# Does Social Security Crowd out Private Wealth? A Survey of the Literature

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ABSTRACT

In this paper, we review the research on the substitution between social security wealth and private wealth. Our review includes over 100 theoretical and empirical contributions. Nearly 70% of the literature identifies the statistically significant impact of social security wealth on different forms of private savings. A strong majority of authors, who obtain statistically significant results find the negative impact of social security on private savings. We discuss the main limitations of the literature.

KEYWORDS

Social security; private wealth; crowd-out effect; substitution; household wealth; the public pension system

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## 1. Introduction

Economic theory does not give a clear prediction about the impact of social security on private savings. On the one hand, the basic life-cycle hypothesis (Modigliani, 1986) predicts full substitution between social security wealth and private wealth. On the other hand, however, other theories of consumption, as well as extended life-cycle models, predict only limited displacement effects. In some cases, social security may even increase private savings. The impact of the public pension system on private wealth accumulation has enormous practical consequences. If social security wealth fully crowds out private wealth public pension system does not create additional savings Therefore one of the main reasons for its existence is not valid. Theoretically, it may be dissolved and replaced by public policies, which only protect low-income earners, who are too poor to accumulate adequate savings for their retirement.

The crowd-out effects of social security wealth are an important research topic in economics. Recently, Fessler and Schürz (2018) studied the crowd-out effects in the Euro area. Lefebrve and Perelman (2020) provided evidence for Belgium. Slavov (2018) and Wassel (2018) extend earlier, a rich literature on the United States. Wroński (2023b) estimated the crowd-out effects in Poland. Etgeton (2018) provided novel evidence for France. Blanchet et al. (2016) studied the substitution between social security wealth (public pension entitlements) and private wealth. In this paper, we review the recent and classical literature.

Not only economists fear that social security displaces private savings. As early as in the 1870s the Royal Commission on Friendly Societies received many complaints that Poor Law relief reduces private savings (Johnson, 1984). Executives of German Saving Banks were afraid that the introduction of Bismarck's social insurance systems would crowd-out private savings and reduce the value of deposits of the working class (Ashauer, 1998). Despite Bismarck's claims that the social insurance system is an example of "Christianity in practice" (von Krockow, 1997), many members of Reichstag feared that the public social insurance system would reduce private forethought and displace private savings (Lehmann-Hasemeyer and Streb, 2017). Similarly in Sweden members of parliament argued that the introduction of public old-age insurance would weaken the incentives for thrift and prudence and decrease private savings (Andersson and Eriksson, 2014).

Theoretical ambivalence and enormous practical importance generated a large body of empirical literature on the substitution between social security wealth and private wealth. Available reviews of this literature (Kessler et al., 1981; Low et al., 1986; Magnussen, 1994a; Kohl and O'Brien, 1998) are seriously outdated. They provide a good assessment of the literature at the moment of their publication, but since that time literature on the displacement effects of social security has grown significantly.

In this paper, we review over a hundred publications on the impact of social security on private wealth. Our review is focused on peer-reviewed publications, but in a few cases we also discuss the results of working papers. Firstly we present theoretical insights on the impact of social security on savings. Then we review available empirical evidence. We separately discuss studies based on aggregate time series data and literature based on microeconometric evidence. Many authors investigated the impact of social security on savings in the US, therefore we separately present outcomes of studies related to the American case. In our review, we discuss the most important older papers and as many recent contributions as possible. Because of the size of the literature, we omit some older papers, which had a limited long-term impact. We try to present evidence on the impact of social security in a high number of countries. Our work is limited to the impact of the public pension system on different forms of private wealth. We do not discuss the impact of private pension entitlements on non-pension wealth (e.g. Munell, 1976). We do not discuss the impact of social security wealth on the distribution of private wealth, and (augmented) wealth inequality (Sierminska and Wroński, 2023; Wroński, 2023a) Then we provide our assessment of the current state of the literature.

Nearly 70% of studies identify the statistically significant impact of social security wealth on private savings.

A strong majority of authors, who obtain statistically significant results find a negative impact of social security on private savings. Identification of the positive impact of social security on private wealth is rare. Most often it takes place if the impact of social security on private savings is considered jointly with its impact on fertility. On the other hand, however, nearly 50% of contributions find nonsignificant or mixed results. The strength of the impact of social security on private savings varies. The median study finds a statistically significant, but relatively small impact of social security on private savings.

In the next section, we review predictions of economic theory on the impact of social security on private savings. Empirical evidence on the issue is presented in the third section. We present our assessment of the current knowledge on the displacement effects of social security in the fourth section. In the last section, we conclude and indicate promising directions for future research.

## 2. Theoretical insights

The basic life cycle model (see Modigliani, 1986) predicts a full offset between social security wealth and pension wealth.[1] If the public pension system is actuarially fair public pension system has no impact on total lifetime income. Social security contributions reduce income at working age, but pension benefits increase income in retirement. Households choose consumption and savings in each period to maximize lifetime utility. The household choice is based on total lifetime income. The composition of lifetime income, including the shares of earnings and pension benefits, has no impact on the choice of the household. Rational decision-makers know that they may save less for retirement because the state's old-age pension system supports them in securing consumption in retirement. Social security contributions displace private savings. Therefore increase in social security wealth is fully offset by a reduction in non-pension wealth (see e.g. Modigliani and Sterling, 1983; Gale, 1998). Also, Friedman (1957) noted that social security wealth would highly reduce private savings.

In practice, the situation is more complicated. The public pension system is not actuarially fair and may significantly change the value of lifetime income. Because of the existence of minimum pensions and rules of entitlements accumulation preferring low-earners public pension systems are usually progressive. Therefore social security may increase the lifetime income of low-earners and decrease the lifetime income of high earners (see e.g., Belloni et al., 2019; OECD, 2019). Some households face borrowing constraints (Hubbard, 1986). Therefore public pension system may increase savings of constrained, usually, low-income households Displacement effects are limited, because low earners rarely save for retirement on their own and they do not have savings that could be reduced. The public pension system offers annuities, which insure households against uncertain life span and longevity risks (Hubbard, 1987). Social security not only provides insurance of income in the old-age but also insures family income in case of death (Li, 2018). Households save not only to smooth consumption and secure income in the old-age but also because of different motives, e.g. bequest motives (Hurd, 1987) or medical expenses (De Nardi et al., 2010). The impact of social security on private savings depends also on the existence of full employment (Eisner, 1983). If Ricardian equivalence holds then the social security system should not impact saving and wealth in the long-term, because households anticipate higher future taxes connected with more generous pension benefits (see Barro, 1974). In a dynastic setting, parents who benefit from the public pension system may transfer money back to their children. If they will do that via the bequest channel public pension system may even temporarily rise savings.

The public pension system may even increase private savings. Many households are too poor to achieve the level of savings, which may secure consumption in the retirement period. Therefore in the absence of the public

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[1] Beacuse life cycle hypothesis is well-known to economists we do not present it here. There are many high quality literature review on this issue (e.g. Mayer, 1972; Deaton, 1992; Attansio and Weber, 2010).

pension system, they would not save, because their savings will be useless in their old age anyway. If the public pension system exists they may increase their savings to complement public benefits (Katona, 1965, Johnson, 1984). Moreover, if the public pension system exists age of retirement may be lower than in the case, in which each individual at their own choice of when to retire (Feldstein, 1974; Modigliani and Sterling, 1983). As a consequence, the public pension system may stimulate the insured population to accumulate additional private savings to finance consumption in the longer retirement period. Many households do not think about retirement (Lusardi, 2000). Thus public pension system may induce individuals to consider their needs in old age, thereby increasing private savings (Cagan, 1965).

The behavioral perspective is particularly important in the area of household finance (Bernheim et al., 2018). The financial literacy of households is limited, which has an impact on their allocation choices (Lusardi and Mitchell, 2014). Even if households have basic knowledge of the public pension system, they often do not know its exact rules (e.g. Liebman and Luttmer, 2015; Czapiński and Góra, 2016). The offset may differ between households informed about the pension system and informed households (Bottazzi et al., 2006). Behavioral economics shows that households apply mental accounting and treat different assets differently (Thaler, 1999). Social security contributions may serve as a means of self-control (Thaler, 1990; Fehr et al., 2008; Bucioll, 2011) and increase the savings of those, who find it difficult to save.

Social security wealth is usually calculated by researchers using actuarial discounting and therefore takes into account not only a discount rate but also the probability of death. Households may, however, price their social security wealth using other discounting methods (Mirer, 1992), for example, simple discounting ignoring the probability of death (Bernheim, 1987) or hyperbolic discounting (Gustman and Steinmeier, 2012). Many households are passive savers and their reaction to public policy changes is very limited (Chetty et al., 2014). The time preferences of the insured may be inconsistent (Tyrowicz et al., 2020). Saving decisions may depend on the expectation of individuals regarding the public pension system (Dolls et al., 2018). Social security has also a negative impact on fertility and through this channel may increase savings (children are rather expensive) (Cigno and Rosati, 1996).

Feldstein (1976) developed an extended life cycle model with social security system and a fixed period of retirement. In his model, public pension systems induce a strong decrease in private wealth accumulation. Barro (1974) and Kochin (1974) presented alternative extended life cycle models with different implications about the effects of social security and public debt. Schröder (1983) developed the model, in which the impact of social security on private savings depends on the relationship between labor productivity and interest rate. He also shows that the method of financing the social security deficit is important for the displacement effects of social security. Burtless (1986) presented a model, in which workers respond differently to anticipated and unanticipated components of pension benefits. Engen and Gale (1993) formulated a stochastic life cycle model, in which households face borrowing constraints and uncertain life span and wages. This model generates imperfect substitution between social security wealth and non-pension wealth.

Blau (2016) established a formal economic model calibrated to the US economy and study the displacement effects of social security. He found that the strength of the crowd-out is highly dependent on modeling choices. The crowd-out by social security nearly doubles from 56% in the least restrictive to 106% in the most restrictive specification. Displacement effects of private pension wealth are also sensitive to the specification but do not exceed 40%. Honarvar et al. (2017) estimated the OLG model to assess the macroeconomic consequences of Iranian pension reforms. According to their results reduction of the social security wealth (a consequence of lower replacement rates) should substantially increase private wealth. Law (2019) assessed the impact of pension system reforms in New Zealand on national savings based on the theoretical model. His model shows that even small changes in the retirement system may result in large moves in the saving rate. Rutkowski (2019) estimated an

overlapping generation model with hand-to-mouth agents to evaluate the impact of the introduction of a new quasi-mandatory pension scheme in Poland. He found strong crowd-out effects. In his preferred specification, only 0.08-0.09 PLN of each PLN allocated to pension plans are new savings, the rest is displaced from voluntary private savings. Tyrowicz et al. (2020) developed a framework with incompletely rational agents, who experience commitment difficulty and have limited financial knowledge. Agents have inconsistent time-preferences. The developed model is calibrated to the case of the German economy. The authors identified substantial crowd-out effects, which limit the increase of capital stock. The increase in capital stock is driven by financially illiterate agents, who would otherwise save almost nothing. Jappelli et al. (2020) developed a model, in which future social security benefits are uncertain and based on Italian data showed that households, who are more skeptical about future public pension benefits more often participate in private pension plans.

The impact of social security wealth on private savings is theoretically ambiguous. The public pension system may increase non-pension wealth, may have no impact on private wealth, or may even increase private savings. Because of this ambiguity, empirical research on this issue is highly important. In the next sections of the paper, we review the most important empirical contributions.

## 3. Empirical evidence

### 3.1. Time series evidence

The first attempts to measure the impact of social security on private wealth were based on aggregate time series evidence. The authors measured the value of social security wealth and other variables over the chosen period. Then they regressed social security wealth and control variables on their dependent variables. Because of data availability, consumption has been usually chosen as the dependent variable. Savings are defined as income minus consumption, thus higher consumption implies lower saving. Because savings rates are low in many developed economies, even a relatively small propensity to consume out of social security wealth in many cases implies a large drop in saving rate. The aggregate character of the data makes it easy to express research outcomes in terms of billions of dollars of lost savings, which might increase the visibility of this strand of the literature to public opinion.

#### 3.1.1. United States

Feldstein in his seminal paper (1974) studied the impact of social security wealth on private wealth accumulation in the USA. His estimates are based on aggregate data for the years 1929 through 1971. World War Two period (1941-1946) was excluded from the sample. Feldstein identifies statistically significant and strong displacement effects of social security wealth. Social security reduces private wealth to half of what it otherwise would be. Feldstein's research generated a great interest in the effects of social security on wealth accumulation.

According to Munell (1974), social security had discouraged private savings, but a decline in private savings had been offset by additional savings for a longer retirement period. Barro (1978) investigated the impact of social security wealth on private savings in the US in a similar period and did not find statistically significant displacement effects of social security. Darby (1979) also found a small and statistically insignificant impact of social security on private savings. Busch ad Wüger (1981) were also critical of the Feldstein hypothesis and its empirical verification. They argued that investigations on social security and savings have produced random results, which cannot be seen as empirical laws. Leimer and Lesnoy (1982) found a programming error in Feldstein's calculation of the social security wealth variable. Correction of this error significantly reduces the displacement effects of social security. Adopting alternate assumptions in the calculation of social security wealth further reduces displacement effects. The authors also proved that Feldstein's (1974) results are very sensitive to change in the examined period. They

concluded that the impact of social security wealth on private wealth is statistically insignificant. Feldstein in his reply (1982) acknowledged programming error but argued that Leimer and Lesnoy (1982) ignored the last changes in the social security system and thus underestimated the true value of social security wealth. He defended his thesis that social security wealth displaces private wealth and discussed the limitations of time series analysis. Todó-Rovira and Pérez-Ramael (1988) also criticized Feldstein's calculation of social security wealth and proposed alternatives, which significantly lower the value of social security wealth and cast doubts about the negative impact of social security wealth on private savings. Lee and Chao (1986) did not find statistically significant displacement effects of social security on private savings. In general, the authors mentioned above criticized Feldstein's paper (1974) for the omission of relevant variables, measurement errors, and the inclusion of the pre-war period in the analysis.

Feldstein (1996) extended the period of analysis by 21 years. According to his results, social security wealth reduced overall private savings by 60 percent. The impact of social security wealth is statistically significant. Meguire (1998) found mixed evidence on the impact of social security wealth on private wealth. He argued that Feldstein's (1974, 1996) results are very sensitive to the inclusion of pre-war years in the sample. Coates and Humprey (1999) found mixed evidence on the impact of social security wealth on private savings. In some of their specifications, the impact of social security on private savings is statistically significant, but in others, it is not statistically significant They noted that results to a large extent depend on the assumptions. In a presidential address to the American Economic Association in 2005, Feldstein defended his position on the effects of social security on private savings (Feldstein, 2005). Pfau (2005) also identified a strong degree of substitution between social security wealth and private savings. However, he acknowledged that his results are not robust across different specifications. Wassel (2018) treated Feldstein's paper (1974, 1996) as a pedagogical example and use his research to discuss crucial problems of time series econometrics. According to him, different conclusions on econometric problems such as cointegration, stationarity, etc. may be drawn depending on the selection of diagnostic tests and the subset of data. When the data are divided into periods (pre-1972 and post-1971) and first differenced social security wealth coefficients are not statistically significant.

### 3.1.2. Other countries

Boyle and Murray (1979) studied the impact of social security on private wealth in Canada. Their investigation covered the 1954-75 period. They did not find a statistically significant impact of social security wealth on private savings. Their coefficient of interest displays small, positive, and negative values. They concluded that Canada's public pension plan has had no impact on private savings. According to Denny and Rea (1979) impact of social security wealth on the saving rate in Canada is also statistically insignificant

Holzmann (1981) investigated the impact of social security wealth on savings in Austria over the period 1956-79. His research does not permit clear-cut conclusions. The impact of social security wealth on private financial savings with a high probability is nil. Social security probably decreases the savings of employees, but it seems to increase the wealth accumulation of self-employed.

Browing (1982) analyzed the impact of public pension wealth on savings in the UK. His research was based on quarterly data from 1962 to 1979. He found a statistically significant, but relatively small impact of public pension wealth on private savings. Blake (2004) studied the impact of social security wealth on savings in the UK in the 1948-94 period and also found statistically significant negative displacement effects of social security wealth.

Johnson (1984) investigated the impact of the introduction of public old-age pensions in Britain in 1906 on private savings. He extended previous research on wealth holdings in Great Britain and calculated aggregated value of social security wealth between 1906 and 1937. He estimated consumption equations separately for the whole population and working population. According to his results, the introduction of public pensions reduced the

consumption of the working-class and increased private savings. It may confirm Cagan's (1965) self-recognition effects, according to which the introduction of public pension insurance induce workers to consider old-age need (see also Katona, 1965). However, in the whole population author found a negative relationship between social security wealth and savings. Similarly, the reaction of workers to inflation and unemployment is different than in the case of the total population. Although this may raise questions about the robustness of Johnson's results, according to him the difference in results is driven by differences in the economic behavior of the working-class and the population as a whole. Johnson concluded that time series analysis cannot answer the question alone. Econometric analysis should be supported by historical evidence. In his view, the introduction of old-age pensions in the UK did not reduce workers' private savings, because workers were simply too poor to save for retirement on their own.

Perelman and Pestiau (1984) studied the impact of social security wealth on private savings in Belgium. Their research covers the 1954-1977 period. The authors identified large displacement effects of social security wealth on private savings. Displacement effects are probably stronger among the pensioners than among the working population.

Zant (1988) investigated the impact of social security wealth on private savings in the Netherlands between 1957 and 1986. The important limitation of this research is the lack of reliable high-quality time series data on private wealth in the country. Nevertheless, the author identified the statistically significant impact of social security wealth on consumption, which implies a decrease in savings.

Magnussen (1994b) analyzed the impact of old-age pensions on personal savings in Norway over the period 1966-1990. The case of Norway is particularly interesting because, after the discovery of oil and gas in the North Sea, the country experienced rapid economic growth and developed a very generous social state. According to obtained results, the impact of social security wealth on the saving rate in the considered period was not statically significant. Markowski and Palmer (1979) investigated the impact of social security wealth on private savings in Sweden, which is also a generous welfare state. Their research cover s1954-75. They found a negative and statistically significant impact of social security wealth on private savings. However, Benztel and Berg (1983) analyzed the displacement effects of social security wealth in Sweden in a similar period (1955-79) and found no displacement effects of social security.

Rosi and Visco (1995) studied the impact of social security on national savings in Italy between 1954 and 1992. They exploited the variation in the value of pension wealth variables caused by policy reforms. The authors identified a positive and statistically significant impact of social security wealth on consumption, which by definition implies a negative impact on savings rates. Aggregate time series evidence suggests that a large part of the decline in saving rates observed in the 1960s is connected to the rise of social security wealth. On the other hand, however, Cigno and Rosati (1992) identified a positive impact of social security on private savings in Italy over the the1960-1984 period.

Cigno and Rosati (1997) measured the impact of social security on private savings in Japan in the years 1965-1990. In their econometric models, they used various indicators of social security wealth. The authors identified the positive impact of pension coverage on savings and the negative impact of pension benefits on savings. The social security deficit has a negative impact on private savings.

Aydede (2007) investigated the impact of social security wealth on private wealth in Turkey between 1970 and 2003. Turkey is an interesting case because it is a middle-income country, which has a very generous public pension system. The age of retirement is low. The author identified the negative and rather strong impact of social security wealth on private savings. This result shows that the displacement effects of social security are not limited to developed economies.

3.1.3. Cross-country evidence

Feldstein (1977, 1980) studied the impact of social security on private savings in a cross-country setting. The first study covered 15 countries (period: 1954-60), while the second one covered 12 countries (period 1969-1975). In both cases, Feldstein identified the negative impact of social security on the private sector savings rate.

Barro and MacDonald (1979) investigated the impact of social security on private savings in 16 industrialized countries over the 1951-60 period. In conclusion, the authors wrote, "[...] the cross country evidence does not provide empirical support for the hypothesis that social security depresses private savings and also does not permit an empirical refutation of the hypothesis". The substitution between social security wealth and private savings remains an open issue.

Kopits and Gotur (1980) studied the impact of social security wealth on private savings in 14 industrialized economies and 40 developing countries. The inclusion of developing countries in the sample is rare, even today. Data availability is the main constraint. According to estimation outcomes, social security influences household saving decisions, especially in developed economies. However, the induced retirement effect outweighs the substitution effect. In industrialized countries, social security has a positive impact on savings. The evidence on developing economies is not conclusive.

Modigliani and Sterling (1983) analyzed the substitution between social security wealth and private wealth in a sample of 23 OECD countries. Their research covered the 1960-1970 period. Authors separately analyze the impact of social security on savings and retirement decisions. According to their findings, the impact of social security wealth on private savings is sensitive to the specification of variables. It is also influenced by extreme observations in the sample. Empirical evidence clearly shows that public pension systems induces earlier retirement. The combination of weak substitution effects and strong retirement effects implies that for most countries, the impact of social security on savings is close to zero, possibly on the plus size.

Koskela and Virén (1983) measured the impact of social security on saving rates in sixteen OECD countries over the period 1960-77. They found that social security has no impact on the household saving ratio. This result is robust to changes in the definition of social security variables, the weighting of countries, and the choice of explanatory variables. Authors attribute the discrepancy between their results and results obtained by Feldstein (1977, 1980) to the construction of dependent variables, different periods of analysis, and choice of countries. Cigno and Rosati (1996) investigated the impact of social security wealth on jointly determined saving and fertility behavior in Germany, Italy, the UK, and the USA. According to their findings, social security coverage decreases fertility and thus increases the saving rate.

## 3.2. Microeconometric evidence

Time series provide evidence on the aggregate impact of social security wealth on private savings. However, displacement effects may be heterogeneous and vary among households. In the research on the micro-level, it is possible to use direct measures of household wealth and savings and to control for various household characteristics. Therefore microeconomic data offers a promising testing ground for empirical analysis of the displacement effects of social security.

Authors investigating the substitution between social security wealth and private wealth based on microeconomic data mostly use survey data. Two types of empirical strategies are most common. Many authors use pension policy reforms, which generate an exogenous shift in the value of social security wealth, and compare the impact on the treated with the control group. In this case, the saving rate is usually the variable of interest. Policy reforms allow for precise identification of the impact of social security wealth on the saving rate in the given period. However, on the other hand, in many cases, it is not clear what are long-term consequences of a decrease in the saving rate over the considered period for the long-term private wealth accumulation.

Reforms of the public pension system, which may be used as natural experiments are rare. Therefore many authors develop econometrics models measuring the impact of social security wealth on private wealth at a given moment. In such a model, some concept of private wealth is the dependent variable, and social security wealth is one of the independent variables. Because the sample usually includes people, who are already retired or in pre-retirement age we may interpret results as the measure of long-term substitution. Nevertheless, the lack of exogenous variation in the value of public pension wealth makes identification less precise, because individuals with a higher taste for saving may self-select in the public pension system. The degree of possible self-selection depends on the design of a public pension system in a considered country.

3.2.1. Studies based on pension system reforms

Introduction of the public pension system:

Andersson and Errikson(2014) investigated the impact of the introduction of public pension insurance on the demand for life insurance in Sweden. They also measured the impact on consumption and savings. In 1913 Sweden introduced universal and compulsory public pension insurance. Before the creation of the public pension system, many Swedish households acquired life insurance. Approximately 66% of households were covered by private life insurance when public pension insurance has been introduced. To identify the effects of the introduction of public pension insurance authors used survey data and financial data of life insurance companies. They estimate the Tobit model and identify the statistically significant negative impact of the introduction of public pension insurance on the demand for life insurance. However, the impact of the creation of public pension insurance on savings and consumption is not statistically significant. Probably displacement effects of the introduction of public pension systems were limited to retirement savings, not all household wealth.

Lehmann-Hasemeyer and Streb (2018) studied the impact of the introduction of Bismarck's social insurance on private savings. Before the introduction of the public pension system in Germany workers saved mainly in savings banks (Sparkassen). Executives of saving banks were afraid that state social insurance systems (composed not only of old-age insurance but also including health insurance, accident insurance, and unemployment insurance) will reduce private savings (Ashauer, 1998). Similarly, some members of the German Reichstag feared that public pension insurance would crowd-out private savings (Lehmann-Hasemeyer and Streb, 2017). To measure the impact of social security wealth on private savings authors calculated the share of people impacted by pension reform (industrial workers, white-collar workers below earnings threshold) in each of Prussian countries (N=398) and saving banks' deposit per capita in each county. The control group is composed of people, who were covered by public pension insurance before (public servants, miners) and those, who had not received pension coverage after Bismarck's reform (farmers). Authors found statistically significant, but rather small (15% of yearly income) displacement effects of social security. In counties with a higher share of newly insured private savings declined. However, the decline in private savings was so small, that it's clear that workers would not have enough private savings to cover old-age insurance on their own. On the other, hand, however, Scheubel (2013) finds that the introduction of social security in Germany reduced fertility because it reduced the importance of family for securing consumption in old age. From an economic point of view, we may say that public old-age insurance partially reduced the demand for private insurance.

Reforms of the public pension system:

Attanasio and Brugiavini (2003) studied the impact of social security on household savings in Italy using exogenous variation in pension wealth induced by the 1992 reform of the Italian pension system. The reform reduced the social security wealth of Italian households, but the reduction was not uniform for different households. They used data from an Italian household wealth survey conducted by the Bank of Italy (Survey on Household Income and Wealth). According to full sample results, social security wealth has a negative and statistically

significant impact on private savings. Additional lira of pension wealth displaces at most 0.4 lira of private savings. The strength of the substitution varies among cohorts. The degree of substitution is highest in the 40-50 years cohort and smallest among older households (age>50).

Attanasio and Rohwedder (2003) investigated the impact of pension wealth on household savings in the UK. They used 3 major reforms of the UK pension system as natural experiments. The authors used economic theory to the model reaction of each household. British Family Expenditure Survey is the data source, authors used observations from 1974 until 1987 (people born between 1906 and 1968). The authors did not find a statistically significant substitution between Basic State Pensions entitlements (basic public pension scheme) and private savings. However, entitlements in the State Earnings Related Pension Scheme (SERP) crowds-out pension savings among older households. The degree of substitution is high (65% for 43-54 years old, 75% for 54-64 years old) and the impact is statistically significant. Nevertheless, the impact of pension wealth in SERP on private savings is not statistically significant among younger consumers.

Interestingly authors (Attansio and Brugiavini, 2003; Attanasio and Rohwedder, 2003) do not discuss the inconsistency of their findings regarding the impact of social security wealth on the savings of different cohorts. In Italy, the crowd-out among the oldest (pre-retirement age) is the smallest, while in the UK it is the biggest among the oldest. However, this inconsistency may reflect cross-country variation in the impact of social security wealth on private savings. The decision about consumption and savings are influenced by many socioeconomic and behavioral factors, which may differ across countries.

Botazzi et al. (2005) measured the impact of social security wealth on private wealth in Italy using the exogenous variation in pension wealth implied by a decade of pension reforms. Reforms reduced replacement rates and increased retirement age, but their impact differed among cohorts and occupational groups. The authors found a statistically significant substitution between social security wealth and private wealth in order of 30% in the total sample (60% in the case of IV estimation). The offset is higher for the elderly, who are better informed on their pension rights. In general, households only partially revised their expectations about future replacement rates. They acknowledged the decrease in the replacement rate caused by reforms but underestimated it. Research by Botazzi et al. (2006) shows that the effects of social security wealth (especially in the case of pension reforms) on private wealth accumulation depend on the knowledge of the insured on the public pension system. Because the offset is only partial and smallest in the case of younger, uninformed individuals there is a substantial risk that many people are not saving enough for their retirement. There are other contributions, which prove that knowledge of households on the pension system is limited (e.g. Smith and Couch, 2014; Leibman and Luttner, 2015; Czapiński and Góra, 2016).

Cerda (2008) studied the substitution between social security wealth and net assets in Chile. According to his results, the impact of social security wealth on net assets is not statistically significant. If we focus only on individuals with primary education impact becomes statistically significant, but the displacement effect is small (10%). In this case, social security wealth decreases private wealth through real estate value. This result is not surprising, because real estate has a lion's share in net assets in Chile and many other economies.

Aguila (2011) investigated the effects of the introduction of personal retirement accounts (PRA) on saving in Mexico. In 1997 Mexican old-age social security scheme for private workers changed its pay-as-you-go (PAYG) system to the PRA model. Social security reform increased the retirement wealth of low-income workers. The author found a statistically significant increase in consumption and a decrease in savings among people treated by the reform. The implied degree of substitutability would range between 55 and 60 percent.

Feng et al. (2011) studied the impact of social security wealth on private savings in China using exogenous variation in public pension wealth induced by policy reform. The authors expressed pension wealth in relation to annual income. They identified the negative and statistically significant impact of public pension wealth on saving

rates. The coefficient of pension wealth relative to income based on OLS regressions is between -0.12 and – 0.25 depending on the scenario considered. As discussed by Gale (1998) OLS coefficients may be biased downwards. Interestingly, in this case, IV (-0.08 to -0.15) estimates are similar and rather lower than OLS estimates. Zhao et al. (2016) compared the consumption behavior of individuals enrolled in public pension programs and the rest of the population in China. Although they do not estimate the displacement effects of public pension wealth, they find that individuals covered by public pension schemes tend to consume more out of the same income than those, who are not covered by public pension schemes. These results also suggest that social security may reduce savings in China.

Lachowska & Myck (2018) investigated the impact of public pension wealth on private savings in Poland. They used cohort-by-time variation in public pension wealth induced by the 1999 reform of the pension system in Poland, which decreased the value of public pension wealth of affected households (see Chłoń et al., 1999; Chłoń-Domińczak, 2002). They identified effects using difference-in-difference regressions and instrumental variable estimator. The authors adjusted the pension wealth variable using Gale's Q (Gale, 1998). According to estimates preferred by authors, one zloty of public pension wealth displace nearly 0.3 zloty of private savings. If Gale's adjustment is not applied the size of the effects halves. Among households with heads, who obtained higher education the substitution is nearly perfect. Results are robust to sensitivity checks. The big sample size is an important strength of the paper. Despite the usage of survey data (Polish Household Budget Survey), the sample size is bigger than 37,000 observations. It is the biggest sample among all papers discussed in this review.

Slavov et al. (2018) measured the impact of social security wealth on private wealth accumulation in the USA. Authors use several reforms of the pension system in the 1970s and 1980s as natural experiments. They found little evidence that social security wealth has a negative impact on private savings. Coefficients of interest have expected signs, but because of high standard errors, they are not statistically significant different from zero. The authors discuss possible reasons for lack of the substitution and give the highest weight to the lack of knowledge on the exact rules of social security.

Etgeton (2019) investigated the impact of reforms of the public pension system in Germany on savings. He used a German Income and Consumption Survey. The large sample is an important strength of his research. According to his results rise in the early retirement age lowered saving rates. The effect is heterogeneous along with levels of education and wealth.

### 3.2.2. Other studies

United States:

Feldstein and Pellechio (1979) investigated the impact of social security wealth on net worth in the USA. They used data from FED's Survey of Financial Characteristics of Consumer conducted in 1962. They found that the degree of the substitution varies between 70-96% depending on the specification. In one of the specifications the substitution equals 167%, but it is a clear outlier. The impact of social security wealth on net worth is statistically different from 0 but is not statistically different from 1. The most important limitation of this piece of research is the data source. The sample includes only 126 married couples and 12 single households. Feldstein and Pellechio acknowledged this limitation themselves. Authors claim that "no single econometric study can ever be conclusive" and results should be interpreted in the context of existing literature. In their view obtained results support the validity of the life cycle approach. Kotlikoff (1979) also studied the impact of social security wealth on net worth in the USA using survey data. He found mixed evidence on the substitution. On the one hand, he found statistically significant and strong substitution (66%) in the 45-59 years old sample. On the other hand, however, he noticed a positive impact of social security on private wealth among the elderly. Therefore he found no evidence that social security reduces aggregate savings.

Novos (1989) analyzed the sensitivity of results obtained by Feldstein and Pellechio (1979). He discovered that

after the removal of farm operators from the sample the impact of the social security wealth on net worth is no longer statistically significant. Moreover, the value of social security wealth calculated by Feldstein and Pellachio (1979) is very sensitive to the choice of year, from which income data are used. The value of social security wealth changes significantly between 1962 and 1963. Novos concluded that the results of Feldstein and Pellachio shall be viewed skeptically.

Gullason et al. (1993) measured the impact of social security wealth on net worth in the USA. They used the 1983 Survey of Consumer Finances (SCF) and include in the sample only married households with male heads between the ages of 55 and 64. Similarly to Feldstein and Pellechio, the authors remove low-income and high-income households from the sample. According to their results, the impact of social security wealth on net worth is not statistically significant. They also investigated the impact of social security wealth on private wealth and find statistically significant displacement effects, which confirms Munell's (1974) conclusion that social security only displaces retirement savings, not whole private wealth. Similarly, as in the case of Feldstein and Pellachio (1979), the most important limitation of the research is a very small sample (154 observations). Gustman and Steinmeier (1999) also found no statistically significant substitution between social security wealth and private wealth in the USA using Health and Retirement survey data. Avery et al. (1986) too used 1938 SCF data and identified a high degree of substitution 66%) between social security wealth and non-pension wealth using a broad measure of non-pension wealth. However, using a narrow concept of non-pension wealth they identify only a small offset (11%).

Gale (1998) investigated the impact of social security on non-pension wealth in the USA using data from the 1983 SCF. He qualified households to the sample if their head is aged between 40 and 64 and works full time. He removed self-employed households from the sample. Although his sample (N=638) is bigger than in the papers discussed above it is still small if assessed based on modern standards. Firstly he demonstrates that measures of pension wealth used before ignored varying planning horizons of households in the sample, which biases measures of the substitution downwards. Moreover, if the researcher compares two households with the same earnings, but with different social security wealth, the parameter $\beta$ will measure both the substitution effect of the difference in pension wealth and the income effect of the differences in total lifetime income. Controlling for current earnings instead of total lifetime compensation may seriously underestimate substitution effects. The bias varies across the life cycle. Measurement error in pension wealth may also bias the estimate of $\beta$ towards zero.

Gale proposed how to adjust measures of pension wealth to control for this bias (so-called Gale's Q). The rate of substitution calculated using adjusted measures of pension wealth is higher than 50%. The substitution between social security wealth and private wealth is statistically significant and higher than calculated using unadjusted measures of pension wealth. The impact of social security wealth on financial assets is not statistically significant.

Engelhardt and Kumar (2011) matched data from Health and Retirement Survey and employer-provided pension Summary Plan Description to measure the displacement effects of pension wealth on non-pension wealth. Matching official descriptions of pension plans to HRS respondents significantly increases the quality of pension wealth measurement. Unfortunately, the authors did not separately measure the impact of social security wealth and private pension entitlements. They argue that employer-provided pension insurance is sometimes integrated with Social Security benefits and therefore the impact of both components of pension savings should be investigated together. The authors found statistically significant and rather strong crowd-out. According to IV results, each dollar of pension wealth is associated with 53-67 cents less in non-pension wealth. In comparison, OLS estimates are biased downwards and indicate a crowd-out of only 23 cents. Half of the difference between IV estimates and OLS estimates may be attributed to measurement error, another half to nonlinearities and unmeasured heterogeneity. Using an instrumental variable quantile regression estimator (see Chernozhukov and Hansen, 2005) Engelhardt and Kumar (2011) identified the strong variation of the displacement effects along the wealth distribution. Below the median, the impact of pension wealth on non-pension wealth is positive and not statistically significant. In the

top quintile of the wealth distribution displacement effects are higher than 50%. Unfortunately, confidence intervals are very wide and this estimate is also not statistically significant. Even at 95h percentile, where each dollar of pension wealth displaces 75 cents of non-pension wealth the confidence interval is very large (0, -1,5). Nevertheless, results of instrumental variable quantile regression suggest that displacement effects are concentrated at the top of the wealth distribution.

Other countries:

Dicks-Mireaux and King (1984) measured the impact of pension wealth on private savings in Canada using survey data. Their research covers both public and private pension schemes. The authors discussed how prior beliefs of different types impact estimates of crowd-out. Their sample includes over 8 000 households, which is a very high number in comparison with other contributions of that time. According to their estimates, the degree of substitution between social security wealth and private wealth varies between 10% and 27%. Displacement effects of private pension entitlements are significantly higher (27% - 51%). Sensitivity analysis (including different interest rates) proves the robustness of crowd-out estimates. Results obtained by authors contradict the results of Boyle and Murray (1979) and Denny and Rea (1979), who did not find a statistically significant impact of public pension wealth on saving based on time series evidence.

Jappelli (1995) investigated the substitution between public pension wealth and private wealth in Italy. He used the Italian Survey of Household Income and Wealth for the years 1989 and 1991. His sample includes over 6 000 households. According to OLS estimates the degree of substitution between social security wealth equaled 16% in 1989 and 11% in 1991. Estimates based on IV are slightly higher (ca. 20% in both years). Estimated displacement effects are statistically significant and rather robust to the specification. Baseline estimates of Jappelli are based on r=3%. He also provides additional estimates for r=4%/7%/10%. In case r=10% some estimates of crowd-out are not statistically significant. Such interest rate is however clearly too high to be used in the calculation of social security wealth in advanced economies.

Alessie et al. (1997) analyzed the impact of mandatory pension savings on personal savings in the Netherlands. He used a high-quality panel dataset (Dutch Socio-Economic Panel, waves 1987-1991), which allows for including household-level fixed effects to control different tastes for savings of individuals. The authors separately measured the impact of social security wealth (basic pension system) and pension wealth ( supplementary pension schemes). They found that the impact of social security wealth on net worth is not statistically significant. However, there exists a statistically significant substitution (ca. 30%) between pension wealth and net worth. However, if fixed effects are introduced to the equation the impact of social security wealth turns out to be statistically significant and very strong (displacement effect of more than 200%), while the impact of pension wealth is not statistically significant. A large sample (N = 7495) is an important strength of the paper. The authors also thoroughly discuss possible econometric biases and fairly assess their research from this perspective. Results of Alessie et al. (1997) confirm previous evidence on statistically significant substitution between social security wealth and saving in the Netherlands based on time series (Zant, 1988). Kapteyan et al. (2005) also studied the substitution between social security wealth and private wealth in the Netherlands using Socio-Economic Panel. They found a limited, but statistically significant substitution. The displacement effect varies between 9-11% in the case of private wealth. In the case of financial wealth it is smaller (ca. 2%), but still statistically significant. According to the authors, relatively low substitution may be the result of the impact of social security on retirement age. Social security may induce individuals to retire earlier and thence increases the need to save, which weakens the negative impact of social security wealth on private wealth.

Euwals (2000) investigated the impact of mandatory pension wealth on private wealth in the Netherlands. He used CentER Savings Survey, which contains more detailed information on household wealth and pension rights than Socio-Economic Panel. He did not identify the statistically significant impact of social security wealth or

pension wealth (supplementary pension schemes) on household wealth. However, he found that pension rights have an impact on declared savings motive. The higher value of pension rights lowers the probability that respondents declare that saving for old-age is important. The main limitation of the Euwals' research is the small sample size (less than 400 respondents in each of the two samples). Moreover, he ignored the pension rights of women because of missing information.

Kim and Klump (2010) studied the impact of public pension wealth on private wealth in Germany. They used data from the 1984-1999 waves of the German Socio-economic Panel and qualified the sample households, whose head in 1988 was aged between 40 and 59. They removed from the sample households, who had obtained income from the public pension system before 1990. The authors applied Gale's correction. They found a small (maximally 20%), but statistically significant substitution between public pension wealth and private wealth. This confirms earlier results of Kim (1992). However, according to Cigno and Rosati (1996), the impact of social security wealth on private savings in Germany is not statistically significant. Cingo et al. (2003) identified the positive impact of social security on private savings in Germany. As we see in the case of Germany results of microeconometric investigation evidence on the impact of social security on private savings are not consistent with macroeconomic evidence on the same issue. However, because substitution effects identified by Kim and Klump (2010) are rather weak, the gap is not as big as it may be.

Hurd et al. (2012) investigated the impact of public pensions on the accumulation of financial assets in OECD countries. To achieve this aim they aggregated data from aging surveys in 12 countries (HRS, ELSA, SHARE). The authors used replacement rates in the public pension system calculated for different types of workers to measure social security wealth and construct measures of median financial wealth comparable across countries. To estimate pre-retirement lifetime income they used evidence from panel surveys (PSID for the USA, ECHP for European countries). They found statistically significant displacement effects. An additional dollar of pension wealth displaces approx.. 22 cents of private savings. Authors control for the education-related differential in mortality, which is rather rare in the literature. Despite the fact that the research of Hurd et al. (2012) is not strictly based on actual data on individuals (it is based on 64 model individuals) it's still worth mentioning here.

Alessie et al. (2013) investigated the substitution between social security wealth and private wealth in Europe. They used data from SHARELIFE. The sample includes 3590 households from 13 EU countries. The authors found a statistically significant impact of social security wealth on non-pension wealth. In the full sample degree of substitution varies between 47% (robust regression and 61% (median regression). In the case of households, who already receive pension benefits (retired sample) the degree of the substitution is much smaller (robust regression: 20%, median regression 30%) and is statistically significant only if estimated using robust regressions. The degree of substitution is higher for high-educated than for low-educated households. It is higher in the case of financial wealth than in the case of net worth.

Alessie et al. (2013) studied substitution in a cross-country setting. Because the sample is too small to measure displacement effects in each country authors measure displacement effects in four countries groups. The displacement effect is highest in the North (91%) and lowest in the South (11%). In the South (Spain, Italy, Greece) and East (Poland and the Czech Republic) impact of social security wealth on net worth is not statistically significant. The displacement effects are higher in the case of financial wealth, but in the East, they are still not statistically significant.

Chetty et al. (2014) studied the effects of different pension policies on private savings in Denmark. The authors used an administrative dataset, which includes 41 million observations on saving for the population of Denmark. They found that governmental subsidies for private pension saving result in a nearly perfect offset of private savings. Each dollar of pension subsidies raises total savings only by about one cent. On the other hand, however, policies, which raise pension contributions without individual action are highly effective. Approximately 15% of the

population are "active savers", who react to public policy by switching the composition of their assets. Active savers usually already save for retirement, therefore subsidies are not effective in increasing savings among those, who are not prepared for retirement. 85% of the society are "passive savers", who are unresponsive to subsidies by are highly influenced by automatic contributions. Therefore automatic contributions are an effective tool for raising pension savings. They have lower fiscal costs are generated relatively small crowd-out in comparison with subsidies. Research-based on US data also confirms the effectiveness of automatic contributions (Madrian and Shea 2001; Card and Ransom 2011) and the limited effects of subsidies (Duflo et al. 2006; Engelhardt and Kumar 2007). Recent behavioral research also supports the use of "nudges", such as automatic employer contributions to pension accounts (Thaler and Sunstein 2008; Madrian 2012).

Blanchet et al (2016) analyzed the substitution between social security wealth and private wealth in France using a large-scale survey focused on household wealth (L'enquête Patrimoine). The authors calculated the value of social security wealth using three different interest rates (r) and apply Gale's adjustment. If r=2% substitution between social security wealth and private wealth equals 35% (based on OLS estimates). In the case of IV estimates the impact of social security wealth on private wealth is not statistically significant. If r=3% the degree of substitution raises to 73% if r=4% the degree of the substitution is higher than 100% (130%). If r=3% or r=4% both OLS and IV estimates are highly statistically significant. For r=3% he presents additional estimates of the impact on social security wealth on different components of private wealth. The displacement effect is statistically significant in the case of both real assets and financial assets.

Fessler and Schürz (2018) investigated the determinants of household wealth in 13 European countries. They used novel microdata from the Eurosystem Household Finance and Consumption Survey (HFCN, 2020). Therefore their dataset is harmonized, despite covering many countries. Among the considered factors, the authors include the share of pension expenditure in the GDP. They found a negative and statistically significant impact of social security on net wealth. This impact is strongest in the bottom of the distribution and smaller for wealthier households. The results of Fessler and Schürz (2018) provide evidence of the substitution between public pension wealth and private wealth.

Lefebrve and Perelman (2020) estimated the impact of public pension wealth on private wealth non-pension wealth in Belgium. They used data from SHARE, therefore their sample contains people between 50 and 85 years of age. The authors applied Gale's adjustment. According to their estimates, the degree of substitution varies (depending on the specification) between 14 and 25%. The impact of public pension wealth on private wealth is statistically significant. The impact is statistically significant in the case of non-financial wealth, but it is not statistically significant in the case of financial wealth. The displacement effects are not statistically significant in the case of women, less-educated, and singles. The authors present results based on OLS, robust regressions, and median regressions. Results based on different methods are quite similar.

Wroński (2023b) investigated the impact of social security wealth on private wealth accumulation in Poland. Based on the data from the Household Finance and Consumption Survey, he found mixed and at best weak evidence for the substitution between private and social security wealth. In the majority of specifications and subpopulations, the effects of social security wealth on private wealth/consumption/saving rate are not statistically significant.

## 4. Discussion of the literature.

In Table 1 we summarize the review of the literature presented above. We include 68 studies conducted in 19 countries and on the cross-national level. For each study, we present the type of evidence (model/time series/microeconometric/regional), information on statistical significance, the direction of the impact of social security wealth, and the strength of the impact. We classify the impact as weak if the implied degree of the substitution is lower than 20%, as a medium if it is between 20 and 50%, and as strong if it is higher than 50%. In

many cases (especially time series studies) interpretation of the impact in terms of the implied degree of the substitution is not easy. In such a case we based on estimates provided by authors and to some extent also their assessment of the identified impact.

**Table 1.** The impact of the social security on private savings – empirical evidence.

| Country | Author | Type of evidence | Statistical significance | Impact direction | Impact size |
|---|---|---|---|---|---|
| Cross-country | Feldstein (1977, 1980) | time series | yes | negative | strong |
| | Barro and MacDonald (1979 | time series | mixed | mixed | mixed |
| | Koptis and Gotur (1980) | time series | mixed | mixed | mixed |
| | Modigliani and Sterling (1983) | time series | mixed | may be positive | small |
| | Koskela and Virén (1983) | time series | no | not significant | not significant |
| | Cigno, A. and Rosati, F.C. (1996) | time series | yes | positive | mixed |
| | Hurd et al. (2012) | microeconometric | yes | negative | weak/medium |
| | Alessie et al. (2013) | microeconometric | yes | negative | medium/strong |
| | Fessler and Schürz (2018) | microeconometric | yes | negative | weak |
| Austria | Holzmann (1981) | time series | no | not significant | not significant |
| Belgium | Perelman and Pestiau (1984) | time series | yes | negative | Strong |
| | Lefebrve and Perelman (2020) | microeconometric | yes | negative | weak/middle |
| Canada | Boyle and Murray (1979) | time series | no | not significant | not significant |
| | Denny and Rea (1979) | time series | no | not significant | not significant |
| | Dicks-Mireaux and King (1984 | microeconometric | yes | negative | weak/medium |
| Chile | Cerda (2008) | microeconometric, policy reform | no | not significant | not significant |
| China | Feng et al. (2011) | microeconometric, policy reform | yes | negative | weak |
| France | Blanchet et al. (2016) | microeconometric | yes | negative | medium |
| Germany | Kim (1992) | time series | yes | negative | strong |
| | Cigno et al. (2002) | time series | yes | positive | strong |
| | Kim and Klump (2010) | microeconometric | yes | negative | weak |
| | Lehmann-Hasemeyer and Streb (2017) | regional (counties) | yes | negative | weak |
| | Etgeton (2019) | microeconometric, policy reform | yes | negative | medium |
| Iran | Honarvar et al. (2017) | theoretical model | n/a | negative, | strong |
| Italy | Cigno and Rosati (1992) | time series | yes | positive | strong |
| | Rosi and Visco (1995) | time series | yes | negative | strong |
| | Jappelli (1995) | microeconometric | yes | negative | weak |
| | Attanasio and Brugiavini (2003 | microeconometric, policy reform | yes | negative | medium |
| | Botazzi et al. (2005 | microeconometric, policy reform | yes | negative | medium/strong |
| Japan | Cigno and Rosati (1997) | time series | yes | positive | medium/strong |
| Mexico | Aguila (2011) | microeconometric, policy reform | yes | negative | strong |
| Netherlands | Zant (1988) | time series | yes | negative | strong |
| | Alessie et al. (1997) | microeconometric | yes | negative | weak/strong |
| | Euwals (2000) | microeconometric | no | not significant | not significant |
| | Kapteyan et al. (2005 | microeconometric | yes | negative | weak |
| Norway | Magnussen (1994b) | time series | no | not significant | not significant |
| New | Law (2019) | theoretical model | n/a | negative | strong |

| | | | | | |
|---|---|---|---|---|---|
| Zealand | | | | | |
| Poland | Lachowska and Myck (2018) | microeconometric, policy reform | yes | negative | medium |
| | Rutkowski (2019) | theoretical model | n/a | negative | weak |
| | Wroński (2023b) | microeconometric | yes/no | mixed | not significant/weak |
| Sweden | Markowski and Palmer (1979) | time series | yes | negative | strong |
| | Benztel and Berg (1983 | time series | no | not significant | not significant |
| | Andersson and Errikson(2014) | microeconometric | no | not significant | not significant |
| Turkey | Aydede (2007) | time series | yes | negative | strong |
| UK | Browing (1982) | tme-series | yes | negative | small |
| | Johnson (1984) | time series | yes | positive | weak/medium |
| | Blake (2004) | tme-series | yes | negative | strong |
| | Attanasio and Rohwedder (2003) | microeconometric, policy reform | yes | negative | strong |
| USA | Munell (1974) | tme-series | no | not significant | not significant |
| | Feldstein (1976) | time series | yes | negative | strong |
| | Barro (1978) | tme-series | no | not significant | not significant |
| | Darby (1979) | time series | no | not significant | not significant |
| | Feldstein and Pellechio (1979) | microeconometric | yes | negative | strong |
| | Leimer and Lesnoy (1982) | time series | no | not significant | not significant |
| | Lee and Chao (1986) | time series | no | not significant | not significant |
| | Avery et al. (1986) | microeconometric | yes | negative | weak/strong |
| | Novos (1989) | microeconometric | no | not significant | not significant |
| | Gullason et al. (1993) | microeconometric | no | not significant | not significant |
| | Gustman and Steinmeier (1999) | microeconometric | no | not significant | not significant |
| | Feldstein (1996) | time series | yes | negative | strong |
| | Gale (1998) | microeconometric | yes | negative | strong |
| | Meguire (1998) | time series | mixed | mixed | mixed |
| | Coates and Humprey (1999) | time series | mixed | mixed | mixed |
| | Pfau (2005) | time series | Yes | negative | strong |
| | Engelhardt and Kumar (2011) | microeconometric | yes | negative | strong |
| | Blau (2016) | theoretical model | n/a | negative | strong |
| | Wassel (2018) | time series | mixed | mixed | mixed |
| | Slavov (2018) | microeconometric, policy reform | no | not significant | not significant |

*Soruce: own based on the literature indicated in the table.*

Among 68 studies included in the table, there are four studies based on theoretical models, 35 studies based on time series regressions, and 29 studies based on microeconometric evidence. One study is based on the regional variation in pension coverage and saving rates. The level of statistical significance is given for 64 entities. The statistically significant impact of social security on private savings has been identified in 39 studies (57% of the literature). In 18 cases (28%) the impact is not statistically significant. In the remaining cases, the evidence of the statistical significance of the impact is mixed. In some specifications, the impact is statistically significant, but in others, it is not.

In 33 of 39 positions of the literature presenting statistically significant outcomes the impact of social security on private savings is negative. This means that nearly 85% of studies with statistically significant results identify the negative impact of social security on private savings. On the other hand, however, only 38 (57%) of all studies imply the statistically negative and statistically significant impact of social security on private savings. There is a notable difference between outcomes based on time series and microeconometric evidence. Only 36% of the former

studies identify the negative and statistically significant impact of social security, while 75% of the latter studies find it. Despite theoretical ambiguity regarding the direction of the impact all four studies based on the theoretical model find a negative impact, but the size of the impact varies from weak to strong.

The classification of the impact size is not always straightforward, but it allows for a more in-depth comparison of research outcomes. This comparison is of course of limited scope because researchers use different data sources and make different decisions on sample selection and econometric specification. Nevertheless, it is still possible. 24 studies (36% of all contributions) identify a strong impact, 7 (10%) find a medium impact, and 10 studies identify a weak impact. In 6 cases there is mixed evidence on the strength of the impact. As mentioned above 18 studies find statistically insignificant outcomes. Literature-based on time series evidence more often identify strong displacement effects than literature based on macroeconomic evidence.

Most of the authors, who identify the statistically significant impact of social security on private wealth identify a weak or strong impact. A low number of studies, which identify displacement effects of medium size may raise the question about the existence of publication bias. Publication of results, which confirms basic predictions of the life-cycle theory (high displacement) or contradicts basic theoretical predictions (lack of offset) may be easier than the publication of mixed results, which do not tell a simple and coherent story about the investigated issue.

Only 9 papers investigate the issue in a cross-country setting. Moreover, many of them are old. This is an important limitation of the literature. Cross-national studies allow for a good comparison of the impact of social security in different countries. Therefore they are particularly valuable. In 11 of 19 countries, there is only one piece of literature available on the issue. The impact of social security wealth on private savings has acquired the highest attention of researchers in the USA (20 studies discussed in the review). In Germany, Italy, the Netherlands, and the United Kingdom the availability of research is also particularly high (more than 3 studies). In many countries, different authors find different outcomes, even if their research covers a similar period. The availability of the literature on the economies outside the industrial core is very limited. In general, the literature is limited to OECD economies. Therefore research on middle-income and developing economies should be particularly encouraged.

There are many sources of differences in research outcomes. The authors study displacement effects in different countries and over different time-period. Decisions on econometric specification and sample selection vary. The assumption used in the calculation of social security wealth variables may have a strong impact on research outcomes. Different data sources may tell a different story on the issue. Therefore cross-country research projects based on common research methodology and at best common/similar data sources would be particularly profitable for the research community. It shall be also noted that researchers who have written many papers on the issue tend to achieve similar results in each of them. It may indicate that some researchers feel obligated to defend their earlier outcomes. Although it is a natural human behavior, it may be dangerous for scientific progress.

In his seminal paper, Gale (1998) discussed the main limitations of the literature on the impact of social security on savings. Recent papers fare better in comparison with his critique than older ones. Nevertheless, some of his points remain valid event today. In almost all papers, the calculation of social security wealth is based on the assumption of uniform mortality. Because of the longer life expectancy of the well-off, this leads to an overestimation of the social security wealth of the worse-off and an underestimation of the social security wealth of the better-off. This may lead to significant bias in the results. In recent contributions on the inequality of the social security/augmented wealth distribution (Oliviera, 2019; Wroński, 2023c) this problem has been (at least partially) addressed. Therefore in the near future, it may be also addressed in the literature on displacement effects of social security. Moreover, in many cases, authors calculate social security wealth based on a static life table. Because life expectancy increases in the time usage of static life tables bias social security wealth downwards. This problem has been addressed in some recent contributions on augmented wealth inequality (Oliviera, 2019; Wroński, 2021).

Many of the papers discussed above are based on relatively small samples. This raises obvious questions about the stability of achieved results, particularly in the case of subgroups. Although some authors censor top and bottom observations, the impact of outliers and censoring decisions on results is rarely discussed. Despite the administrative data revolution currently taking place in economics nearly none of the papers (Chetty et al., 2014 is a noticeable exception) is based on administrative evidence. Recent research in Estonia (Meriküll et al., 2021) and Nordic countries (e.g. Chetty et al., 2014) proves that it is possible to construct household wealth portfolios based on administrative data. Because social security programs are administrated by state entities it shall be possible to merge those data and evaluate the impact of social security on savings based on administrative evidence.

The displacement effects of social security are heterogeneous. Today we know relatively a lot about the heterogeneity across cohorts and education levels. Many authors of recent papers analyze those dimensions. However, our knowledge of heterogeneity along other dimensions such as gender, immigration background, and race is limited. Moreover, behavioral characteristics are rarely included in the models. Botazzi et al. (2005) show that displacement effects differ among informed and uninformed households. In our view, this division shall be more often implemented in the econometric specification.

The assumptions about discount rates have a large impact on the value of social security wealth. Researchers usually provide a robustness check and measure the impact of social security wealth on private savings using many interest rates. However, as far as we are aware, there are no contributions, which differentiate discount rates by household types/characteristics It's doubtful that all households discount the future according to the same rules.

The literature has also some methodological implications. Many papers do not provide casual evidence on the issues, because exogenous shocks to pension wealth are rare. Endogeneity remains an issue, because not only social security wealth influences private wealth accumulation, but also private wealth can influence social security wealth accumulation. Omitted variable bias may be a problem, because some psychological characteristics, which are not measured in household surveys (patience, cognitive skills, financial knowledge) may influence the accumulation of both social security wealth, and private wealth.

## 5. Conclusions

Economic theory does not give a clear prediction about the direction of the impact of social security on private savings. It may vary from strongly negative to positive depending on the factors considered in theoretical research. Therefore empirical research on the impact of social security wealth on private savings has enormous importance, also because of the practical consequences of the results.

In this paper, we firstly presented theoretical insights on the impact of social security wealth on private wealth. Then we reviewed a large set of empirical outcomes and discussed the state of our knowledge on the displacement effects of social security. The comparison of research results is difficult because of methodological differences. The impact may also vary across countries and time. Nevertheless, it is still possible and valuable.

Nearly 70% of papers included in our review find a statistically significant impact of social security wealth on private savings. Papers based on microeconometric evidence more often find statistically significant results than papers based on time series evidence. In 85% of cases with statistically significant results, the authors identify the negative impact of social security on private savings. On the other hand, only 56% of all papers find a negative and statistically significant impact of public pension wealth on private savings. Some authors find mixed evidence on the impact. They admit that its size and statistical significance vary across econometric specifications. The impact of social security on private savings is positive and statistically significant in less than 10% of cases.

The strength of the impact varies from weak to strong. 36% of contributions find a strong (displacement effects higher than 50%) impact of social security wealth on private savings, 10% find a medium impact (displacement effects higher than 20% and lower than 50%), 15% find a weak impact (displacement effects lower than 20%). In

nearly 10% of contributions evidence on the strength of the impact is mixed. In remaining, 30% of contributions impact is not statistically significant. Literature based on aggregate, time series evidence more often finds high displacement effects than contributions based on microeconometric evidence. Authors rarely find evidence of medium impact, which may raise the question about the existence of publication bias.

The empirical literature on the substitution between social security wealth and private wealth is rich, but not consistent. If we order studies according to the strength of identified impact (from positive, through non-significant, to highly negative) median study would find small, but statistically significant displacement effects. In our view, this is a relatively good and general assessment of the impact of social security on private savings.

The literature discussed in this review has three most important limitations. Firstly its geographical scope is very narrow. Studies are constrained to developed economies, availability of research on economies outside the industrial core is low. A strong majority of authors measure the impact of social security only in a single country, which limits the comparability of results. Calculation of the value of public pension rights is usually based on static and uniform (differentiated only by gender) life tables. Therefore social security wealth of the well-off is underestimated, while the social security wealth of the worse-off is underestimated. Moreover, authors rarely consider an increase in longevity over retirement, which biases social security wealth downwards. Most of the research is based on survey data and small samples are a common problem. Intergenerational projects based on common assumptions and administrative data would be particularly valuable to the research community.

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## Conflict of Interest

The author claims that the manuscript is entirely original, and declares no conflicts of interest.

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