# The distributional effects of the pension system reform in Poland [1]

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Abstract

We show that the 1999 reform of the pension system in Poland increased the inequality of future pension benefits within age cohorts. 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 pension capital accumulated according to pre-reform more generous rules. At the same time, inequality in replacement rates decreases due to a stronger link between contributions paid throughout the entire working life and pension benefits.

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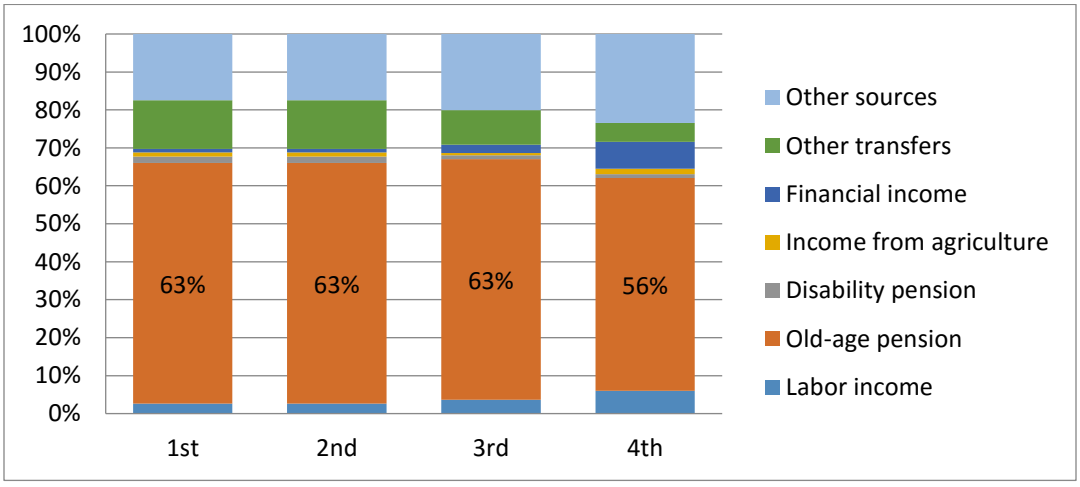
## 1. Introduction

The majority of developed countries are expecting decreases in their replacement rates (RR) as a result of recent pension reforms (see OECD, 2013). Poland stands out as it has one of the largest predicted drops in RR among the EU-27 during the 2010-2050 period. For an average income earner with a 40-year career, the drop in RR is predicted to be 35 percent due to a shift from the defined benefit (DB) to the defined contribution (DC) pension system (EC, 2012).

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 needs to complement public pension benefits with private pensions and other savings. According to a World Bank study, in Poland, working cohorts aged 20–50 should save an additional 10 percent of their annual earnings to guarantee them current RRs (World Bank, 2014). Low-income earners, persons with short tenures 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 need in-depth knowledge about the income distribution of current and future retirees, so that they can target their social policies towards the most vulnerable.

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




*Source: Own calculations based on the Polish HBS individual data. "Other transfers" cover mainly unemployment, social assistance and family transfers and "Other sources" income from rental, gifts and money from private persons, maintenance, etc.*

This paper studies the distributional effects of the Polish pension reform based on the micro data from the Polish Household Budget Survey (PHBS). Following a benchmark earnings equation[2], and using a new microsimulation model we developed, 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 analyzing the projected pension incomes of individuals from different cohorts, we can study the effects of the 1999 pension reform, which are materializing only gradually. We find that the 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 RRs decreases somewhat.

As a result of the 1999 pension reform in Poland, the more generous and redistributive DB formula was replaced with the DC formula that takes into account life expectancy at retirement age (see Section 2 for details). While the new pension system is more sustainable in the long run, this 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 an individual's last pre-retirement wages) or in euro amounts. The latter objective is achieved 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 the DC formula results in a smaller inequality in terms of RRs, given that the 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 analyzed 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 on groups of retirees within age cohorts (see e.g. Ervik and Linden 2013 and OECD 2013).

To our knowledge, this paper is the first to analyze the distribution of future pension incomes of the Polish elderly within cohorts, i.e. intra-generational inequality. Previous studies on Poland that predicted future pension benefits did not investigate the whole income distribution. Most of the previous studies predicted 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 intergenerational differences (see Jabłonowski and Müller 2013; Egert 2012; Leifels et al 2010). These studies found large drops in projected RR, especially for people with career breaks and short careers as well as low earners.

By contrast, Lachowska and Myck (2015) made predictions of pension benefits for households based on the micro data, but they did not study the distributional effects of pension reforms within the elderly

[2] See e.g. Heckman et al. (2003) and Lemieux (2006).

cohorts. They focused 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 found that under the current indexation rules the projected minimum pension would substantially decrease, which would increase the risk of poverty for future retirees.

The plan of the paper is as follows. In section 2, we provide a brief description of the Polish pension system. In section 3, we describe the data and empirical methods used to project pension incomes and replacement rates for individuals in selected cohorts. Section 4 describes the results, section 5 analyzes the sensitivity of the 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, which is managed by the Social Insurance Institution (ZUS). There are three separate old-age pension schemes in Poland and the ZUS pension system is the largest one. The ZUS pension system covers the vast majority of the working population and retirees (around 80 percent)[3]. It was reformed in 1999.

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

1. The first pillar is 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 were originally split between the 1st (12.2%) and the 2nd (7.3%) pillars (this was obligatory until 2014). The annual ceiling to these contributions is set at 30 times average monthly earnings projected for a given year.

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

In 2013, a part of the 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, 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 voluntary retirement 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.

The pension reform implemented in 1999 in Poland changed the 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 who did not choose the funded pillar and fulfilled all the requirements to retire under the old rules before 2009. Initially, all of the insured born after December 31st, 1968 had their pension contributions split between two obligatory pillars: NDC (managed by public ZUS) and FDC (an open pension fund managed by private entities). However, as of 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 for women and 65 for men, with numerous possibilities for earlier retirement (usually at age 55/60). Since 2013, the statutory retirement age has been increasing until in 2040 it will reach 67 years for both men and women in order to increase future pension adequacy. However, the increase in the statutory retirement age is still being debated, and polls show that the majority of Poles are against the increase to 67[4].

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* is equal to the average economy-wide wage at the time of calculating the first pension,

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

- *IB – individual base* stands for the ratio 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 rates for high earners.

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[5].

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

For people who worked before 1999, ZUS estimated the so-called 'initial capital' in order to account for accrued pension rights in the previous system[6]. The initial capital is a hypothetical old-age pension according to the pre-reform DB formula multiplied by the life expectancy of a 62-year-old and by the adjustment factor, AF. The initial capital is computed as *0.24 x Base amount x AF x Life expectancy for a 62-year-old*.

[5] See Queisser and Whitehouse (2006) for a discussion of different discount rates in existing NDC schemes.
[6] For details, see Chłoń-Domińczak (2002).

For men the adjustment factor AF has the following form:

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

For people with a longer tenure before 1999, their initial capital is relatively more important for the level of future pension benefits than the contributions paid since 1999. In other words, for older cohorts, initial capital has a larger impact on pension benefits than for younger cohorts. Due to the redistributive part of the initial capital i.e. the base amount from the old formula, one would expect that pension benefits of older cohorts would 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.

## 3. Data and methods

*Data and the sample*

The data comes from the Polish Household Budget Survey (PHBS) run by the Polish Central Statistical Office. The PHBS is an annual representative survey which covers over 37 thousand Polish households and over 105 thousand individuals. We use available data from 2012[7].

To project future pension benefits, we first need to make several assumptions. The PHBS offers information on individual net monthly earnings, but we do not know how many hours individuals work in a month. So, we limited our sample to employees that receive their income from permanent jobs and assumed that two individuals in a similar permanent job work the same number of hours[8]. By restricting our sample to employees in permanent jobs, we ensure that our predictions of lifetime labor earnings 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 the form of a civil contract that

[7] For earnings projections ideally we would use panel data with at least several years of observations. But unfortunately, in the 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 already observed in 2011.
[8] The corresponding variable in Polish is "Dochody z pracy najemnej stalej w kraju".

is often exempt from social security contributions, so income from these jobs does not contribute to future pensions.

There are 31,963 individuals who received income from permanent employment in 2012. We limited our sample to males because we can project their pension benefits with higher accuracy than female pension benefits. Women usually experience more career breaks due to family or care duties and there is no information available on career breaks in PHBS. On the other hand, males (at least, in Poland) rarely have periods of time out from employment because of family and care duties. We trimmed 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 16,706 male individuals.

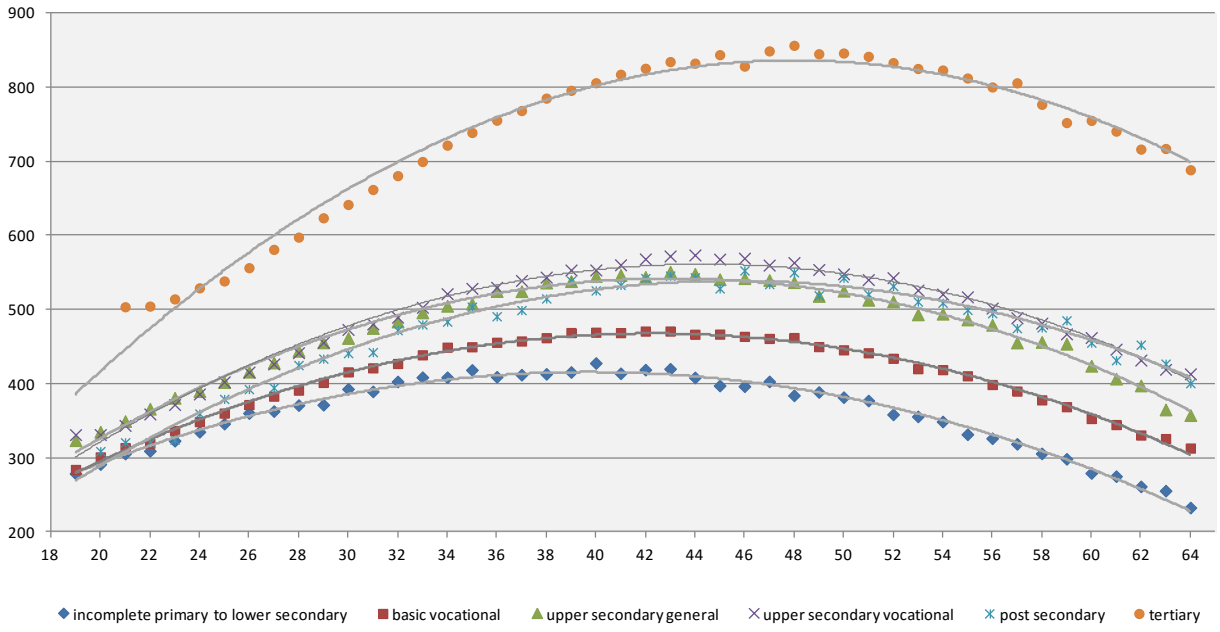
To assess the pension benefits and replacement rates of *future* retirees we developed a simple micro-simulation model[9]. Below we discuss the main assumptions and the steps used in this paper.

*Earnings profiles*

Following a benchmark Mincer earnings equation (see e.g. Heckman et al. (2003) and Lemieux (2006)), we calculated the earnings profiles. We ran 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, minus seven. We grouped 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 grouped incomplete primary, primary and lower secondary in one group because there were only a few cases observed in the first two categories. The predicted age-earnings profiles are presented in Figure 2.

[9] We use Visual Basics to do micro-simulations.

**Figure 2. The observed (cross section) and predicted age-earnings profiles for men aged 18-64 by education level, in euro**




*Note: Earnings are net monthly earnings in EUR 2012. Own calculations based on 2012 PHBS.*

*Pension benefits projections*

We used 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 assumed that, except for age, all the current characteristics, i.e. education level and region of living, were fixed and the profile only changes with tenure. We also assumed that they all live and work until the statutory retirement age of 67. So we did not account for various mortality or disability patterns among persons from the same cohort.

For earnings projections, we limited our sample to males aged 33-43 in 2012, i.e. born between 1969 and 1979. The cohort born in 1969 was the first cohort covered entirely by the new reformed pension system, i.e. without any transitory rules, such as those allowing for early retirement on the DB formula. Thus, we could exclude individuals that may retire earlier. Another reason to limit our sample to individuals in mid-career is that wages are more stable during these and later years, thus making our

predictions more reliable. From the literature,[10] we know that there are large increases in wages at the beginning of most peoples' careers, but after that they change much less. This was also confirmed by our data. In addition, by the time they have reached their thirties, most people have stopped their formal education, so our assumption on the fixed education level is more plausible. We ended up with 5,353 male observations in our sample.

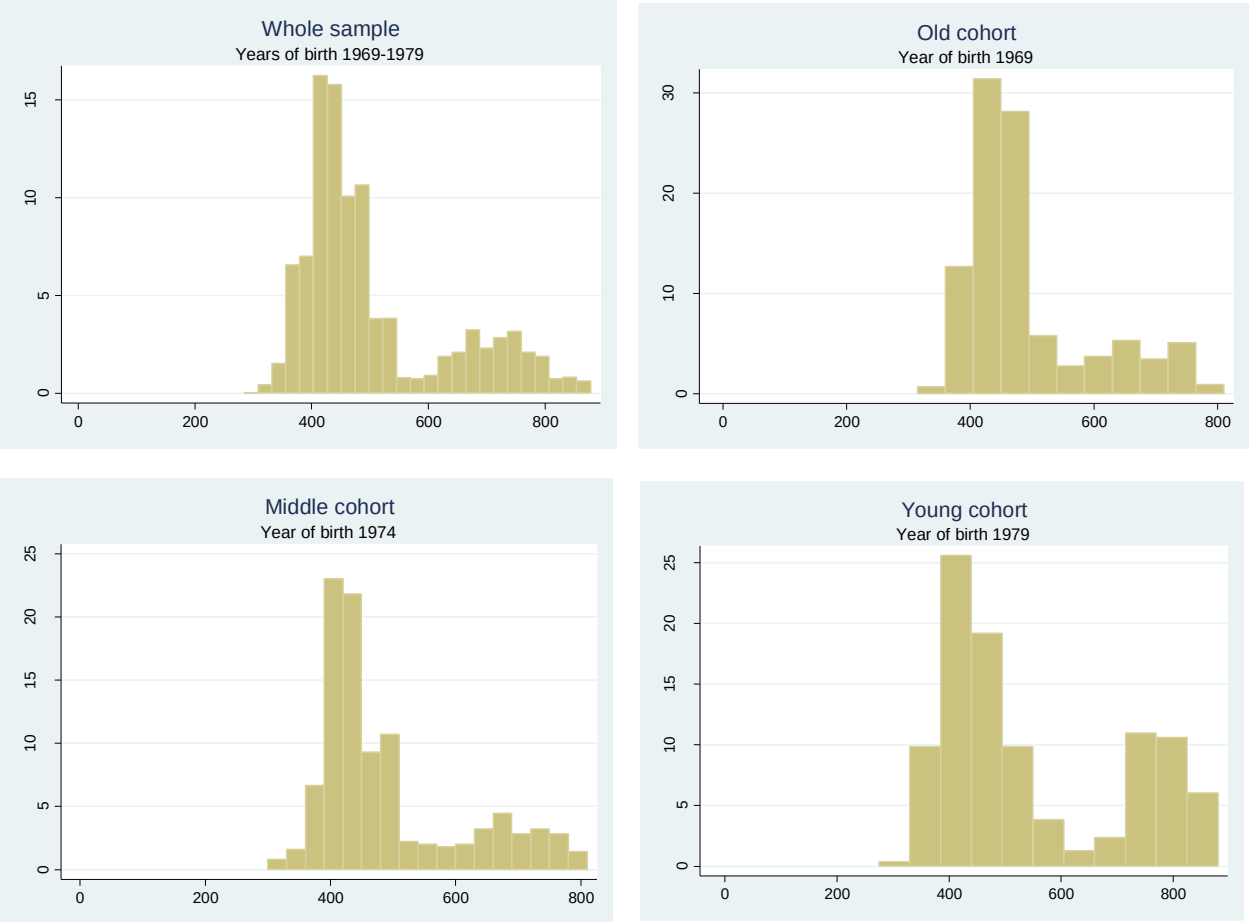
We discuss other assumptions for the *baseline scenario* in the Appendix. We check the sensitivity of the results to the main assumptions in Section 5. We also discuss an *alternative scenario*, in which people retire at the age of 65. By comparing the corresponding RR and Gini coefficients with the 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 the government might decrease the retirement age again because of public pressure.

## 4. Results

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

[10] See e.g. Lemieux (2006).

**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 the 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 1 shows the predicted first pension benefits in euro and inequality indices at the retirement age of 67 by cohorts, starting from the oldest cohort in our sample (born in 1969) up until the youngest cohort (born in 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 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. The 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 found that a shift from a DB pension system to a DC pension system increased inequality in old-age pensions in Estonia.

Focusing on the decile ratios p10/p50 and p90/p50, we found 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, the 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 around 1.6 and the ratio of the 10th to the 50th percentile is not more than 0.8. From the policy perspective, an increase in inequality only in the upper part of the distribution as a result of the shift from the DB to the 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 | N | Average | Std dev | p10 | p50 | p90 | p90/p10 | p90/p50 | p10/p50 |
|---|---|---|---|---|---|---|---|---|---|
| **1969** | **433** | **62%** | **9.83** | **46%** | **64%** | **71%** | **1.54** | **1.11** | **0.72** |
| 1970 | 417 | 60% | 9.02 | 45% | 63% | 69% | 1.53 | 1.10 | 0.71 |
| 1971 | 447 | 58% | 9.14 | 45% | 61% | 67% | 1.49 | 1.10 | 0.74 |
| 1972 | 469 | 57% | 8.93 | 44% | 60% | 66% | 1.50 | 1.10 | 0.73 |
| 1973 | 475 | 56% | 8.73 | 43% | 58% | 64% | 1.49 | 1.10 | 0.74 |
| **1974** | **495** | **54%** | **8.03** | **42%** | **57%** | **62%** | **1.48** | **1.09** | **0.74** |
| 1975 | 503 | 53% | 7.31 | 41% | 52% | 61% | 1.49 | 1.17 | 0.79 |
| 1976 | 535 | 52% | 6.93 | 43% | 51% | 59% | 1.37 | 1.16 | 0.84 |
| 1977 | 486 | 50% | 5.96 | 43% | 50% | 58% | 1.35 | 1.16 | 0.86 |
| 1978 | 545 | 50% | 5.36 | 42% | 48% | 56% | 1.33 | 1.17 | 0.88 |
| **1979** | **547** | **49%** | **4.67** | **43%** | **49%** | **55%** | **1.28** | **1.12** | **0.88** |

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

As expected, inequality in replacement rates is much lower than inequality in pension benefits as under the DC pension system, pension benefits are closely linked to lifetime contributions. We found that inequality in replacement rates decreases over time, reflecting the fact that the pension benefits of younger cohorts are more strongly linked to earnings than the pension benefits of the older cohorts. Ratio of 90th to 10th percentile is 1.5 for the cohort born in 1969 and decreases to around 1.3 for those born in 1979. That is mainly due to a decrease in the lower part of the replacement rates distribution.

In the alternative scenario we assumed that the recent decision to increase the retirement age was reversed and that the male retirement age will be 65 (see Table 3). Under our assumptions, future replacement rates would decrease and would have a moderate impact on the intragenerational inequality in the various cohorts.

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

| Year of birth | N | Average | Std dev | p10 | p50 | p90 | p90/p10 | p90/p50 | p10/p50 |
|---|---|---|---|---|---|---|---|---|---|
| **1969** | **433** | **52%** | **8.10** | **39%** | **54%** | **59%** | **1.51** | **1.09** | **0.72** |
| 1970 | 417 | 51% | 7.44 | 38% | 53% | 58% | 1.53 | 1.09 | 0.72 |
| 1971 | 447 | 49% | 7.52 | 37% | 51% | 56% | 1.51 | 1.10 | 0.73 |
| 1972 | 469 | 48% | 7.34 | 37% | 50% | 55% | 1.49 | 1.10 | 0.74 |
| 1973 | 475 | 47% | 7.17 | 36% | 49% | 53% | 1.47 | 1.08 | 0.73 |
| **1974** | **495** | **46%** | **6.59** | **35%** | **48%** | **52%** | **1.49** | **1.08** | **0.73** |
| 1975 | 503 | 44% | 5.98 | 36% | 44% | 51% | 1.42 | 1.16 | 0.82 |
| 1976 | 535 | 44% | 5.64 | 36% | 43% | 49% | 1.36 | 1.14 | 0.84 |
| 1977 | 486 | 42% | 4.82 | 37% | 42% | 48% | 1.30 | 1.14 | 0.88 |
| 1978 | 545 | 42% | 4.30 | 36% | 40% | 47% | 1.31 | 1.18 | 0.90 |
| **1979** | **547** | **41%** | **3.70** | **36%** | **41%** | **46%** | **1.28** | **1.12** | **0.88** |

*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 predicted the median replacement rate for individuals of the same age at 44[11]. 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 the wage at age 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. Temporary (but short) breaks in social insurance are less important if a person paid high contributions in other periods of their professional life.

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, a 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. This can be explained by positive returns to education in terms of higher expected earnings, especially for those with higher education (see Strawiński (2006) or Myck et al. (2009)).

[11] There are small differences between our predictions and those made by Lachowska and Myck (2015). They predicted replacement rates for the heads of households, 68% of which are men, while we predict them for men (see Table 4 in Lachowska and Myck, 2015).

**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 the low predicted pension benefits is the low average wages in some Polish regions (voivodships). Over 40% of future retirees from less developed regions with relatively low wages will be in the 10th decile of the whole pension distribution, while almost all retirees living in the most developed regions, e.g. Mazovia region of which Warsaw is the capital, 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 for poverty, especially when living alone in retirement or when faced with the costs of pharmaceuticals, which account for 75% of private health care expenditures of those with long-term illness and retirees (see Boulhol et al., 2012).

In addition to education and wages, breaks in contributions are also important. Besides periods of unemployment that we have accounted for in this paper, breaks due to maternity or other care duties would also result in lower predicted pension benefits.

As we have focused on men with incomes from permanent work due to data restrictions (see Section 3, data and the sample), we did not account for vulnerable groups, which includes people doing temporary work, short tenure or on contracts under civil law. Long periods on temporary contracts would negatively influence the adequacy of future pensions in the Polish DC pension system[12].

[12] Previous studies for Poland (e.g. Chłoń-Domińczak and Strzelecki 2013) show that groups with shorter tenure and career breaks will be at a higher risk of falling below the poverty line in retirement. Lewandowski et al. (2015) estimate that pension benefits for workers on contracts under civil law[12] can be lower by 17% than for those on standard employment contracts.

## 5. Sensitivity of results

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

First, we changed the real rate of return in the FDC and the real annual indexation of accumulated pension capital in the 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 as 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 increased life expectancy at 67 by 12 months from the current 236 months for those retiring in year 2036 (the cohort born in 1969) and 254 months for those retiring in 2046. Longer life expectancy results in a decrease in absolute benefits but has no impact on pension inequality. Third, we dropped our assumption of being unemployed with the probability of the average unemployment rate in the economy and instead assumed no unemployment. We found that this assumption had the strongest impact on the predicted results. In particular, without unemployment, the expected inequality in pension benefits decreased substantially for the whole sample and for all cohorts. This is due to relatively longer contributory periods for less 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 analyzes the intra-generational 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.

We focus on men born between 1969 and 1979 who will retire in the future according to the fully-mature DC system at age 67. Apart from a decrease in pensions or replacement rates, which was also predicted by 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, whereas pension capital from 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.

Although temporary short breaks in social insurance are less important if a person paid high contributions during other periods of his or her professional life, the sensitivity analysis suggests that unemployment in our simulation model contributes significantly to the observed inequality in pension benefits. Higher unemployment probabilities for less educated men have a strong impact on their expected future pensions.

A hypothetical lower retirement age would decrease future replacement rates but would have only moderate impact on intragenerational inequality (measured by replacement rates) in various cohorts.

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

Our results show that policymakers should try to identify potentially vulnerable groups (i.e. those with low expected future pensions) in every cohort and implement policies that would allow individuals to accumulate enough pension capital to have an adequate pension income in future.

Our model shows that for younger generations, inequality increases only in the upper part of the distribution so it is less dangerous from the point of view of relative poverty.

## References:


Boulhol, H., Sowa A., Golinowska S., and P. Sicar (2012). Improving the Health-Care System in Poland. *OECD Economics Department Working Papers*, No. 957, OECD Publishing.

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. (2002). "The Polish pension reform of 1999". In E. Fulz (ed.), *Pension reform in Central and Eastern Europe*. Vol. 1, Restructuring with privatization: case studies of Hungary and Poland. Budapest, International Labour Office, pp. 95-205.

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 intergenerational redistributions 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 Distribution of the Dutch Elderly between 1989 and 2020: a Dynamic Microsimulation, *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.

Myck, M., Nicinska, A. and L. Morawski (2009). Count Your Hours: Returns to Education in Poland, *IZA Discussion Paper*, no. 4332.

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.

Strawiński, P. (2006). Zwrot z inwestowania w wyższe wykształcenie. *Ekonomista* vol. 6., p. 805-821.

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 introduction of funded pension scheme on intragenerational 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 included the following:

- In the future, individual real wages will grow at the rate of the average wage growth in the economy. In the base scenario, we assumed a 2% annual real average wage growth since 2014.
- For the calculation of contributions, we also needed information on individual earnings before 2012. Some men in our sample paid their contributions over 25 years. We assumed 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 used gross earnings, in which taxes and social security contributions are added to net earnings. For that, we assumed that social security contributions rates and personal income tax rates in the future will be the same as in 2012.
- To take into account unemployment, we assumed that every person was unemployed and did not pay his contributions with the probability equal to the average unemployment rate from 2005-2014 for men with the same education level as a man in the sample. During 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 accounted for the average expected unemployment by education in a business cycle but disregarded persistence in unemployment. We assumed that unemployment is a period during which there are no contributions to the pension system[13].
- We assumed that every person in our sample started working just after completing his/her formal education. For older cohorts that worked before 1999, we needed to estimate the initial capital (see section 2). We calculated initial capital according to the formula discussed in section 2.

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

- 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 assumed that the *real* annual indexation of accumulated pension capital in the NDC pillar and the rate of return in the FDC would be the same and in the base scenario is is equal to 2%. For the 1999-2013, we took the actual indexation (see ZUS website[14]).
- 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 201.1 months for 2014.
- For simplicity, we assumed that people retired on January 1st of the year they turned 67. We do not allow for partial pension benefits at age 65.

[14] http://www.zus.pl/default.asp?id=3416&p=1&idk=, date of access 3rd May 2015.