The Effect of Public Pension Wealth on Saving and Expenditure

Marta Lachowska and Michał Myck

Online Appendix A: Sample, variables, and calculation of pension wealth

In this appendix, we discuss the details of restrictions with respect to the analysis sample, computation of lifetime earnings, and the assumptions and steps made in the process of calculating future pension benefits and expected pension wealth.

A.1 Sample selection

1. In order to reduce the influence of outliers, for each year of the Polish Household Budget Surveys (Badanie Budżetów Gospodarstw Domowych, or BBGD), we trim the available household income below the 1st and above the 99th percentile.

2. In years 1998, 1999, 2000, and 2003, the BBGD contains information on the year and month of birth. In other years (1997, 2001, and 2002), we compute it as the difference between the year and month of the survey and the current age of the respondent reported in years in the data. Additionally, since the BBGD contains a small two-observation rolling-panel component, for years 2001 and 2002 for some observations, we match the month of birth from the information in 2000 and 2003 data, respectively.

3. In the main analysis sample, we keep households whose head was born between 1939 and 1958; hence, the year of birth of the household head is within 10 years before or 10 years after 1949, the birth year of the first cohort directly affected by the reform.

4. We only include households for which we observe the household head's occupation at the time of the survey. The information on occupations is necessary for sample selection and for the computation of lifetime earnings; see Section A.2.
5. We drop all of the households in which the head or the spouse works in farming or in the agricultural industry, or in which the main household income comes from agriculture.
6. We exclude households in which the head or the spouse works in the following occupations: the armed forces, legislators, miners, or educators. We do this because these occupations have special pension arrangements.
7. We exclude households where the head receives earnings from being self-employed because of the insufficient reliability of self-employment earnings information and the lack of details on the level of their pension contributions.
8. We drop households whose main source of income is retirement or disability pensions and those in which the household head receives income from these sources.
9. The final sample consists of 37,404 observations, with about 4,100–6,250 observations in each year of data.

A.2 Lifetime earnings profiles

In order to estimate the lifetime earnings profiles, we use households whose head was born between 1937 and 1980; each year, the sample is restricted to include 18- to 65-year-old male household heads and 18- to 60-year-old female household heads. Earnings in the BBGD are measured net of taxes and Social Security contributions. We use the SIMPL tax–benefit microsimulation model for Poland (see Bargain et al. (2007)) to gross up net earnings so they include taxes and Social Security contributions. We define total earnings for each person as the sum of earnings from temporary and permanent employment in the private and public sectors, and we express all values in 2005 constant prices.

We forecast log earnings separately for household heads and spouses using the 1997–2003 waves of the BBGD. For household heads, we calculate the earnings profiles by estimating an ordinary least squares (OLS) regression of the earnings of the household head on age, age squared, gender, marital status, interaction between gender and marital status, education level, occupation dummies, industry dummies, year dummies, and indicators for decade of birth. The last category is controlled for in order to allow cohort-specific intercepts to reflect differences in cohort productivity. We use the predicted log earnings profile to forecast expected earnings for each household head, given his (her) characteristics, from the age the head of household was at the time, starting at 23 (25) and going until 65 (60).

We transform predicted log earnings to earnings in levels by using the exponential function, in which we multiply the exponentiated predicted log earnings by $\exp(\sigma^2/2)$, σ^2 being the square of the root mean square error (RMSE) of the regression.

We model the log earnings process separately for female and male spouses. For female spouses, we forecast the log earnings profiles using a Heckman selection correction. This is done to include the large number of zero earnings of this group. The earnings of the spouse are regressed on age, age squared, education level, indicators for decade of birth, and year dummies. The "selection equation" for labor force participation (defined as earnings greater than 0) uses age, age squared, the number of children in the household who are 14 or younger, an interaction term between age and the number of children, level of education, and decade-of-birth dummies. For male spouses, we estimate log earnings profiles by an OLS regression of the earnings of the male spouse on age, age squared, education level, indicators for decade of birth, and year dummies. We use the predicted log earnings profiles to forecast earnings for each spouse using the

transformation described above, given his (her) characteristics, from the age the spouse was at the time, starting at 23 (25) and going until 65 (60).

When computing the lifetime earnings profiles, we assume that, except for age and its square, all the current characteristics are fixed and the profile changes with age and its square.

A.3 Pension benefit and pension wealth calculation

We calculate future public pension benefits based on the entitlement that individuals will have acquired by the time they transition into old-age retirement according to the legislation at the time of the observation. Hence, the changes induced by the pension reform will reflect on expected pension benefits in the years 1999–2003. In 1997 and 1998, expected pension benefits are calculated according to the pre-reform legislation.

Pre-reform pension benefits

In the pre-reform system (see Chłoń-Domińczak 2002), the old-age pension formula consisted of a common economy-wide component and an individual earnings-based component.

The common economy-wide component of the pension benefit consisted of 24 percent of economy-wide average earnings. The individual earnings-based component was based on the individual's 10 best consecutive years of work out of the 20 years prior to retirement. This individual-based average was then multiplied by the number of years of work contributions and by 1.3 percent. In the pre-reform system, nonwork contributory years also counted (e.g. years spent in college, in military service, and on maternity leave), and the individual-based average was multiplied by a factor of 0.7 percent. In the pre-reform system, there were also a minimum pension and a maximum. The individual earnings-based component was capped at a maximum of 2.5 times economy-wide average

earnings. The minimum pension benefit was set at 35 percent of economy-wide average earnings.

Specifically, we compute the pre-reform pension benefit as $benefit = \max\{0.35BA, 0.24BA + \min\{CAE, 2.5BA\}\times(0.013C_W + 0.007C_{NW})\}$. *BA* stands for the "basic amount," the average economy-wide earnings published by the Polish Statistical Office, Główny Urząd Statystyczny (GUS); *CAE* stands for "countable average earnings," based on the average of the 10 best years of work contributions out of the last 20 years; C_W stands for years of work contributions, which were at least 20 years for women and 25 for men; and C_{NW} stands for years of nonwork contributions (e.g. military service or maternity leave), which were limited to a maximum of one-third of the total number of years of contributions.

Assumptions for computing pre-reform benefits. We compute the 10 best years of each individual based on the forecast lifetime earnings profiles described in Section A.2. In our calculations, we assume that men and women contribute fully to the system, according to the pre-reform legislation: 25 years of work contributions for men and 20 for women. We also assume that men have three years of nonwork contributions (at the time, there was two years' compulsory military service) and that women have five years of nonwork contributions. We assume that women retire at age 60 and men at 65. Since the pre-reform minimum pension benefit was benchmarked to the economy-wide average earnings published by GUS, we assume that this economy-wide average grows by 4 percent annually in real terms.

Post-reform pension benefits and initial capital

The cohorts we study who have participated for at least one year in the pre-reform system were entitled to an "initial capital" sum that converted the contributions they had made so far into a starting capital sum, beginning in 1999 for the

reformed notionally defined contribution (NDC) plan; Chłoń-Domińczak (2002, 126) provides a detailed explanation of how the initial capital sum was computed.

The initial capital consists of an economy-wide component and a person-specific component. The formula for the economy-wide component of initial capital requires computing the following correction factor, *CF*:

$$CF = \min\left\{1, \sqrt{\frac{age\ in\ 1998 - 18}{retirement\ age - 18}} \times \frac{years\ of\ contributions\ in\ 1998}{required\ years\ of\ contributions}\right\},$$

where the formula sets *retirement age* to 60 for women and 65 for men and *required years of contributions* to 20 years and 25 years respectively. The initial capital is computed as $0.24 \times BA \times CF \times G_{62}$, where G_{62} is the unisex life expectancy for a 62-year-old in 1998 and *BA* is the basic amount, defined above. In our calculations, we compute years of contributions as of the end of 1998 as the age of an individual in 1998 minus 23 years (minus 25 for women, to account for sporadic labor force participation). We compute G_{62} as a simple average of 62-year-old men and women's life expectancy in 1998.

The person-specific initial capital is computed in the following way. For each person, we predict earnings five years back in time and obtain economy-wide average earnings for five years back in time. We divide the predicted earnings by economy-wide average earnings and compute an average, which we multiply by the basic amount for 1999 and by 0.7 percent times the number of years of nonwork contributions up to 1999 and by 1.3 percent times the number of years of work contributions up to 1999. As before, we assume that, given each person's age in 1999 and our assumptions regarding when people start to work, men have at most 25 years of work contributions and women have at most 20. Also, as before, we assume that given each person's age in 1999, men have at most three

years of nonwork contributions and women have at most five years of nonwork contributions. All of our calculations are indexed to 2005 constant prices.

For the years after the 1999 reform until the year of retirement, we calculate contributions as 19.52 percent of an individual's gross earnings (the legislated level of retirement contributions from 1999). We compute the post-reform pension benefit as

$$benefit = \frac{initial\ capital + 0.1952 \sum_{t=1999}^{year\ of\ retirement} earnings_t}{unisex\ life\ expectancy\ at\ retirement}.$$

The minimum pension benefit is defined as 24 percent of average economy-wide earnings in the year of retirement (Chłoń-Domińczak and Strzelecki 2013).

Finally, for the first five cohorts of women affected by the reform, we compute the pension benefit according to the mixed pre-reform and post-reform pension formula described in Table A.1.

Assumptions for computing post-reform benefits. We assume that men contribute continuously until they retire at 65 years of age and that women contribute continuously until they retire at 60. The pension benefit is computed as the sum of person-specific and economy-wide initial capital and the contributions of an individual's earnings divided by the remaining unisex life expectancy at the statutory age of retirement.

Pension wealth

The general formula for computing pension wealth is the following:

$$PW(i) = \sum_{\tau=ret.age}^{max.age} \frac{pr_{\tau|age(i)} \times benefit(i) \times (1+g)^{\tau - ret.age}}{(1+r)^{ret.age - age(i)}},$$

where

- $PW(i)$: pension wealth of individual i;
- *ret.age*: retirement age, set at 65 for men and 60 for women;
- g: real growth rate of pension benefit;
- r: real interest rate;
- *max.age*: maximum attainable age, set at 100 years (the end of the life table);
- $pr_{\tau|age(i)}$: the probability that someone aged $age(i)$ will be alive at age τ = *ret.age*, . . . , *max.age*;
- $benefit(i)$: pension benefit of individual i, computed as described above.

Assumptions for computing pension wealth. When calculating pension wealth, we adjust the future stream of pension benefits using separate male and female survival probabilities from the 1999 Polish life tables from GUS. The maximum age is also taken from the life tables and is set to 100 years for everyone. If a spouse receives retirement or disability benefits, we use those to compute pension wealth. We use a 3 percent real interest rate to compute the present value of the sum of expected benefits.

We compute pension benefits separately for the household head and the spouse and then take their sum. For female household heads, we scale the pension wealth by 30 percent to account for expected survivor's pension benefits. The actuarially-adjusted sum of future pension benefits of the household head and the spouse is discounted back to the current age of the household head. In all of the regressions, pension wealth is divided by predicted (fitted) current gross household earnings, obtained from the predicted values using the estimation described in section A.2.

Table A.1: Between-cohort variation in the post-reform pension system

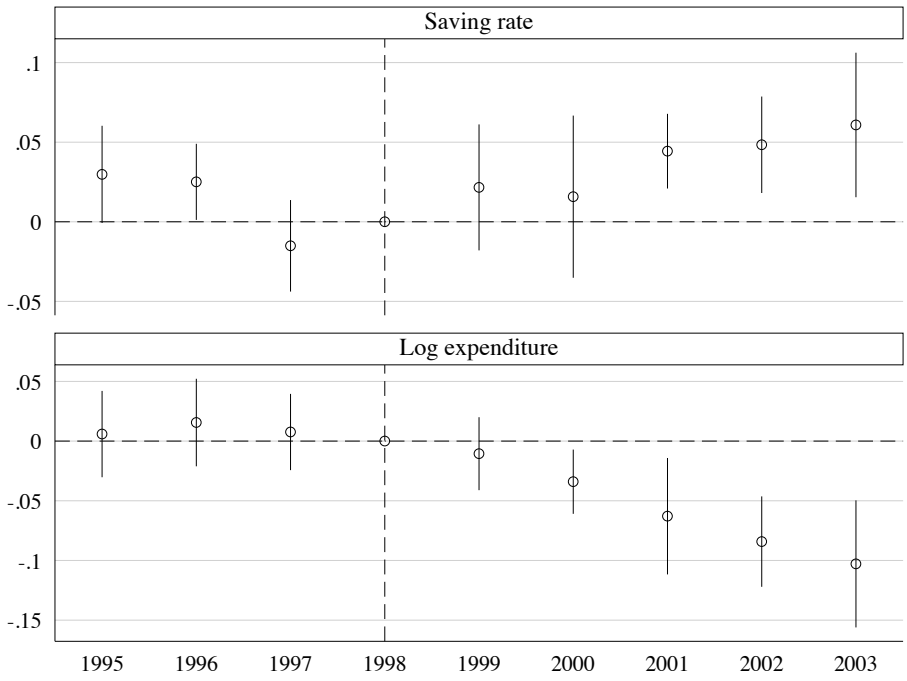
Cohorts:	Born before December 31, 1948	Born between January 1, 1949 and December 31, 1968 (transitory cohorts)	Born on or after January 1, 1969
Benefit formula:	Pre-reform formula	Post-reform formula with some exceptions	Post-reform formula
Exceptions to the benefit formula?	No	Separate rules for the first five cohorts of women (born 1949–53)[a] The 1949 cohort receives part of the benefit according to the old pension system formula (80 percent) and the rest according to the new formula (20 percent). The 1950 cohort receives a 70/30 percent mix. The 1951 cohort receives a 55/45 percent mix. The 1952 cohort receives a 35/65 percent mix. The 1953 cohort receives a 20/80 percent mix.	No
Early retirement provisions?	Yes	Yes, conditional on age and contribution requirement being fulfilled before December 31, 2007	No early retirement provisions. In the post-reform system, men retire at 65 and women at 60

[a] From Chłoń, Góra, and Rutkowski (1999, 21).

Online Appendix B: Sample selection and some results for the data pooled for the years 1995−2003

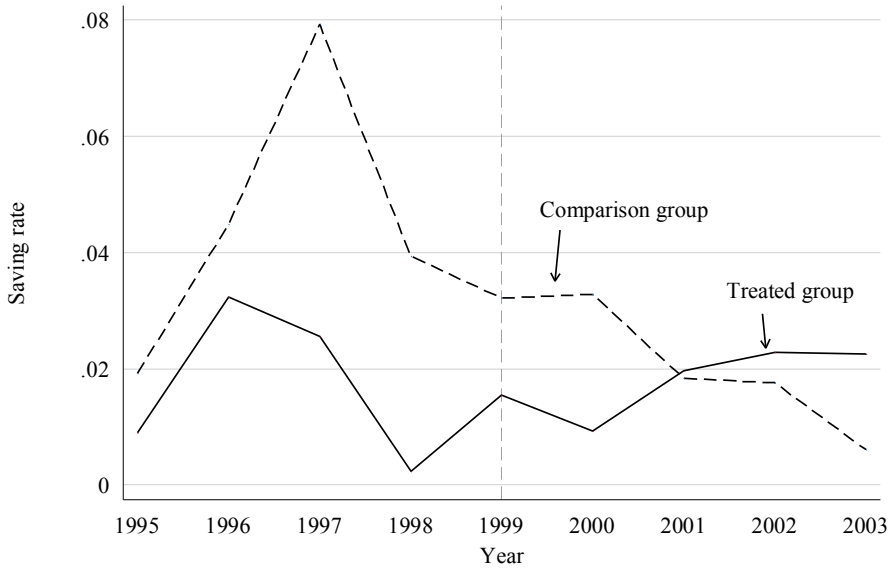
The principal sample selection criteria are the same as for the main sample (described in Online Appendix A). Since for the years 1995 and 1996 we do not have information on occupation, selection criteria with respect to this variable cannot be applied. Thus, points 4, 5, and 6 from the list of sample restrictions given in Section A.1 do not apply. The final sample consists of 53,635 observations, with about 4,215–8,595 observations in each year of data.

Figure B.1: Estimated effect of the 1999 pension reform on saving rate and log expenditure, by year



Note: Authors' calculations using the BBGD, 1995–2003. The universe consists of BBGD for the years 1995−2003 for households whose head was born between 1939 and 1958. The sample also omits households whose head works in agriculture (forestry, fishery, and farming), mining, or the education sector. The figure shows point estimates from a multiyear difference-in-differences regression of the outcome variable on a "treated" dummy (if born 1949–58), eight year dummies, treated-by-year interaction terms, and controls. The controls consist of a cubic polynomial in age, a gender dummy, number of persons in the household, number of children, marital status, education dummies, and industry dummies. Each panel presents the treated-by-year interaction point estimate over time. The omitted categories are year 1998 (the year before the reform) and the comparison group born 1939–48. The regression uses robust standard errors clustered by year of birth and the figure presents 95 percent confidence intervals (whiskers). The dashed vertical line indicates the first year of the reform.

Figure B.2: Mean saving rate, by year and group



Note: Authors' calculations using the BBGD, 1995–2003. Saving rate is defined as available household income minus total household expenditure, divided by available household income. The dashed line indicates the "comparison group," born 1939–48, and the solid line indicates the "treated group," born 1949–58. The dashed vertical line indicates the first year of the reform.

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