at the rate of the average wage growth in the economy. In the base scenario we assume 2% annual real average wage growth since 2014.
- For calculation of contributions, we also need information on individual earnings before 2012. Some men in our sample paid their contributions during 25 years. We assume that previous individual earnings change according to estimated age-earnings profiles.
- Earnings in the PHBS are reported net of taxes and Social Security contributions. We gross up the net earnings to include taxes and social security contributions. For that, we assume that social security contributions rates and personal income tax rates in the future are the same as in 2012.
- To take into account unemployment, we assume that every person is unemployed and does not pay his contributions with the probability equal to the average unemployment rate from years 2005–2014 for men with the same education level as a man in the sample. In this period average unemployment rates varied from 19.2 percent for the shortest education (i.e. category 1: incomplete primary, primary and lower secondary education) to 4.5 percent for tertiary education. Thus, we account for the average expected unemployment by education in a business cycle but disregard persistence in unemployment. We assume that unemployment is a period without contributing to the pension system[11].
- We assume that every person in our sample starts working just after completing his/her formal education. For older cohorts that worked before 1999 we need to estimate the initial capital (see section 2). We calculate the initial capital according to the formula discussed in section 2.
- The rate of return and indexation of funds in the accumulation phase and the benefit formula are the same as in the current Polish pension system. As we do not know how many people decided to stop paying contributions to open pension funds we assume

11 In Poland contributions are paid on unemployment benefits but less than 20 percent of the unemployed are entitled to such benefits.

that *real* annual indexation of accumulated pension capital in NDC pillar and the rate of return in FDC will be the same and in the base scenario equal to 2%. For years 1999–2013 we take the actual indexation (see information on ZUS website).

- Future unisex life expectancy at age 67 was calculated on the basis of EUROPOP2010 projections of life expectancies at 65 (Eurostat database). That resulted in 0.73% growth in LE at 67 every year starting from actual 201.1 months for 2014.
- For simplicity, we assume that people retire on 1st January of the year when they turn 67. We do not allow for partial pension benefits at age 65.