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## The Displacement Effects of Social Security Wealth in a Transition Economy: The Case of Poland\*

Czy uprawnienia w publicznym systemie emerytalnym wypierają oszczędności w gospodarce okresu transformacji? Przypadek Polski

### Abstract

Economic theory does not give clear predictions on the impact of social security wealth on private wealth. While the basic life-cycle hypothesis predicts full displacement, many more advanced theoretical contributions anticipate only a limited offset. Empirical research on the issue is also not conclusive. In this paper, we measure the substitution between social security wealth and private wealth in Poland. To obtain measures of long-term substitution, we measure the displacement effects of social security wealth on net wealth. Our estimates of the effects on consumption and the saving rate reflect a short-term impact. Our results do not provide support for the hypothesis that social security wealth crowds out private savings in the long term. The short-term evidence is mixed, but the effects of social security wealth on consumption are at best weak, while the impact on saving rates is not statistically significant. In our view, in transition economies, the influence of social security wealth on private wealth is weaker than in developed economies because the wealth distribution has been to a large extent transformed by random and rapid events such as the privatisation of housing assets.

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public economics, crowding out, social security wealth, household wealth, wealth distribution

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### Streszczenie

Teoria ekonomii nie dostarcza jasnych prognoz dotyczących wpływu uprawnień w publicznym systemie emerytalnym na akumulację majątku prywatnego. Zgodnie z podstawową hipotezą cyklu życia uprawnienia emerytalne powinny w pełni wypierać oszczędności prywatne, jednakże w wielu bardziej zaawansowanych modelach teoretycznych przewiduje się jedynie ograniczony zakres substytucji. Badania empiryczne również nie są rozstrzygające. Celem zrealizowanego badania był pomiar zakresu substytucji pomiędzy uprawnieniami emerytalnymi a majątkiem prywatnym w Polsce. Aby zmierzyć zakres wypierania w długim okresie, dokonano pomiaru substytucji pomiędzy uprawnieniami emerytalnymi a majątkiem prywatnym (*net wealth*). W celu zidentyfikowania efektów krótkookresowych dokonano pomiaru wpływu uprawnień na konsumpcję i stopę oszczędności.

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Otrzymane wyniki nie potwierdzają występowania efektu wypierania w długim okresie. Wyniki dotyczące konsekwencji krótkookresowych są zróżnicowane, jednakże wskazują co najwyżej na niewielki zakres substytucji. W krajach przechodzących transformację gospodarczą wpływ uprawnień emerytalnych na majątek prywatny może być słabszy niż w gospodarkach rozwiniętych, ponieważ rozkład majątku był kształtowany przez rzadkie, trudne do przewidzenia zdarzenia, takie jak sama transformacja gospodarcza oraz szeroko zakrojona prywatyzacja zasobu mieszkaniowego w tym okresie.

## Introduction

The public pension system is important for the well-being of the citizens. Entitlements in public pension systems have a significant position in household wealth portfolios, especially among poorer households. Social security wealth plays an important role in intertemporal consumption smoothing. Because consumption in old age is secured by public pension systems, households may accumulate less private wealth.

Economic theory does not offer clear forecasts on the substitution between social security wealth and private wealth. The basic life-cycle hypothesis [Modigliani, 1986] predicts full substitution between social security wealth and private wealth. However, extended life-cycle models [Feldstein, 1976; Engen, Gale, 1993] predict only partial crowding-out effects. In some cases, it is even possible that social security wealth raises private wealth [Cagan, 1965; Katona, 1965; Johnson, 1984]. Because of theoretical ambiguity and practical importance, empirical analysis of the displacement effects of social security wealth has generated a lot of interest among economists. The literature is not conclusive and the identified displacement effects of social security wealth on private wealth vary from mildly positive to strongly negative. In many cases, the identified displacement effects of social security wealth on private savings are not statistically significant [Wroński, 2021a].

In this paper, we assess the displacement effects of social security wealth in Poland. First, we measure the link between social security wealth and private wealth to measure the long-term displacement effects of public pension systems. Then we analyse the possible effects on current consumption and saving rates, which we interpret as short-term displacement. We use a novel data source: the Eurosystem Household Finance and Consumption Survey. Our models take into account the education-related mortality differential, which is rare in the literature because uniform mortality rates are usually used. Moreover, while the majority of the literature focuses on developed economies, we estimate the substitution between social security wealth and private wealth in a transition country.

The influence of the public pension system on the accumulation of private wealth in transition countries may be significantly different from its effects in developed economies. The distribution of wealth has, to a large extent, been influenced by the privatization of state-owned housing after the economic transition [Brzeziński, Sałach, 2021]. Therefore the position of households in net wealth distribution is largely driven by random events (privatisation of housing), while the importance of past allocation decisions is weaker. Moreover, the link between income and wealth is weaker than in Western European economies [Wroński, 2020]. The life cycle hypothesis [Modigliani, 1986] assumes that households optimise utility over the life cycle and make long-term allocation decisions. Thus they may offset social security contributions with private savings. Poland's economic reality rapidly changed after 1989. Therefore in our opinion, it is doubtful that households follow long-term consumption plans. Our sample covers the population of pensioners. About half of their working lives took place before the economic transition. In such a situation, the substitution hypothesis may not be valid. In our view, investigating the substitution between social security wealth and private wealth in a transition country may significantly expand our knowledge on the link between the public pension system and private savings.

According to our results, the substitution between social security wealth and private wealth is not statistically significant. Social security wealth does not displace private wealth in the long term. This result is robust

across different portfolio concepts (net wealth, total assets, real assets, and financial assets) and many sub-populations. The only exception may be the displacement among poorer households. The outcomes of quantile regression analysis suggest that the substitution between social security wealth and private wealth varies across the wealth distribution. Among poorer households, social security wealth raises private savings, while among richer households the impact is not statistically significant. This result directly corresponds with the research of [Cagan \[1965\]](#), [Katona \[1965\]](#), [Johnson \[1984\]](#), who show that the public pension system may raise private savings among poorer households because it incentivises households with relatively low levels of financial knowledge to consider their situation in retirement. Moreover, without a public pension system, poorer households will not be able to accumulate wealth large enough to secure consumption in old age. Therefore private savings for old age when the public pension system does not exist may be pointless because the poor cannot save enough to support their consumption in retirement [[Johnson, 1984](#)]. [Johnson \[1984\]](#) speculates that households who know that they are not able to accumulate significant savings for retirement may have little incentive to save for retirement at all.

The evidence on the effects of social security wealth on consumption is mixed. In the whole sample, we find that public pension wealth tends to increase consumption. However, the estimated coefficients are statistically significant only at the 95% level. The marginal propensity to consume out of private wealth is higher than the marginal propensity to consume out of social security wealth. This is not a surprise because social security wealth is not liquid. Pensioners receive benefits on a monthly basis, but cannot use their entitlements to purchase durables or cover unexpected expenses. The influence of social security wealth on consumption is statistically significant only in some of the considered subpopulations. Higher consumption by definition means lower savings. However, the influence of social security wealth on the saving rates is not statistically significant. In our view, our results provide only weak support for the hypothesis that public pension entitlements displace savings in the short run.

In the first section, we review the literature on the crowding-out effects of social security wealth. Then we present our dataset and empirical method. We also briefly discuss the impact of social security wealth on augmented wealth inequality, which has been addressed in a separate paper [[Wroński, 2023a](#)]. The third section presents the main empirical results of the paper. The last section concludes and suggests directions for future research.

## Literature review

The basic life cycle model (see [Modigliani \[1986\]](#)) predicts full substitution between social security wealth and private wealth<sup>1</sup>. In the first period, social security contributions decrease income in the working period; then in the next period pension benefits increase income in the retirement period. Households accumulate less private savings because they know that they will receive public pension benefits in retirement. Therefore social security contributions displace private savings. An increase in social security wealth is fully offset by a reduction in non-pension wealth (see e.g. [Modigliani and Sterling \[1983\]](#), [Gale \[1998\]](#)).

However, in practice, the offset may be limited. The public pension system may induce the insured to retire earlier and accumulate higher private savings to secure consumption in a longer retirement period than preferred [[Feldstein, 1974](#)]. Many households are credit-constrained, which limits the displacement effects [[Hubbard, 1986](#)]. The crowding-out effects are limited also because households may lack the financial knowledge needed to make optimal allocation choices [[Bottazzi et al., 2006](#); [Lusardi, Mitchel, 2014](#)]. Behavioural research on “mental accounting” proved that households treat different assets differently [[Thaler, 1999](#)], which limits the impact of social security wealth on other asset categories. Social security contributions may serve as a mean of self-control [[Thaler, 1990](#); [Fehr et al., 2008](#); [Bucioll, 2011](#)] and increase the savings of those who

<sup>1</sup> Because the life cycle hypothesis is well known to economists we do not present it here. There are many high-quality literature reviews on this issue (e.g. [Mayer \[1972\]](#), [Deaton \[1992\]](#), [Attansio and Weber \[2010\]](#)).

find it difficult to save. Households save not only to smooth consumption and secure income in old age but also because of other motives, e.g. bequest motives [Hurd, 1987] or medical expenses [De Nardi et al., 2010]. The displacement effects of social security may also depend on macroeconomic conditions (e.g. Schröder [1983]). While economists estimate the value of social security wealth using actuarial discounting, households in practice may apply different discounting methods [Bernheim, 1987; Mirer, 1992]. The impact of public pension entitlements on private savings may be also limited by the inconsistent time preferences of the insured [Tyrowicz et al., 2020].

Wroński [2021a] reviews the literature on the impact of social security wealth on private wealth. Seventy percent of the analysed contributions find a statistically significant impact of social security wealth on private wealth. Most authors who obtain statistically significant results identify a negative impact of social security wealth on private wealth. The positive impact of social security wealth on private savings is rare, and most often identified if the impact of social security wealth on private wealth is considered jointly with its impact on fertility (e.g. Cigno et al. [2002]). Because children are expensive if social security lowers fertility it may also raise private savings. On the other hand, in many cases, the identified effects of social security wealth on private wealth are not statistically significant or the evidence on the impact is mixed and highly dependent on the model specification. Older literature reviews [Kessler et al., 1981; Low et al., 1986; Magnussen, 1994; Kohl, O'Brien, 1998] also find that the evidence on the impact of social security on private wealth accumulation is not conclusive and the results are to a large extent dependent on the specification chosen. Fessler and Schürz [2018] using HFCS data confirm that the different generosity of public pension systems partially explains the cross-national differences in net wealth.

The displacement effects of social security wealth in Poland have been evaluated by Lachowska and Myck [2018]. They use an exogenous shift in the value of social security wealth implied by policy reform and estimate the effect of social security wealth on private savings based on the difference-in-difference estimation. According to their results, the degree of substitution is about 30%. One zloty (PLN) less of social security wealth increases private savings by PLN 0.30. The offset is strongest among households with higher education. In this group, the substitution is nearly perfect. In comparison with the results for other countries, Lachowska and Myck assess the estimated degree of substitution in Poland as relatively small.

There are four main differences between our paper and the contribution of Lachowska and Myck [2018]. Lachowska and Myck [2018] estimate the impact of social security wealth on saving rates in the 1998–2003 period. It is not clear if higher saving rates in this period imply higher wealth over the life cycle. Our main variable of interest is private wealth. Our sample includes old-age households. Therefore our estimates of the substitution between social security wealth and private wealth may be seen as long-term. Our reference year is 2016, thus our research covers a period 15 to 20 years later than in the case of Lachowska and Myck [2018]. The economic conditions changed significantly over that time. Poland joined the European Union, unemployment decreased, and incomes rose rapidly. Lachowska and Myck [2018] use data from the Polish Household Budget Survey (*Badanie Budżetów Gospodarstw Domowych*). We use data from the Eurosystem Household Finance and Consumption Survey (HFCS). The PHBS provides high-quality data on household income and consumption but does not provide information on household wealth. The HFCS covers all three areas. Moreover, oversampling strategies applied in the HFCS raise the coverage of the top of the income and wealth distributions. Our empirical strategies also differ. Lachowska and Myck [2018] use an exogenous shift in pension wealth caused by policy reform, which allows for the identification of causal effects. However, the identified substitution may be driven only by the short-term reaction of households to policy reform, not long-term considerations on consumption smoothing. In our case, no exogenous shift in the value of pension wealth may be used. Because of the wide differences between the research presented in this paper and that of Lachowska and Myck [2018], we believe that our research is complementary. Although our analysis does not identify causal effects, in our view, it expands our understanding of the link between the public pension system and private wealth accumulation.

**Jabłonowski [2021]** estimates the distribution of augmented wealth in Poland based on administrative data from the HFCS combined with administrative data. He imputes the value of social security wealth based on a 1% sample of public pension system accounts. Unfortunately, this data set is no longer provided by the Social Insurance Institution. Although he uses a different method and different samples, his estimates of the value of social security wealth are similar to those of **Wroński [2021b; 2023a]**. Jabłonowski estimates the mean value of social security wealth at PLN 388,000, while the mean value of social security wealth estimates used in this paper is PLN 377,000. Jabłonowski estimates the marginal propensity to consume (MPC) out of augmented wealth at 10% on average, ranging from 6% to 20%. He finds a negative correlation between MPC and wealth.

**Jabłonowski [2021]** provides estimates of MPC and net wealth, but does not directly measure the impact of social security wealth on consumption or wealth. Thus he does not directly estimate the displacement effects of social security wealth on private wealth. His outcomes indicate that higher social security wealth increases consumption while lowering savings. The important difference in the outcomes of our research may be driven by the selection of the samples. His sample includes working-age households who were impacted by the pension reform launched in 1999, which strongly increased the link between current income and future pension benefits. Our sample is composed mostly of households that were not impacted by pension reforms and remained in the “old” pension systems, in which the link between current earnings and future benefits was much weaker than after the 1999 pension reform.

The substitution between social security wealth and private wealth outside core industrial economies has been rarely studied. As described above, **Lachowska and Myck [2018]** investigate the substitution between public pension wealth and private savings in Poland and find modest crowding-out effects, and **Jabłonowski [2021]** estimates the marginal propensity to consume out of augmented wealth. **Aydede [2007]** studies the issue in Turkey using time-series evidence and identifies a negative and statistically significant impact of social security wealth on private savings. **Feng et al. [2011]** find a weak substitution between social security wealth and private wealth in China. **Cerda [2009]** investigates the displacement effects of public pension wealth in Chile and does not find evidence of a statistically significant impact of public pension wealth on private wealth. **Honarvar et al. [2017]** estimate the theoretical model and find that public pension wealth displaces private savings in Iran. **Rutkowski [2019]**, based on OLG models calibrated for the Polish economy, evaluates the *ex-ante* impact of the introduction of additional quasi-compulsory pension plans (*Pracownicze Plany Kapitałowe*) in Poland and finds that only a small share of savings in the new pension plan represents new savings.

## Data and method

The Eurosystem Household Finance and Consumption Survey (HFCS) is our data source. The survey is held by the European Central Bank in cooperation with national central banks and statistical agencies. Participation in the survey is compulsory for all euro-area countries and voluntary for the rest of the European Union. Poland, Hungary, and Croatia participated on a voluntary basis. In Poland, the HFCS was conducted in late 2016 by the National Bank of Poland and the Statistics Poland agency. **HFCN [2020a]** describes the main outcomes of the survey at the European level, while **NBP [2017a]** presents the outcomes of the survey conducted in Poland. **HFCN [2020b]** and **NBP [2017b]** discuss the survey methodology in detail. The micro-data from the HFCS are shared with researchers by the European Central Bank.

Because wealthy households less often participate in surveys, measures of wealth inequality based on survey data tend to underestimate wealth inequality [**Kennickel, McManus, 1993; Vermeulen, 2016, 2018; Kennickel, 2017a, 2017b; Bricker et al., 2019; Wroński, 2019**]. The HFCS oversamples wealthy households to increase the representativeness of the top end of the wealth distribution. Oversampling is the right decision, but the HFCS data still underestimates the wealth inequality [**Bach, 2019; Brzeziński et al., 2020; Meriküll, Rõõm, 2021**]. The underrepresentation of the wealthiest households has a limited impact on our results because the share of the wealthiest households in the population is small.

The HFCS covers a wide range of household assets and liabilities. The survey questionnaire also includes detailed questions on household income, consumption, and various characteristics of household members. In accordance with OECD Guidelines for Microstatistics on Household Wealth [OECD, 2013], net wealth is the major wealth concept. Net wealth is defined as the value of assets minus the value of liabilities. This concept excludes the value of public pension entitlements. The main reason for this exclusion is the lack of internationally comparable data on the value of public pension entitlements [OECD, 2013].

The survey questionnaire includes questions on the value of public pension entitlements. However, in the Polish case, the quality of the information on the value of accounts in public pension plans is too low to be used directly. A comparison with the official statistics of the Social Insurance Institution shows that the HFCS severely underestimates the value of accounts in public pension plans. The mean value of savings on individual accounts in the public pension system implied by the HFCS is nearly 10 times lower than the value implied by the official statistics. Moreover, more than 70% of respondents did not respond to the questions. This shows that Polish households have limited knowledge of their entitlements in the public pension system. This is not a surprise because sections on pension plans are always the most difficult parts of wealth surveys for respondents [Bucks, Pence, 2015; NBP, 2017b].

Because of the lack of reliable data on the social security wealth of the working population, our research covers only those households that already receive public pensions. Such a limitation is common in the literature (e.g. Alessie [2013]). Our sample includes households in which at least one member receives a pension from the public pension system. We remove multigenerational households from the sample because in their case it is not possible to determine what share of wealth is owned by pensioners. We also exclude pensioners who are more than 10 years younger than the official retirement age (60 years for women, and 65 years for men) because they are covered by special, more generous pension systems (e.g. military pension system) and may distort the results. Our sample also excludes households in which a partner of the pensioner is not retired or at pre-retirement age (defined as the 10-year period before the official retirement age), because such households (with a high age gap between the partners) may have different consumption profiles than typical pensioner households. Because big differences in the age of spouses are rare this does not have a significant impact on our results. To protect the privacy of survey respondents older than 85, their age has been coded as 85. Because knowledge of the exact age of each household member is needed to estimate the value of social security wealth, we must exclude from the sample households with members whose age has been coded as 85.

Our final sample includes 1,741 households, 65% of them with income from public pension systems. The majority of the excluded households are multigenerational households. In our view, this proportion is high enough to treat the obtained results as a valid measurement of the substitution between social security wealth and private wealth in the retired population, especially among typical retired households.

Although our measure does not cover the whole population, this approach has its advantages. We measure the substitution between social security wealth and private wealth among those who actually profit from their public pension entitlements. Therefore they have relatively good knowledge of the value of their entitlements in the public pension system. While in the case of the working-age population social security wealth is only a theoretical concept, in the case of the retired population it is one of the crucial aspects of living. Discrepancies in the HFCS data on the value of accounts in the Social Insurance Institution prove that working-age households do not know the value of their pension entitlements. Moreover, research on financial knowledge clearly shows that many people do not have basic knowledge of the rules governing the Polish pension system [Czapiński, Góra, 2016]. Of course, economists may estimate regressions, but it is doubtful if households will be able to offset social security contributions with private savings if they do not know how the pension system works. Estimating the value of the social security wealth of the working population is complicated by many non-linearities in rules determining the value of a future pension. For example, some individuals do not accumulate enough social security contributions to obtain a pension, which is high enough to make an independent life possible. They may be entitled to minimum pensions. However, to be entitled to minimum pensions, it is necessary to work long enough. Therefore it is not clear how we should treat individuals who

have accumulated few social security contributions and did not work long enough to be entitled to a minimum pension, but will probably be entitled to minimum pensions in the future. Similarly, many working-age people are single and may get married in the future, which also significantly affects the value of their social security wealth because of the existence of survivor's benefits.

For recipients of public pension benefits, the computation of social security wealth (also known as public pension wealth or public pension entitlements) is relatively straightforward. Social security wealth equals the discounted cash flow of public pension benefits (see e.g. [Feldstein \[1974\]](#), [Alessie et al. \[2013\]](#), [Bönke et al. \[2020\]](#), [Oliviera \[2018\]](#), [Wolff and Marley \[1989\]](#), [Wolff \[2015, 2017\]](#)). For people at pre-retirement age (defined as the 10-year period before the official retirement age) who belong to pensioner households included in our population, we follow [Alessie et al. \[2013\]](#) and use the expected value of public pension benefits. In the appendix (Table A1), we compare the value of pension benefits received by pensioners and the value of the expected pension benefits of those who are members of pensioner households and are at pre-retirement age. Both distributions are quite similar. Therefore we treat the expected values of pension benefits as reasonable. For this group of households, we decrease public pension wealth by the remaining social security contributions. In a few cases, in which people above the retirement age still work we assume that they retire immediately and receive the expected pensions. The number of such cases is small and cannot have a significant impact on our results.

In the calculation of social security wealth, we use mortality rates implied by Eurostat's EUROPOP 2019 forecast. Therefore our measure includes the rise of life expectancy in the retirement period, which is rather rare in the literature. We estimate the education-related differential in mortality and use it in our estimation of social security wealth [[Wroński, 2021b; 2023a](#)]. Therefore our estimates are not biased by the usage of uniform mortality rates (see [Gale \[1998\]](#)). In Poland, the partner of the deceased pensioner may give up their own pension and claim 85% of the partner's pension benefit. Thus our calculation includes survivor's benefits. Equations 1–4 directly present the applied method of the calculation of public pension wealth.

$$SSW_i = \sum_{t=0}^T \frac{1}{(1+r)^t} * P_{i,t} \quad (1)$$

$SSW_i$  stands for the social security wealth of person  $i$ ,  $r$  stands for the interest rate, and  $P_{i,t}$  is the value of pension entitlements of person  $i$  in year  $t$ . Social security wealth equals the value of the discounted stream of future pension benefits. We assume that pension benefits rise with inflation and that their real value does not change. Such an assumption is common in the estimation of social security wealth. In Poland, it is unlikely that pension benefits will rise slower than inflation because current indexation rules provide for direct adjustment for inflation.

We follow [OECD \[2019\]](#), [Cowell et al. \[2017\]](#), and [Bönke et al. \[2019\]](#) and use  $r = 2\%$ . The maximal age is set to 100 (as in Eurostat's EUROPOP 2019 forecast). To check the robustness of our results, we recalculate the value of social security wealth using  $r = 1\%$  and  $r = 3\%$  (see Appendix).

The estimation of the value of  $P_{i,t}$  differs between persons eligible for a survivor's pension and those who are not eligible. A person is eligible for a survivor's pension if his or her deceased spouse received a pension. The value of the survivor's pension is 85% of the pension benefit of the deceased partner and to claim it pensioners have to give up their own pension. Therefore only those pensioners whose pension is lower than 85% of the pension of the deceased partner will claim the survivor's benefit. If an entitled person claims a survivor's benefit they do not receive their own pension. Women account for nearly 80% of those who will be entitled to the survivor's pension if their partner dies. Therefore ignoring the survivor's pension would cause an important gender bias in our estimation. Equation 2 is estimated to calculate the value of the pension benefits of persons who would not receive survivor's benefits in case of the death of their partner. Equation 3 is estimated to calculate the pension benefits of those who will receive survivor's benefits in case of the death of their partner.

$$P_{i,t} = \text{benefit}_i * q_{i,t,e,g} + 0,5 * \text{benefit}_i * q_{i,t-1,e,g} * d_{i,t,e,g} \quad (2)$$

if person  $i$  is single or person  $i$  is married and  $\text{benefit}_i > 85\% * \text{benefit}_p$

$$P_{i,t} = \text{benefit}_i * q_{i,t,g,e} * q_{p,t,g,e} + 0,5 * \text{benefit}_i * q_{i,t-1,g,e} * q_{p,t-1,g,e} * \quad (3)$$

$$d_{i,t,g,e} + 0,85 * \text{benefit}_i * q_{i,t,g,e} * (1 - q_{p,t,g,e}) - 0,5 * \text{benefit}_p * q_{i,t-1,g,e} * q_{p,t-1,g,e} * d_{p,t-1,g,e} + 0,5 * 0,85 * \text{benefit}_p * q_{i,t-1,g,e} * (1 - q_{p,t-1,g,e}) * d_{i,t,g,e}$$

if person  $i$  is entitled to survivor's pension and  $\text{benefit}_i < 85\% * \text{benefit}_p$

$P_{i,t}$  stands for the value of pension entitlements of person  $i$  in year  $t$ . This value depends on the probability of survival. The *benefit* is the yearly value of pension benefits.  $q_{i,g,e,t}$  is the probability that person  $i$  with education level  $e$  and gender  $g$  will survive to the end of year  $t$ .  $d_{i,g,e,t}$  is the probability that this person dies in year  $t$ . Because our calculation is based on yearly mortality rates we (similarly as Eurostat) assume that each person who dies in year  $t$  dies after six months (mortality is the same in each month). Therefore we assume that in the year of death pensioners receive half of the yearly pension (six monthly pensions). Equation 3 includes not only probabilities related to a given person ( $i$ ), but also probabilities related to the partner ( $p$ ) of the individual ( $p$ ). It also includes survivor's benefits. In the case of people who are too young to retire in year  $t$  the value of  $P_{i,t}$  is set to zero.

Wealth is measured at the household level. Therefore social security wealth should also be measured at the household level. The social security wealth of households is the sum of the value of the social security wealth of household members as presented in Equation 4.

$$SSW_h = \sum_{i=1}^{l=2} SSW_i \quad (4)$$

$SSW_h$  stands for the social security wealth of household  $h$ . In the case of single-person households, it equals the value of social security wealth calculated at the individual level. In the case of two-person households, it is equal to the sum of the social security wealth of both household members.

To measure the displacement effects of social security wealth, we first estimate OLS regressions. Then we estimate median regressions and quantile regressions for quantiles 0.25 and 0.75. Estimating median and quantile regressions allows for comparing the effects of social security wealth on the given variable across the considered distribution. We estimate median and quantile regressions to obtain more robust results and check if the link between social security wealth and private savings differs between poor and rich households. Because HFCs data is based on multiple imputations [HFCN 2020b], we follow Rubin's Rule [Rubin, 1987]. We estimate median and quantile regressions using values averaged over all imputations.

The models estimated in this paper have the following form:

$$\begin{aligned} \text{Dependent variable}_i &= \beta_0 + \beta_1 \text{Social security wealth}_i + \beta_2 \text{Equalized\_income}_i \\ &+ \beta_3 \text{Age} < 65_i + \beta_4 \text{Higher\_education}_i + \beta_5 \text{Elementary\_education}_i \\ &+ \beta_6 \text{Married}_i + \beta_7 \text{Employed}_i + \beta_8 \text{Total years employed}_i \\ &+ \beta_9 \text{Received\_inheritance}_i + \beta_{10} \text{Owns\_HMR}_i \\ &+ \beta_{11} \text{Ability\_financial\_support}_i + \beta_{12} \text{Risk averse}_i \\ &+ \beta_{13} \text{Inflation\_higher\_than\_income\_rise}_i + \varepsilon \end{aligned} \quad (5)$$



In the first model, net wealth is the dependent variable. Because the displacement effects of social security wealth may vary across asset categories, we estimate the substitution between social security wealth and total assets/real assets/financial assets. In our view, the effects of social security wealth on private wealth provide a measure of the long-term displacement effects of social security wealth.

In the second model, consumption is the dependent variable. In the third model, the saving rate, defined as income minus consumption divided by income, serves as the dependent variable. If a household's consumption is higher than its income, we assume that the saving rate equals zero. To obtain results, which may be displayed in tables in a convenient way, we multiply the saving rates by 100. Thus the saving rates take values between 0 and 100 (not 0 and 1). The saving rate is lower than 0 for around 10% of the households, and for 2.6% of the households, it is lower than -100 (consumption is at least two times higher than income). We equalise the measures of consumption and income using an OECD-modified equivalence scale following the approach of the HFCS team [HFCN, 2020a, 2020b]. Income and consumption are measured on a yearly basis. The measure of consumption covers spending on consumer goods and services (including utilities and rent) and excludes spending on durables. Here we are constrained by the approach taken by the survey organisers. In our view, the impact of social security wealth on consumption and saving rates (measured in the last year before the survey) reflects the short-term crowding-out effects of social security.

Our control variables include economic variables, demographic variables, and behavioural variables. The first group is formed of equalised income, the number of years in employment (household head), and three binary variables indicating the receipt of inheritance, homeownership, and an ability to receive financial assistance from relatives. The second group includes binary variables for young pensioners (mean age lower than 65 years), higher education, elementary education, presence of people who are still employed in the household, and civil status. The behavioural variables measure risk aversion and the perception that in the future inflation will rise faster than income. Behavioural variables are rarely used in the research on the crowding-out effects of public pension entitlements. The control variables vary across the models estimated in the paper.

We measure the displacement effects of social security wealth on net wealth, the value of different assets, consumption, and savings, because we would like to obtain broader measures of the displacement effects of social security wealth. The existing literature usually considers only the impact of social security wealth on net wealth or saving rates, depending on data availability. The displacement effects on net wealth and saving rates are rarely studied jointly. Our data source provides extensive information on a wide set of household characteristics, and we want to exploit arising opportunities. The choice of control variables is based on the existing literature. Explanatory variables on age and education of household head, civil status, and homeownership are widely used in the literature. Behavioural variables are rarely used in research on the crowding-out effects of public pension entitlements. Because our data source also contains variables on risk aversion and expectations about future inflation and income rises, we include them in our models to check if behavioural factors influence the substitution between social security wealth and household wealth.

The displacement effects of social security wealth may vary across household types. Therefore we estimate our models not only in the whole sample but also across seven subpopulations. Two subpopulations are defined by education level. The first is composed of households in which someone has only an elementary education. The second includes households in which someone has higher education. Note that in the case of two-person households, both subpopulations may overlap. The next two subpopulations are defined by age. The first includes young pensioners, or households with a mean age of members lower than 65 years. The second includes older pensioners, or households with a mean age of members higher than 75 years. Another subsample includes only households in which all members receive public pensions. Then we separately estimate regressions in subsamples composed of single-person households and two-person households.

Table 1 presents descriptive statistics. The mean value of net wealth is PLN 280,825, while the mean value of social security wealth stands at PLN 376,810. The value of social security wealth is higher than the value of net wealth, but we must keep in mind that our sample includes only the old-age population. Among the

working population, the value of net wealth would probably be higher than the value of social security wealth. In a separate paper, we analyse the distributional impact of social security wealth. The public pension system decreases wealth inequality because social security wealth is distributed less unequally than net wealth. The inequality of the distribution of augmented wealth (Gini=0.3472) is lower than the inequality of net wealth (Gini=0.5007). The equalising impact of social security wealth is confirmed by inequality decomposition techniques [Wroński, 2021b, 2023a, 2023b]. Jabłonowski [2021] also confirms the equalising impact of social security wealth in Poland. Wroński [2023b] compares the equalising impact of the public pension system on wealth inequality in Poland and 18 other EU member states, and finds that, depending on the criteria used, the relative strength of the equalising impact of the public pension system in Poland may be assessed as either medium or low. Sierminska and Wroński [2022] review the literature on the impact of social security wealth on wealth inequality and conclude that the equalising impact of the public pension system on wealth inequality has been confirmed in 25 economies.

**Table 1. Descriptive statistics**

Statistics	Value
Mean net wealth (PLN)	280,825
Median net wealth (PLN)	205,000
Mean social security wealth (PLN)	376,810
Median social security wealth (PLN)	316,047
Mean equalised consumption (PLN)	19,064
Mean equalised income (PLN)	29,935
Mean age	69.7
Share: elementary education	0.28
Share: higher education	0.19
Share: age < 65	0.29
Share: age > 74	0.24
Share: all members are pensioners	0.89
Share: single-person households	0.50
Share: two-person households	0.50
Share: risk-averse	0.89
Share: expect that inflation will be higher than the rise of pension benefit	0.65

Source: Author's own estimation based on HFCS data.

The shares of single-person households and two-person households in the population are nearly equal and stand at 50% (we have excluded multigenerational households from the sample). In 28% of the households, at least one member has an only elementary education. In 19% of households, at least one member completed higher education (defined as ISCED 5–8). The mean age is slightly lower than 70 years. In nearly 30% of the households, the mean age of household members is lower than 65 years. We call these households “young pensioners”. In 24% of the households, the mean age is higher than 74 years. In nearly 90% of the households, all members are pensioners. Two-person households in which one person is still working are present in our sample but they are rare.

Our sample is rather conservative and risk-averse. Sixty-five percent of the households expect that in the future inflation will be higher than the rise of pension benefits. The question about investment attitudes reveals that nearly 90% of households are not willing to take any financial risks. Only 8% of households are willing to take the average financial risk to earn average returns. About 1% of households are ready to accept high levels of financial risks and returns on investment. Risk aversion and pessimism are probably the consequence of old age.

## Results

The results of the OLS model measuring the displacement effects of social security wealth on net wealth are presented in Table 2. In the whole sample, the assumed effects of social security wealth on private wealth are positive but very small (one zloty of social security wealth raises net wealth by less than PLN 0.01) and not statistically significant. We find that social security wealth tends to increase private wealth (crowding-in) in five subsamples. The relation is negative (crowding-out) among older households and two-person households. In all cases, the potential impact of social security wealth on net wealth is not statistically significant. Table 3 presents the possible effects of social security wealth on wealth components. In all three cases (total assets, real assets, and financial assets), the displacement effects of social security wealth are not statistically significant.

**Table 2. The displacement effects of social security wealth: net wealth**

	All households	Elementary education	Higher education	Age<65	Age>74	All HH members are pensioners	Single-person HH	Two-person HH
Social security wealth	0.003 (0.090)	0.055 (0.097)	0.188 (0.158)	0.016 (0.116)	-0.200 (0.592)	0.089 (0.013)	0.090 (0.242)	-0.050 (0.091)
Number of observations	1741	502	340	509	420	1554	867	874

Note: Standard errors are presented in parentheses (1,000 bootstrap replications). Controls include equalised income, number of years of employment (household head), and binary variables for: age < 65, higher education, elementary education, marriage, employment status, receipt of inheritance and gifts, homeownership, risk aversion, expectation that inflation will rise faster than pension benefit. \*, \*\*, \*\*\* indicate p-value lower than 0.01, 0.05 and 0.1 respectively.

Source: Author's own estimation based on HFCS data.

**Table 3. The displacement effects of social security wealth: wealth components**

	Net wealth	Total assets	Real assets	Financial assets
Social security wealth	0.003 (0.009)	0.007 (0.089)	-0.012 (0.083)	0.019 (0.022)
Number of observations	1,741	1,741	1,741	1,741

Note: Standard errors are presented in parentheses (1,000 bootstrap replications). Controls include equalised income, number of years of employment (household head), and binary variables for: age < 65, higher education, elementary education, marriage, employment status, receipt of inheritance and gifts, homeownership, risk aversion, expectation that inflation will rise faster than pension benefit. \*, \*\*, \*\*\* indicate p-value lower than 0.01, 0.05 and 0.1 respectively.

Source: Author's own estimation based on HFCS data.

The most important concern about the estimated models is the potential endogeneity of social security wealth. Although in the old pension system (before the 1999 reform) the link between earnings and the future pension was much weaker it still existed. The correlation between net wealth and social security wealth is considerable (Pearson's  $r = 0.3177$ ). Social security wealth may also be correlated with other explanatory variables (e.g. education level), thus multicollinearity may also be a problem.

First, we estimate the variance inflation factors (VIF) to test for multicollinearity. In the main model covering all households (Table 2, row 2), the mean VIF is 1.38, and the VIF takes the highest value for social security wealth variables at 2.53. These values are significantly below the commonly accepted thresholds for detecting multicollinearity (5/10). For other models estimated in Table 2 and Table 3, the values of VIFs are similar. The mean VIF is the highest in the model estimated for those with an elementary education but is nonetheless limited (1.55). Thus multicollinearity is not a serious problem in our models.

To test for endogeneity, we estimate a 2SLS regression model. We drop the explanatory variable indicating age lower than 65 years, estimate the main model again (the results do not change significantly, and the potential displacement effects of social security wealth are still not statistically significant), and use age and

age squared as instruments for social security wealth<sup>2</sup>. Then we perform Durbin and Wu-Hausman tests for endogeneity. In both cases, the p-values are high enough to reject endogeneity ( $p = 0.1512/p = 0.1530$ ). Moreover, our 2SLS regression is not plagued by the weak instrument problem ( $F = 188$ ). The outcomes of the Sargan and Basman tests make it possible to reject overidentification ( $p = 0.2059/p = 0.2076$ ); our model is well specified and valid. Although social security wealth may to some extent be influenced by the same variables as net wealth, our outcomes are not biased by the endogeneity of social security wealth. Thus the OLS outcomes are not biased. This procedure also makes it possible to control the endogeneity in other OLS models and reject the hypothesis that endogeneity is biasing our results.

The outcomes of the median regression and quantile regression analysis at 0.25/0.75 quantiles are presented in Table 4. The quantile regression model estimated at 0.25 quantile suggests that social security wealth tends to increase net wealth. The possible effects are rather small (implied crowding-in of less than 4%), but it is marginally statistically significant ( $p < 0.1$ ). This result shows that, among poorer households, the public pension system may increase private savings. Such a possibility was discussed before by Cagan [1965], Katona [1965], and Johnson [1984]. At the median, the impact of social security wealth on net wealth is still positive, but not statistically significant. Estimates at 0.75 quantile suggest that, among wealthier households, social security wealth may displace private savings, but the results are not statistically significantly different from zero. At higher quantiles (results not presented here), we also obtain negative estimates of the crowding-out parameter, but they remain not statistically significant. The obtained results do not support the hypothesis that social security wealth displaces private wealth in the long term. Among poorer households, it even raises private wealth.

**Table 4. The displacement effects of social security wealth: net wealth (quantile regressions)**

	OLS	Median regression	Quantile regression (Q=0.25)	Quantile regression (Q=0.75)
Social security wealth	0.003 (0.090)	0.047 (0.046)	0.049* (0.028)	-0.054 (0.069)
Number of observations	1,741	1,741	1,741	1,741

Note: Standard errors are presented in parentheses. Controls include equalised income, number of years of employment (household head), and binary variables for: age < 65, higher education, elementary education, marriage, employment status, receipt of inheritance and gifts, homeownership, risk aversion, expectation that inflation will rise faster than pension benefit. \*, \*\*, \*\*\* indicate p-value lower than 0.01, 0.05 and 0.1 respectively.

Source: Author's own estimation based on HFCS data.

The possible effects of net wealth and social security wealth on consumption are presented in Table 5. Income is a crucial determinant of consumption. The net wealth is positive and highly significant statistically in relation to consumption, but the assumed effects are smaller than the impact of current income. There are only two groups of households among which the relation of net wealth to consumption is not statistically significant. The first is the group of households with a member who completed only an elementary education. Young pensioners are the second group in which the impact of net wealth on consumption is not statistically significant.

We find mixed evidence on the influence of social security wealth on consumption. In the whole sample, the influence is positive. However, the estimated effects are weak and statistically significant only at the medium level ( $p < 0.05$ ). Among the seven considered subsamples, only three show a statistically significant

<sup>2</sup> According to the life-cycle hypothesis, net wealth should also be related to age and age squared. However, in our case, this is not true. Our sample includes only pensioners or people close to retirement. The households in our sample are at a similar stage of the life cycle. Moreover, the single most important asset owned by over 80% of the households in the sample is the household's main residence. The liquidity of real estate in Poland is limited; it is not possible to dissave. The impact of age and age squared on the value of private wealth is not statistically significant in our sample. However, the impact of both variables on the value of social security wealth is statistically significant. The impact is positive in the case of age and negative in the case of age squared. This confirms the validity of the chosen instruments.

link between social security wealth and consumption. In these three cases (older pensioners, households composed only of pensioners, and single-person households), the influence is positive and rather weak. In all cases, the p-value is lower than 0.05 but higher than 0.01.

**Table 5. The effects of social security wealth on consumption**

	All households	Elementary education	Higher education	Age<65	Age>74	All HH members are pensioners	Single-person HH	Two-person HH
Net wealth	0.007*** (0.002)	0.001 (0.002)	0.009** (0.003)	0.008* (0.005)	0.009*** (0.002)	0.008*** (0.002)	0.010*** (0.003)	0.005*** (0.001)
Social security wealth	0.004* (0.002)	0.001 (0.002)	0.002 (0.003)	0.005 (0.004)	0.021** (0.09)	0.006** (0.003)	0.010** (0.005)	0.004 (0.002)
Number of observations	1,741	502	340	509	420	1,554	867	874

Note: Standard errors are presented in parentheses (1,000 bootstrap replications). Controls include equalised income, number of years of employment (household head), and binary variables for: age < 65, higher education, elementary education, marriage, employment status, receipt of inheritance and gifts, homeownership, risk aversion, expectation that inflation will rise faster than pension benefit. \*, \*\*, \*\*\* indicate p-value lower than 0.01, 0.05 and 0.1 respectively.

Source: Author's own estimation based on HFCS data.

Table 6 presents the outcomes of median regression and quantile regression models estimated at 0.25 and 0.75 quantiles. The results of the median regression analysis are similar as in the case of OLS. All the results confirm that net wealth has a statistically significant and positive impact on consumption. The evidence on the influence of social security wealth is mixed. On the one hand, the quantile regression estimated at 0.25 quantile and the median regression confirm that social security wealth has a positive and statistically significant influence on household consumption. On the other hand, according to the outcomes of the quantile regression model calibrated at 0.75 quantiles, social security wealth has no statistically significant impact on household consumption. This result shows that the link between social security wealth and consumption varies across the consumption distribution.

**Table 6. The effects of social security wealth on consumption (quantile regressions)**

	OLS	Median regression	Quantile regression (Q=0.25)	Quantile regression (Q=0.75)
Net wealth	0.007*** (0.002)	0.004*** (0.001)	0.004*** (0.001)	0.006*** (0.001)
Social security wealth	0.004* (0.002)	0.004** (0.002)	0.003*** (0.001)	0.001 (0.002)
Number of observations	1,741	1,741	1,741	1,741

Note: Standard errors are presented in parentheses. Controls include equalised income, number of years of employment (household head), and binary variables for: age < 65, higher education, elementary education, marriage, employment status, receipt of inheritance and gifts, homeownership, risk aversion, expectation that inflation will rise faster than pension benefit. \*, \*\*, \*\*\* indicate p-value lower than 0.01, 0.05 and 0.1 respectively.

Source: Author's own estimation based on HFCS data.

All the models confirm a statistically significant relation of net wealth to consumption, while the evidence on the influence of social security wealth on consumption is mixed. The marginal propensity to consume out of net wealth is stronger than the marginal propensity to consume out of social security wealth. This difference is probably driven by the varying liquidity of the two considered wealth categories. Net wealth, except for the household's main residence, is to a large extent liquid, while social security wealth is not liquid. Households receive a pension each month, but cannot use their social security wealth in advance. Therefore the impact of net wealth on consumption is stronger and more robust than the impact of social security wealth.

Table 7 presents the displacement effects of social security wealth on the saving rates. Note that the saving rates are multiplied by a hundred, and the explanatory variable is expressed in thousands in this case. Otherwise, the potential impact would still be significant, but the obtained coefficients would be proportionally smaller and too small to be presented in the table.

**Table 7. The displacement effects of social security wealth: saving rate (multiplied by 100)**

	All households	Elementary education	Higher education	Age<65	Age>74	All HH members are pensioners	Single-person HH	Two-person HH
Private wealth (thous)	-0.009*** (0.002)	-0.000 (0.005)	-0.013*** (0.002)	-0.009*** (0.003)	-0.006 (0.005)	-0.009*** (0.002)	-0.008** (0.004)	-0.009*** (0.002)
Social security wealth (thous)	0.005 (0.005)	-0.024*** (0.007)	0.006 (0.006)	0.002 (0.007)	0.019 (0.025)	-0.000 (0.008)	0.022* (0.13)	0.003 (0.004)
Number of observations	1,741	502	340	509	420	1,554	867	874

Note: Standard errors are presented in parentheses (1,000 bootstrap replications). Controls include equalised income, number of years of employment (household head), and binary variables for: age < 65, higher education, elementary education, marriage, employment status, receipt of inheritance and gifts, homeownership, risk aversion, expectation that inflation will rise faster than pension benefit. \*, \*\*, \*\*\* indicate p-value lower than 0.01, 0.05 and 0.1 respectively.

Source: Author's own estimation based on HFCS data.

The net wealth in the whole sample and the majority of subsamples tend to lower the saving rates (the outcomes are statistically significant). Our sample is composed of older households. Probably those who have already accumulated significant wealth holdings do not have incentives to continue saving. Households who own only limited wealth still save to purchase durables and cover future risks. Only among households with an elementary education and the oldest households (with the mean age of members higher than 74), the possible effects of net wealth on the saving rate are not statistically significant. The negative influence of net wealth on the saving rate is consistent with its positive effect on consumption.

The possible displacement effects of social security wealth on the saving rate in the whole sample and the majority of subsamples are not statistically significant. As in the case of consumption, the difference between the influence of net wealth and social security wealth is probably driven by different liquidity. Households cannot use their social security wealth to purchase durables, cover medical expenses or spend accumulated public pension entitlements in case of unexpected events. Only among households with only an elementary education, the influence of public pension wealth on the saving rate is negative and statistically significant. Among single-person households, the influence is positive and marginally significant statistically. However, in both cases, the identified effects are rather weak.

Table 8 presents the results of median and quantile regressions estimated at 0.25 and 0.75 quantiles. The influence of net wealth on the saving rate remains negative and statistically significant in all specifications. In regressions estimated at 0.25 quantile and median, the influence of social security wealth on the saving rate, similarly as in the case of OLS, is not statistically significant. However, in the regression estimated at 0.75 quantiles, the impact of public pension wealth is negative and marginally significant statistically. This suggests that, among households with the highest saving rates, social security wealth may to some extent displace private savings.

In our view, the results of models measuring the effects of social security wealth on consumption and the saving rates provide at best weak evidence that public pension entitlements displace private savings. The possible effects identified by our model are small and often not statistically significant. Moreover, while long-term displacement effects would mean that public pension systems partially displace long-term private wealth accumulation and thus are not fully effective in raising savings for old age, lower saving rates among old-age households are not necessarily a bad thing.

**Table 8. The effects of social security wealth on saving rate (multiplied by 100, quantile regressions)**

	OLS	Median regression	Quantile regression (Q=0.25)	Quantile regression (Q=0.75)
Net wealth (thous)	-0.009*** (0.002)	-0.010*** (0.001)	-0.010*** (0.002)	-0.011*** (0.001)
Social security wealth (thous)	0.005 (0.005)	-0.004 (0.005)	-0.002 (0.004)	-0.008* (0.004)
Number of observations	1,741	1,741	1,741	1,741

Note: Standard errors are presented in parentheses (1,000 bootstrap replications). Controls include equalised income, number of years of employment (household head), and binary variables for: age < 65, higher education, elementary education, marriage, employment status, receipt of inheritance and gifts, homeownership, risk aversion, expectation that inflation will rise faster than pension benefit. \*, \*\*, \*\*\* indicate p-value lower than 0.01, 0.05 and 0.1 respectively.

Source: Author's own estimation based on HFCS data.

The value of social security wealth to some extent depends on the interest rate used in the calculation. As described above, we have calculated the value of social security wealth using an interest rate of 2%. It is the most popular choice in the literature and it reflects the post-crisis low-interest rates. To check the robustness of our results, we estimate our models once again, using the value of social security wealth estimated based on interest rates of 1% and 3%.

The results of alternative estimations are presented in the Appendix, in Tables A2-A5. Table A2 presents the median and mean values of social security wealth calculated using alternative assumptions regarding the interest rate. Tables A3-A5 present the displacement effects of social security wealth calculated on the basis of alternative assumptions on net wealth, consumption, and saving rates. Our results are robust to alternative assumptions related to interest rates. The influence of social security wealth on the considered dependent variables remains similar after the change in the interest rate. The values of the estimated coefficients change only marginally, and the level of statistical significance changes only in the case of the influence of social security wealth on consumption. The full versions of Tables 2 and 5 are reported in the Appendix, Tables A6 and A7.

## Conclusions

In this paper, we use a novel data source to investigate the displacement effects of social security wealth (sometimes also called public pension wealth, or entitlements in the public pension system) on private savings in Poland. While most literature in this area covers developed economies, we analyse the link between the public pension system and household wealth in a transition country. We separately estimate the effects of social security wealth on net wealth, wealth components, consumption, and saving rates.

We do not identify statistically significant displacement effects of social security wealth on net wealth and different types of assets. The public pension system does not displace private wealth in the long term. The results of quantile regression suggest that the public pension system even raises private wealth among poorer households.

We find small, positive effects of social security wealth on consumption. However, the estimated coefficients are statistically significant only at the 95% level in the whole sample and are not statistically significant in some subsamples. The marginal propensity to consume out of net wealth is higher than the marginal propensity to consume out of social security wealth. This difference is probably driven by different liquidity. Higher consumption by definition means lower savings. However, when we estimate the relation between social security wealth and the saving rate we do not identify a statistically significant influence of public pension entitlements on the saving rates. In our view, the evidence on the short-term substitution between social security wealth and private savings is at best weak.

In general, our results do not support the prediction that social security wealth displaces private savings arising from the life cycle hypothesis [Modigliani, 1986]. Even if social security wealth reduces the saving rates among wealthier households, the impact of social security wealth is small. According to the outcomes of

quantile regressions estimated at the 0.75 quantile, 1,000 additional zlotys of social security wealth reduces saving rates only by approximately 0.8%.

The substitution hypothesis may be true in developed economies, but the situation of former centrally planned economies differs significantly. First, the net wealth distribution has been to a large extent influenced by the privatisation of state-owned housing assets. Housing wealth has a lion's share in the wealth of Polish households and remains an important wealth component even at the top of the wealth distribution. Because homeownership was to large extent driven by random events, the wealth of Polish households is not a result of an optimal decision-making process, as foreseen by the life-cycle hypothesis. Moreover, after 1989 the economic situation changed rapidly, which lowers the possibility that households follow long-term allocation plans and optimise utility over their lifetime. The high importance of housing wealth also reduces the space for the substitution between social security wealth and private wealth. Housing wealth is not liquid, and thus households cannot partially reduce the value of their homes or flats. Moreover, the value of the financial assets of Polish households is relatively small. Thus dissaving is rather difficult for households in Poland.

The most important limitation of our research is that the sample is limited to households that already collect public pension benefits or will do so in the coming years. Therefore our sample includes those who are at the peak of their life-cycle wealth profile or near the peak. This limits the generalisability of our conclusions. The link between social security wealth and private wealth accumulation may look different among younger households who still accumulate household wealth. Moreover, a strong majority of households in our sample, because of their age, remained in the "old" pension system and were not impacted by the pension reform introduced in 1999. Thus our results cannot be generalised for current workers, who participate in the "new" pension system. It should also be noted that the relationship between social security wealth and other economic variables estimated in this paper is not causal. Our results are not based on an exogenous shift in the value of pension wealth.

Our research is based on survey data. Microdata from the household survey may be theoretically combined with detailed administrative data on entitlements in public systems stored in Social Insurance Institution databases. Unfortunately, this is not possible at the moment because of legal obstacles to administrative data sharing. The merging of survey data with administrative data remains a promising direction for future economic research in Poland, not only in the case of the substitution between social security wealth and private wealth. The usage of bigger data samples would allow for a more precise estimation of the impact of the public pension system on private wealth accumulation.

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## Appendix

**Table A1. The value of pension benefits and expected pension benefits (PLN)**

	Pension benefits	Expected pension benefits
Mean	23 876 (370)	24 557 (1 461)
P10	12 618 (236)	12 000 (2 265)
P25	16 756 (363)	18 000 (1 532)
Median	21 753 (438)	24 000 (1 393)
P75	28 320 (385)	30 000 (2 201)
P90	36 816 (1 057)	41 868 (4 974)
P95	45 312 (1 588)	48 000 (4 618)
P99	57 327 (2 116)	54 000 (4 009)

Note: Standard errors are presented in parentheses (1,000 replications).

Source: Own estimation based on HFCS data.

**Table A2. The value of social security wealth (PLN, alternative interest rates)**

	r = 2% (baseline)	r = 1%	r = 3%
Mean	376,810	420,353	335,382
Median	316,047	350,726	285,148

Source: Own estimation based on HFCS data.

**Table A3. The effects of social security wealth on net wealth (alternative interest rates)**

	r = 2% (baseline)	r = 1%	r = 3%
Social security wealth	0.003 (0.090)	0.008 (0.078)	-0.022 (0.102)
Number of observations	1741	1741	1741

Note: Standard errors are presented in parentheses (1,000 bootstrap replications). Controls include equalised income, number of years of employment (household head), and binary variables for: age < 65, higher education, elementary education, marriage, employment status, receipt of inheritance and gifts, homeownership, ownership of financial assets, risk aversion, expectation that inflation will rise faster than pension benefit. \*, \*\*, \*\*\* indicate p-value lower than 0.01, 0.05 and 0.1 respectively.

Source: Own estimation based on HFCS data.

**Table A4. The effects of social security wealth on consumption (alternative interest rates)**

	r = 2% (baseline)	r = 1%	r = 3%
Net wealth (thous)	0.07*** (0.002)	0.007*** (0.002)	0.007*** (0.002)
Social security wealth (thous)	0.004* (0.002)	0.004* (0.002)	0.005** (0.002)
Number of observations	1,741	1,741	1,741

Note: Standard errors are presented in parentheses (1,000 bootstrap replications). Controls include equalised income, number of years of employment (household head), and binary variables for: age < 65, higher education, elementary education, marriage, employment status, receipt of inheritance and gifts, homeownership, risk aversion, expectation that inflation will rise faster than pension benefit. \*, \*\*, \*\*\* indicate p-value lower than 0.01, 0.05 and 0.1 respectively.

Source: Own estimation based on HFCS data.

**Table A5. The effects of social security wealth on saving rate (multiplied by 100, alternative interest rates)**

	r = 2% (baseline)	r = 1%	r = 3%
Net wealth (thous)	-0.009*** (0.002)	-0.009*** (0.002)	-0.009*** (0.002)
Social security wealth (thous)	0.005 (0.005)	0.004 (0.004)	0.006 (0.006)
Number of observations	1,741	1,741	1,741

Note: Standard errors are presented in parentheses (1,000 bootstrap replications). Controls include equalised income, number of years of employment (household head), and binary variables for: age < 65, higher education, elementary education, marriage, employment status, receipt of inheritance and gifts, homeownership, risk aversion, expectation that inflation will rise faster than pension benefit. \*, \*\*, \*\*\* indicate p-value lower than 0.01, 0.05 and 0.1 respectively.

Source: Own estimation based on HFCS data.

Table A6. The displacement effects of social security wealth: net wealth (full results)

	All households	Elementary education	Higher education	Age<65	Age>74	All HH members are pensioners	Single-person HH	Two-person HH
incom_eq	4.673** (1.750)	1.202 (1.914)	6.511*** (1.909)	6.322*** (1.459)	2.924 (7.315)	3.138 (2.580)	2.112 (2.837)	6.866 (1.586)
social security wealth	0.00293 (0.0900)	0.052 (0.0978)	0.188 (0.158)	0.0158 (0.116)	-0.200 (0.593)	0.0889 (0.134)	0.0902 (0.242)	-0.0498 (0.0907)
Age < 65	3993.7 (22856.3)	-12286.4 (26339.5)	-11706.1 (95778.7)					
higher_edu	71541.5** (23218.1)	-53064.8 (63628.4)		38696.4 (57540.7)	71360.8 (39728.5)	84442.8*** (22348.5)	76630.8** (27235.9)	67999.9* (32478.1)
elem_edu	-13158.8 (11902.2)		-203151.5 (138211.3)					
married	55608.6 (20901.6)	26829.3 (21433.6)	27721.4 (58611.6)	55847.2 (46049.4)	98916.6 (67278.0)	40793.3 (25350.2)	101225.8* (42606.5)	
employed	26812.6 (44606.6)	122567.3 (64283.6)	-65107.9 (115270.4)	-17093.9 (39384.2)	48830.7 (203444.6)	47098.8 (62486.8)	-14148.4 (65064.2)	32651.4 (41749.1)
years_employment	283.0 (713.2)	555.9 (719.7)	-1229.7 (2098.3)	-933.3 (971.7)	-753.3 (1799.8)	287.5 (796.1)	382.3 (1109.1)	1649.8 (806.6)
received_inheritance	63529.8 (16291.3)	-644.4 (19381.1)	108964.1* (51603.5)	153559.7*** (31287.7)	2986.6 (34644.2)	49813.3** (17379.2)	53887.5** (18242.8)	74214.1** (27700.9)
has_real_estate	261877.3*** (11583.3)	235775.7*** (11649.0)	354881.1*** (39384.1)	236150.5*** (21832.9)	259409.4 (21565.1)	259998.1 (11607.0)	245668.5*** (13488.4)	298471.4*** (19796.9)
able_to_get_fin_assistance	1386.6 (12976.5)	31044.4 (15089.4)	91988.2* (46151.7)	11781.9 (25753.9)	30564.6 (21086.2)	7823.7 (12892.7)	-1243.2 (14449.3)	16034.1 (23494.4)
expect_inflation	-27751.4 (14574.6)	-1094.7 (15210.3)	-75857.2 (46328.5)	-46895.2 (30494.0)	-25115.9 (27616.6)	-24906.0 (14542.7)	-27435.5 (17154.6)	-28368.6 (25155.5)
risk_averse	-42459.0 (38516.2)	-54293.1 (45397.1)	-52600.5 (91966.6)	-47316.8 (71503.7)	-156.3 (61327.2)	-44311.1 (42502.0)	-23684.3 (54762.0)	-41240.2 (53031.4)
_cons	-84660.1 (52971.2)	-22626.8 (50447.2)	-210518.3 (110395.3)	-75312.5 (87327.4)	-32826.0 (104440.6)	-73703.9 (60397.2)	-49079.6 (69359.7)	-178497.4** (65736.8)
N	1741	502	340	509	420	1554	867	874

Standard errors in parentheses

Source: Own estimation based on HFCS data.

Tab A7. The effects of social security wealth on consumption (full results)

	All households	Elementary education	Higher education	Age<65	Age>74	All HH members are pensioners	Single-person HH	Two-person HH
Income_eq	0.0973* (0.0417)	0.210*** (0.0562)	0.0929* (0.0445)	0.118 (0.0491)	-0.0300 (0.116)	0.0871 (0.0629)	0.0554 (0.0750)	0.137*** (0.0341)
net_wealth	0.00698*** (0.00187)	0.00112 (0.00218)	0.00914** (0.00353)	0.00837 (0.00466)	0.00903*** (0.00199)	0.00771*** (0.00202)	0.0100** (0.00315)	0.00466*** (0.00113)
social security wealth	0.00425* (0.00217)	0.00240 (0.00286)	0.00195 (0.00272)	0.00536 (0.00402)	0.0216* (0.00884)	0.00555* (0.00269)	0.00959* (0.00456)	0.00378 (0.00239)
Age < 65	-540.8 (578.0)	-185.5 (806.9)	1459.5 (2188.3)					
higher_edu	2193.3** (669.7)	-3264.0 (3050.5)		1431.2 (1759.4)	2628.7* (1142.8)	3201.8*** (641.0)	2916.1*** (859.1)	2489.8** (923.1)
elem_edu	-2984.5*** (394.1)		-5412.9 (3040.8)					
married	-684.4 (652.8)	899.6 (640.3)	-1333.8 (1653.4)	-1676.9 (1540.3)	-2349.1 (1199.4)	-971.0 (688.2)	-1863.9 (1059.9)	
employed	2108.4* (963.7)	-203.4 (1063.5)	-1489.7 (1940.1)	1992.3 (1170.3)	10271.5* (3988.9)	3108.8* (1387.5)	3856.3* (1783.1)	1466.0 (809.2)
years_employment	41.34* (18.25)	43.00 (25.49)	145.9** (52.40)	79.08* (32.42)	7.356 (42.61)	53.38* (20.99)	60.70* (27.25)	41.61 (30.91)
received_inheritance	-665.6 (408.4)	-1426.5** (512.6)	841.5 (1127.4)	180.2 (947.3)	-719.2 (844.6)	-766.0 (427.9)	-919.5 (523.4)	-584.5 (641.0)
has_real_estate	-622.2 (631.5)	412.7 (691.8)	-542.6 (1866.7)	-1628.1 (1435.6)	-1141.5 (862.7)	-509.0 (702.9)	-1088.4 (955.0)	-207.8 (855.1)
able_to_get_fin_assistance	-557.1 (400.5)	50.62 (495.6)	-448.6 (1101.4)	-695.0 (834.4)	-830.9 (892.6)	-163.9 (412.2)	484.9 (484.6)	-1985.4** (728.2)
expect_inflation	219.9 (414.7)	935.2 (526.9)	931.4 (1041.0)	209.4 (786.3)	225.2 (798.4)	122.9 (439.8)	536.2 (517.5)	-231.8 (722.4)
risk_averse	-862.1 (897.3)	-1385.0 (1796.4)	-2665.6 (1801.5)	-1192.4 (1754.5)	-65.40 (1705.8)	-1142.5 (953.3)	-3418.1* (1433.2)	1229.2 (1025.9)
_cons	13585.2 (1487.9)	7882.4 (2160.3)	13763.4 (3028.3)	11160.1*** (2635.1)	13300.2*** (2891.5)	11723.8*** (1702.7)	12711.4*** (2102.9)	10913.1*** (2088.3)
N	1741	502	340	509	420	1554	867	874

Standard errors in parentheses

\* p &lt; 0.05, \*\* p &lt; 0.01, \*\*\* p &lt; 0.001

Source: Own estimation based on HFCS data.