# TREATMENT EFFECTS OF RIESTER PARTICIPATION ALONG THE WEALTH DISTRIBUTION: AN INSTRUMENTAL QUANTILE REGRESSION ANALYSIS

Dorothee Ihle[†]

MAY 2017

THIS IS A PRELIMINARY VERSION. PLEASE DO NOT CITE.

## ABSTRACT

In numerous industrialized countries, the demographic change erodes the financial basis of traditional pay-as-you-go pension systems. To compensate for decreasing statutory pensions, many governments incentivize private saving by means of subsidized retirement plans. In this context, Germany has introduced the so-called Riester pension plans. To assess its effectiveness, this paper analyzes the effects of participation in Riester plans on wealth at different points of the distribution. We employ an instrumental quantile regression approach using Riester eligibility as instrument for Riester participation. The analysis is based on microeconomic survey data from the German Socio-Economic Panel of wave 2012. Results suggest substantial heterogeneity in the effect of Riester participation on wealth. While Riester participation increases total net wealth in the lower tail of the conditional distribution, it does not have a significant effect on households ranking in the middle part of the distribution. In the upper tail of the conditional asset distributions, we find negative treatment effects providing weak evidence in favor of a mere reallocation of the household's asset portfolio.

**KEYWORDS:** Saving incentives, Retirement, Wealth distribution, Instrumental quantile regression

**JEL CLASSIFICATION:** D31, D91, I38, J32

[†]Dorothee Ihle is a Research Fellow at the Center for Applied Research in Economics Muenster (CAWM), University of Muenster, Am Stadtgraben 9, 48143 Muenster. E-mail: ihle@insiwo.de.

# 1 Introduction

Demographic change is well-respected as one of the most important challenges for many industrialized countries. The ongoing rise in the share of elderly people in the populations due to declining fertility rates and simultaneously increasing life expectancies erodes the financial basis of traditional pay-as-you-go (PAYG) pension systems. Owing to concerns that individual savings for retirement are not sufficient to compensate for the reduction in public pillar replacement rates, many governments incentivize private saving by means of subsidized retirement plans. In this context, Germany has introduced the so-called Riester pension plans in 2002. Due to the great importance of savings for the personal economic security in old-age as well as for the national economic performance (Bernheim, 1999), policymakers worldwide are highly interested in evaluating the effectiveness of retirement plans and - if necessary - to learn how to improve their design for stimulating thrift.

From a theoretical point of view, the effect of saving subsidies on financial provision behavior is ambiguous. According to the standard life-cycle hypothesis going back to Modigliani and Brumberg (1954), the higher net return on retirement savings affects saving behavior of eligibles through three channels. First, through a rise in the price of today's consumption, so that consumption is shifted towards the future and savings increase (substitution effect). Second, through the rise in the value of current resources, so that actual as well as future consumption is assumed to increase, thereby reducing savings (income effect). Third, an increase in the subsidy reduces the price of retirement savings relative to non-retirement savings, leading to substitution of non-subsidized to subsidized accounts (crowding-out effect). The overall effect on savings depends on the magnitude of these effects which is determined by individual preferences and thus is unclear. However, theory makes clear predictions about the effects of Riester subsidies along the wealth distribution: The higher wealth holdings are, the higher the crowding-out effect, letting overall savings largely unchanged. In addition, theory predicts that high-wealth households are more responsive to saving subsidies than households with lower wealth holdings (Lang, 1998; Wilke, 2012; Chetty et al., 2014). Accordingly, based on the life-cycle hypothesis, we would expect large qualitative and quantitative heterogeneity in responses across individuals with different levels of wealth.

Previous empirical research largely concerns the US experience with employer-sponsored occupational defined contribution plans, the so-called 401(k)s, and private pension plans, in particular, Individual Retirement Accounts (IRAs). Early empirical evidence regarding the effectiveness of saving subsidies is highly controversial. While Engen et al. (1994), Engen et al. (1996b), Engen et al. (1996a), and Engen and Gale (1997) find substantial substitution between 401(k) and non-subsidized assets, Poterba et al. (1995), Poterba et al. (1996a), and Poterba et al. (1996b) find that the majority of 401(k) and IRA saving represent net new saving. The substantial variation in their results can largely be explained by differences in the empirical strategy and identifying assumptions. Apart from Pence (2002) and Abadie (2003) who also find positive effects, more recent studies employing more sophisticated empirical methods find that the effect of participation in subsidized retirement saving plans differs significantly across households. Results of Engen and Gale (2000) and Benjamin (2003) suggest that the effect of 401(k) participation varies by earnings level. For low-income households, 401(k) assets are more likely to represent additions to net wealth than for high-income households for which a displacement of assets from non-subsidized to subsidized retirement accounts is more likely. Chernozhukov and Hansen (2004) and Engel-

1

hardt and Kumar (2011) both analyze the effects of pension plans along the wealth distribution using an instrumental-variable quantile regression approach. Their results provide evidence that in the lower tail of the wealth distribution, they increase total net wealth, while at upper wealth quantiles, they are almost completely offset by reductions in other wealth components.

For the German Riester pension plans, empirical evidence is rather scarce. Coppola and Reil-Held (2009) and Pfarr and Schneider (2013), primarily focusing on analyzing the participation decision in Riester pension plans, find that the Riester scheme hardly generates any effect on savings. Corneo et al. (2008), Corneo et al. (2009), and Corneo et al. (2010) evaluate the Riester scheme as a natural experiment and compare pre- and post-reform propensities to save. Their estimation results suggest that the Riester scheme induces a reallocation of private assets from existing non-subsidized to subsidized saving contracts. They conclude that the main economic effects of the Riester scheme depend on the distribution of the subsidies that represent windfall gains for their beneficiaries. Corneo et al. (2015) examine distributional effects of the Riester scheme. They analyze the subsidy volume and Riester participation along the income distribution and investigate the effects of the Riester scheme on income inequality and poverty. Their findings suggest that the Riester scheme is almost distributionally neutral regarding income, but that it might have greater effects on the wealth distribution. To the best of our knowledge, there is no study that examines heterogeneity in the effects of participation in Riester plans along the wealth distribution.

Against this background, this paper examines the effects of participation in Riester pension plans on the household wealth distribution for Germany using microeconomic survey data from the German Socio-Economic Panel (GSOEP) of wave 2012. The GSOEP is a yearly repeated panel survey of around 12,000 private households and 30,000 individuals from the Federal Republic of Germany aged 17 years and older. It provides detailed information on a wide range of asset categories, socio-demographic as well as household characteristics. The GSOEP is especially suitable for analyses including wealth as wealth data are multiply imputed.

The key problem in determining the effect of participation in Riester plans on wealth is saver heterogeneity together with endogeneity of Riester participation. More precisely, selection into participation is partly based on heterogeneous unobserved saving preferences and thus is non-random. Households with higher unobserved preferences for saving are more likely to choose to participate in subsidized retirement saving plans than households with lower saving preferences, so that standard quantile regression estimates will be biased upwards. Therefore, we employ the instrumental variable conditional quantile regression approach developed by Abadie et al. (2002). Quantile treatment effect estimation is a powerful and intuitive tool that allows to discover treatment effects on the entire distribution. Following a number of previous studies (Poterba et al. (1996a), Benjamin (2003), Abadie (2003), Chernozhukov and Hansen (2004), and Corneo et al. (2010) among others), we use eligibility as instrument for program participation. Applying the same line of reasoning, we argue that eligibility can be taken as exogenous conditional on covariates as it is based on legal definitions and as it is unlikely that fundamental household decisions concerning employment, marital status or birth of children are driven by considerations associated with Riester participation.

To the best of our knowledge, this is the first study to investigate the effects of Riester participation along the entire wealth distribution. As theory predicts heterogeneous treatment effects, previous studies focusing solely on the mean do not reveal information about the effects on other

points of the wealth distribution. However, from a policy perspective, it might be of particular interest to know the exact effects on low-wealth households, a target group of the Riester scheme, as they are less likely to being able to build up adequate financial reserves for old-age. Given that occupational and private pension plans are much more important in the US than in Germany, evidence from the US can hardly be transferred.[1] To assess the amount of potential crowding-out and to detect wealth components which are associated with potential sources of substitution, we study the effect of Riester participation on various measures of wealth. We additionally contribute to the literature by evaluating the Riester scheme using more recent data and a relatively new method which has not been employed for estimating causal effects of Riester plans before.

Results suggest substantial heterogeneity in the effect of Riester participation on wealth. In the lower tail of the conditional distribution, we find that Riester participation increases total net wealth, among others due to positive spillover effects. This has important implications for public policy as low-wealth households are likely to be those who are least prepared for retirement. For households ranking in the middle part of the conditional wealth distribution, Riester participation does not have a significant impact on asset accumulation which is consistent with previous studies that investigated median effects only. In the upper tail of the conditional asset distributions, we find negative treatment effects which provide weak evidence in favor of a mere reallocation of the household's asset portfolio.

The remainder of the article is organized as follows. Sections 2 and 3 present the institutional and theoretical framework of the analysis. The empirical strategy including identifying assumptions and the data used are described in sections 4 and 5 respectively. In section 6, we provide the empirical results and check for their robustness. Section 7 summarizes, discusses the main results and derives policy implications as well as topics for further research.

## 2 Institutional Setting

**The retirement system in Germany.** Germany introduced the first formal national pension system worldwide (the so-called Bismarckian system) in the late 19th century, which has been traditionally dominated by a generous public pay-as-you-go (PAYG) scheme (Börsch-Supan et al., 2014). The ongoing demographic change in most industrialized countries poses major problems to classical PAYG pension schemes, as more and more retirees must be financed by a shrinking number of employees. To cope with this development, the German pension system has been profoundly reformed over the last two decades. Early reforms involved a rise in the statutory retirement age and a substantial reduction in public pillar replacement rates. Especially the cut in public pension payments created an increasing gap in old-age income relative to past benefit levels so that pre-retirement living standards are no longer protected (Börsch-Supan et al., 2012). In this context, the Riester reform has been launched in 2001 and became effective on January 1, 2002. The idea of the reform is to partially substitute PAYG financed pensions by funded pensions. Therefore, the Riester reform transformed the monolithic public PAYG pension scheme into a multi-pillar system and introduced occupational and private pensions. Both occupational and private pension plans are highly subsidized to incentivize people to privately build-up financial reserves and to compensate for the cuts in public pension benefits. The three-pillar system takes on the following form. The first pillar comprises the traditional government-organized statu-

---

[1]For detailed information on the German and the US pension systems, see (Bönke et al., 2017).

tory retirement insurance system based on PAYG (comparable to Social Security in the US). The second pillar comprises occupational pension plans where employers support employees to build up retirement reserves (comparable to 401(k) plans in the US). The third pillar comprises private pension plans, where individuals themselves are responsible to provide for old-age (comparable to Individual Retirement Accounts (IRAs) in the US) (Dolls et al., 2016). Both occupational and private pension plans are voluntary.

**Riester pension plans.** For the third pillar, the so-called Riester pensions have been introduced, which are the focus of the analysis at hand. The German Retirement Savings Act defines a number of certification criteria[2] that Riester pension products must fulfill so that incentives are provided. The main restriction is that the government subsidizes only investment vehicles guaranteeing an annual payout plan from the date of retirement (Börsch-Supan and Wilke, 2004). Moreover, Riester pension subsidies are bound to eligibility criteria. Basically, everyone who is affected by the reduction in public pension benefits, that is every person in the mandatory pension insurance, is directly eligible to participate in the Riester scheme. Thus, the group of eligible persons includes dependent employees, recipients of wage compensation benefits (e.g. unemployment benefit or child benefit), self-employed people in mandatory pension insurance, persons in vocational education, persons in military or social service, farmers and civil servants. The spouse of an eligible person is also allowed to participate in the Riester scheme and is designated as indirect eligible. The population of non-eligible persons comprises self-employees who are not compulsorily insured in the public pension system, self-employees who are voluntarily insured in the public pension system, (self-) employees in professional association pension schemes, recipients of social welfare, recipients of old-age pension, and students (Labour and (ed.), 2006).

The incentives offered by the state to contribute to a Riester retirement account comprise three elements. First, there is a direct basic subsidy, that matches the participant's own contribution. Second, there is a fixed child subsidy for all eligible individuals with children. Third, Riester retirement savings can be deducted from the income tax as special allowances up to a maximum amount. This amount has been fixed at €2,100 from 2008 onwards. The overall saving incentive is the sum of direct subsidies and tax allowances. This design of the Riester scheme implies that low-income earners receive a relatively high basic subsidy for a relatively low saving effort due to matching contributions, while middle-income earners rather benefit from tax deductions due to the progressive nature of income tax rates.

To receive the maximum direct subsidies, the beneficiary must save a specified percentage of his or her gross earnings of the previous year including the sum of direct subsidies. This percentage increased stepwise from one percent in 2002 to four percent in 2008 and onwards. The corresponding basic subsidies were €38 and €154, respectively. The child subsidies have been raised from €46 in 2002 to €185 in 2008.[3] If the total contribution, i.e. own contribution plus direct subsidies, is below the required contribution for the maximum direct subsidies, the saving subsidy is reduced proportionally (Börsch-Supan et al., 2012). However, a certain minimum amount of

---

[2]For the full set of criteria, see the Certification of Retirement Pension Contracts Act ("AltZertG").

[3]As direct subsidies themselves are counted as part of the Riester contribution, the contribution required for the full subsidy depends on the number of children. For illustrative purposes, consider the following example: An eligible household with two adults but without children has gross income of €40,000. To receive the full subsidy in 2008, four percent of the household's income must be contributed (€1,600) minus the subsidy they receive, which is two times the basic subsidy (€308). Consequently, they must save €1,292. An eligible household with two children but otherwise equal characteristics must only invest €922 (€1,600-€308-€370, where the latter amount represents two times the child subsidy).

4

contribution is necessary. As of 2005, it amounts to €90 without child, to €75 with one child and to €60 with two or more children (Börsch-Supan and Wilke, 2004).

Due to the complex eligibility and subsidy design of the Riester scheme and a lack of information, the demand for Riester products in the first two years after their introduction was rather low. After a simplification of the initial design in 2005 to improve transparency and acceptance of Riester products, the demand increased significantly and remains dynamic. Though with a slower growth rate, until today, the number of Riester contracts made is steadily increasing (Börsch-Supan et al., 2012). According to the Federal Ministry of Labour and Social Affairs, in the third quarter of 2016, more than 16.5 million contracts[4] have been taken up and at the end of 2009, the coverage rate among eligible households amounts to roughly 40 percent (Coppola and Gasche, 2011).

Riester pensions were specifically designed to incentivize low-income earners and families with children to privately build-up financial reserves as these groups traditionally have low saving rates. However, Börsch-Supan et al. (2014) show that there is substantial heterogeneity in Riester pension coverage rates along the income distribution. While in the upper income quintile 60 percent of households possess a Riester retirement account, in the bottom quintile the corresponding percentage amounts to 20 percent only. The authors suppose that this might be explained by a lack of information and the difficulty in reaching this group.

According to Börsch-Supan et al. (2012), in 2010, Riester pension savings totaled €9.4 billions. The associated direct costs amount to €3.5 billions which is about 0.14 percent of gross domestic product (GDP)[5]. Thus, one Euro of subsidies is associated with two Euros of household's own saving effort.

# 3  Theoretical background

The common theoretical framework to analyze individual saving behavior is the life-cycle hypothesis (LCH) going back to Modigliani and Brumberg (1954).[6] According to the LCH, individual life-time utility is maximized if actual consumption equals permanent income[7]. Consequently, individuals adjust their saving behavior to keep utility of consumption constant over their life-time. Simply put, in each time period, fully rational and forward-looking individuals decide how much to save based on a comparison of their actual and permanent incomes. Any income that exceeds permanent income will be saved. Hence, individuals save more in times of high income (if the difference of permanent income and current income is positive) and save less in times of low income (if the difference of permanent income and current income is negative). In this simple version of the LCH, any individual life-course saving decision is driven by the old-age provision motive which states that individuals save during working years to finance consumption during retirement, when no respectively less income is generated.

Prior to the Riester reform, life-time consumption respectively life-time saving has been automatically smoothed by the statutory pension scheme. With the launch of the Riester reform, a

---

[4]The Federal Ministry of Labour and Social Affairs estimates the number of inactive contracts to be around one fifth.

[5]See Federal Statistical Office at https://de.statista.com/statistik/daten/studie/1251/umfrage/entwicklung-des-bruttoinlandsprodukts-seit-dem-jahr-1991/

[6]The basic model of consumption behavior originally goes back to Fisher (1930). Harrod (1948) extended the initial two-period model by introducing life-cycle stages and Modigliani and Brumberg (1954)'s contribution largely was to examine consumption behavior in response to changes in wealth.

[7]Permanent income in this context represents an individual's average life-time income.

large part of the responsibility for old-age financial provision is shifted from the state to the individual (Wilke, 2012). To compensate for the cut in public pension benefits, according to the LCH, rational actors need to re-optimize their labor market and/or saving choices. More precisely, they need either to retire later, or to increase old-age saving provisions, or both. As the focus of this paper lies on the effects of subsidies on private savings, in the following, we focus on changes in saving behavior and abstract from possible adjustments in retirement choices.

**Model setup.** In similar vein to Bernheim (1999), Prinz et al. (2003), and Chetty et al. (2014), we utilize a simple two-period life-cycle model to illustrate the theoretical impact of Riester subsidies on saving behavior and therewith on wealth accumulation. Suppose that households can adjust their saving between two periods: working life, $t = 1$, and retirement, $t = 2$. Labor supply is assumed to be fix. Moreover, earnings, $Y$, are fixed and received entirely in the first period. Earnings can either be used for consumption or can be saved in one of two accounts, both of which are risk-free: a (private) retirement savings account or a taxable savings account. For assets in the taxable savings account, individuals earn the interest rate, $r$, and for savings in the retirement account they additionally earn a subsidy, denoted by $\theta$. For ease of exposition, we assume $\theta$ to be net of taxes and fees. Besides, we neglect taxes on income and capital gains. Then, consumption in the two periods, $C_1$ and $C_2$, is given by

$$
\begin{aligned}
C_1(S, P) &= Y - S - P \\
C_2(S, P) &= (1 + r)S + (1 + r + \theta)P,
\end{aligned}
\tag{3.1}
$$

where $P$ denotes voluntary individual contributions to the retirement account and $S$ denotes non-retirement savings. Note that overall saving equals expenditure on second-period consumption. In this simple setting, owing to the higher net return on retirement savings, it would be optimal to set $S = 0$. However, households are assumed to derive utility from consumption in the two periods and from holding liquid assets which can be accessed before entering retirement. The value of asset liquidity, $\phi(S)$, is a concave benefit of saving in the non-retirement account. Presuming time-separable additive preferences, household's utility is given by

$$
U(C_1) + \beta * U(C_2) + \phi(S),
\tag{3.2}
$$

with $\beta = \frac{1}{1+\rho}$, where $\beta$ is the discount rate and $\rho$ represents time preferences. Fully rational, forward looking household's choose $S$ and $P$ such that their utility is maximized.

**Comparative Statics.** In this simple two-period life-cycle setting, the Riester subsidy is associated with an uncompensated increase in the return on retirement savings. According to the standard LCH, an increase in the subsidy affects $S$ and $P$ through three channels. First, households who are eligible for Riester subsidies face the classical income and substitution effects when deciding about the optimal amount of saving.[8] On the one hand, the higher net return on saving raises the price of today's consumption. As a result, consumption is shifted towards the future, so that savings increase (substitution effect). On the other hand, the subsidy raises the value of current resources, so that actual as well as future consumption is assumed to increase, thereby reducing savings (income effect). Third, an increase in the subsidy reduces the price of retirement savings relative to non-retirement savings, leading to substitution of non-subsidized to subsidized accounts

---

[8]Saving behavior of non-eligible households may also be affected by Riester subsidies if subsidies are financed through higher taxes on non-eligible households or by reducing their transfers. We assume these individuals to be outside of the model.

(crowding-out effect). The overall effect on consumption and saving is unclear. It depends on the magnitudes of the three effects which are determined by individual preferences with regard to intertemporal substitution ($\rho$) and cross-account substitution. The latter depends on the curvature of $\phi(S)$. If the elasticity of intertemporal substitution (EIS) for example is small, individuals have high preferences for today's consumption. Consequently, they won't increase savings. If at all, in the case of simultaneous high cross-account substitution elasticity and thus low preferences for liquid assets, they finance retirement account contributions by shifting assets from non-subsidized to subsidized retirement accounts. In the case of a relatively small elasticity of cross-account substitution, asset displacements are not expected. On the contrary, if the EIS is sufficiently large, the substitution effect dominates, so that an increase in the Riester subsidy leads to an increase in total saving.

However, theory clearly predicts heterogeneous responses along the wealth distribution. The higher wealth holdings are, the more likely is a displacement of assets from non-subsidized to subsidized saving accounts, with little or no effect on overall saving. First, high-wealth households are likely to have a number of different wealth accounts, so that they have greater possibilities to displace assets from one account to another. Second, high-wealth households already have enough wealth, so that they do not need to accumulate additional assets for old-age. Third, wealth is positively correlated with financial literacy and attentiveness (Bucher-Koenen (2011) and Behrmann et al. (2012) among others), so that high-wealth households are likely to possess the necessary knowledge and information for optimizing their portfolio. According to Chetty et al. (2014) and Carroll et al. (2009), individuals with higher saving rates and thus higher wealth, are also expected to be more responsive with regard to price subsidies than households with lower wealth.[9] Hence, on the basis of the LCH, we expect qualitative and quantitative heterogeneity in the effects of Riester plans along the wealth distribution (Lang, 1998; Chetty et al., 2014; Wilke, 2012).

Meanwhile, the simple version of the LCH has been modified and extended in a number of ways. Modifications comprise the modeling of uncertainty, the incorporation of several other saving motives such as bequest and precautionary saving as well as the inclusion of liquidity constraints.[10] Moreover, Shefrin and Thaler (1988) have developed the so-called Behavioral Life Cycle (BLC) hypothesis that describes actual rather than rational behavior. The BLC incorporates problems of self-control, human limitations and a lack of information among others. Some of these variants suggest that individuals may be insensitive to saving incentives and could explain alternative saving outcomes.

---

[9]Chetty et al. (2014) and Carroll et al. (2009) distinguish between active and passive savers who differ in their responses to saving incentives. Active savers are defined as those individuals who respond in line with neoclassical predictions and are supposed to be those individuals with higher saving rates and higher wealth.

[10]Feldstein (1974) extended the life-cycle model by formally incorporating the impact of availability and generosity of public pensions on individual retirement and saving behavior while making the event of retirement endogenous. More recent studies analyzing retirement and saving behavior present dynamic versions of the previously static life-cycle models and include expectations over subjective longevity and changes in the public pension design among others (e.g. Klaauw and Wolpin (2008) and Haan and Prowse (2014)).

# 4 Empirical Strategy

**Identification approach.** The key problem in estimating the effect of Riester participation on wealth is that we do not observe saving preferences which are heterogeneous across the population and are likely to affect selection into Riester participation. As participation in Riester plans is voluntary, it seems likely that individuals with higher tastes for saving are more likely to choose to participate in Riester plans than individuals with lower tastes for saving. Hence, differences in the distribution of assets between Riester program participants and non-participants may simply stem from differences in saving tastes instead of program participation itself and standard estimators are likely to be biased upwards.

Therefore, we use an instrumental variable (IV) identification strategy to recover the true effects. The challenge of the IV approach is to find a valid instrument, i.e. a variable that has a significant impact on program participation, but does not affect the outcome variable, so that we can filter out and use the exogenous part of the treatment variable to estimate the treatment effect. As theory predicts heterogeneous effects of Riester plans on saving behavior for different wealth quantiles, we are interested in quantile treatment effects (QTE). We focus on conditional QTE estimators because identifying assumptions are often more plausible conditional on covariates. There are two possible conditional QTE estimators under selection on unobservables, the one developed by Abadie et al. (2002), and the one developed by Chernozhukov and Hansen (2005). The difference of these estimation approaches concerns the assumptions underlying the potential outcomes framework. There is no advantage of one estimation approach over the other and the results are found to be very similar (Chernozhukov and Hansen, 2004). Lastly, we employ the IV conditional QTE approach developed by Abadie et al. (2002) as it resembles the LATE approach which identifies the ATE of compliers in a heterogeneous effects framework and thus has an intuitive appeal.

**Notation and framework.** To illustrate the QTE identification approach, we introduce some notation based on Abadie et al. (2002). Let $Y$ denote continuous outcome, $D$ binary treatment, $Z$ the binary instrument and $X$ the controls. As we do not not observe the outcome of the same individual in both cases treated and non-treated, we have to define causal effects using potential outcomes and treatments. We denote potential outcomes which depend on $D$, as $Y_d$, and potential treatment states which depend on $Z$, as $D_z$. Accordingly, $Y_1$ and $Y_0$ are the values of an individual's outcome if $D = 1$ and $D = 0$ respectively. Similarly, $D_1$ and $D_0$ would be individual's treatment choice if $Z = 1$ and $Z = 0$ respectively. Depending on treatment choice, the population can be partitioned into four groups: compliers, never-takers, always-takers and defiers. The group of compliers consists of all individuals that choose treatment if the instrument value is one and choose no treatment if the instrument value is zero ($D_1 = 1$ and $D_0 = 0$). Never-takers never choose treatment independent of the instrument value ($D_1 = 0$ and $D_0 = 0$). Always-takers are the opposite and always participate in the program independently of the instrument value ($D_1 = 1$ and $D_0 = 1$). Finally, the group of defiers comprises individuals that choose treatment if the instrument value is zero and choose not to participate if the instrument value is one ($D_1 = 0$ and $D_0 = 1$).

Abadie et al. (2002) postulate four assumptions that underlie their IV approach. The first assumption is the "Independence" assumption stating that potential outcome and treatment choice are jointly independent from the instrument conditional on covariates, formally: $(Y_1, Y_0, D_1, D_0) \perp$

$Z|X$. Independence of the outcome from the instrument represents an exclusion restriction and ensures that the instrument has no direct effect on outcomes. Independence of treatment choice from the instrument ensures that the effect of $Z$ on $D$ is causal. The second assumption, "Nontrivial assignment", states that the instrument must be binary and takes on the value 0 or 1, formally: $P(Z = 1|X) \in (0, 1)$. Assumption three, "First-stage" $(E[D_1|X] \neq E[D_0|X])$, makes sure that the instrument affects treatment choice behavior. Furthermore, Abadie et al. (2002) impose monotonicity, which can be formalized as $P(D_1 \geq D_0|X) = 1$. This assumption implies that for all individuals, the probability of participation in treatment increases with higher values of the instrument and thus rules out the existence of defiers.

"Independence" is the crucial assumption in this setting. It implies that for the group of compliers, treatment status conditional on covariates does not depend on potential outcomes $((Y_1, Y_0) \perp D|X)$.[11] Thus, for compliers, given $X$, the effect of $D$ on $Y$ is causal.

**The QTE model.** The linear model for conditional QTE developed by Abadie et al. (2002) can be formalized as

$$Q_\theta(Y|X, D, D_1 > D_0) = \alpha_\theta D + X'\beta_\theta. \tag{4.3}$$

The left-hand side of 4.3 represents the conditional $\theta$-quantiles of $Y$ for compliers and $\alpha_\theta$ gives the CQTE, i.e. the difference in the conditional $\theta$-quantiles of $Y$ for treated and non-treated compliers. When considering low wealth quantiles, the CQTE can be interpreted as the effect of individuals with low wealth conditional on $X$, i.e. low wealth relative to those with similar characteristics, although the absolute value of wealth might be high. When considering high wealth quantiles, the CQTE measures the effect of individuals with high wealth in relation to those with the same $X$, while their absolute wealth might be low (Frölich and Melly, 2010).[12] The parameters of the conditional QTE model can be written as the solution of the following minimization problem

$$(\alpha_\theta, \beta_\theta) = \underset{(\alpha,\beta)}{\arg\min} E[\kappa * \rho_\theta(Y - \alpha D - X'\beta)], \tag{4.4}$$

where $\rho_\theta(\lambda)$ is the check function[13] and $\kappa(D, Z, X)$ is a weighting function that identifies compliers in expectation. It can be written as

$$\kappa(D, Z, X) = 1 - \frac{D(1 - Z)}{1 - P(Z = 1|X)} - \frac{(1 - D)Z}{P(Z = 1|X)}. \tag{4.5}$$

Since $\kappa$ is negative if $D \neq Z$, the sample objective function is not convex and the sample analog of 4.4 does not have an LP representation. Therefore, the following non-negative weighting function with conditional expectation given $U = (Y, D, X)$ is used

$$\kappa_\nu = E[\kappa|U] = 1 - \frac{D(1 - \nu_0(U))}{1 - P(Z = 1|X)} - \frac{(1 - D)\nu_0(U)}{P(Z = 1|X)}, \tag{4.6}$$

where $\nu_0(U) = E[Z|U] = P(Z = 1|Y, D, X)$.

---

[11]This results from the fact that for compliers we have $D = Z$, so that $Z$ in the independence assumption can be replaced by $D$.

[12]Note that unconditional QTE measure the effect of individuals with absolute low respectively absolute high wealth.

[13]Bassett and Koenker (1982) define the check function as $\rho_\theta(\lambda) = (\theta - 1)\lambda$ for $\lambda < 0$ and $\rho_\theta(\lambda) = \theta\lambda$ for $\lambda \geq 0$.

**Application.** In the context of Riester pension plans, $Y$ is wealth measures, $D$ is Riester participation and $Z$ is Riester eligibility. Both assumptions non-trivial assignment and relevance of the instrument are clearly satisfied. Monotonicity is also plausible in our context as individuals only are allowed to participate in Riester plans if they are eligible, so that $D_0 = 0$ for everyone. The independence assumption is the most controversial one. Since the mid nineteens, there is a large debate on whether eligibility for 401(k) plans might be exogenous or not (Poterba et al. (1995), Poterba et al. (1996a), Engen et al. (1994), Engen et al. (1996b), Engen et al. (1996a), and Bernheim (1999)). Opponents argue that eligibility is significantly correlated with individual saving preferences as they assume employees to choose their job according to the firm's offer of good pension coverage, including 401(k)s. Proponents in contrast presume that the process that determines saving does not influence eligibility for 401(k)s for a number of reasons. In line with Poterba et al. (1995), Poterba et al. (1996a), Benjamin (2003), Abadie (2003), Chernozhukov and Hansen (2004), and Corneo et al. (2010), we argue that, given covariates, eligibility for pension plans, in our case, Riester eligibility, is exogenous. First, eligibility for Riester pension plans is based on legal definitions. Second, we assume that elementary household decisions concerning employment type, marital status or birth of children are not driven by considerations with regard to Riester participation. Third, we condition on a number of covariates and thus control for numerous factors that might be correlated with unobserved determinants of wealth. Moreover, we control for differences in saving tastes by using the difference of wealth between the years 2002 and 2012 as dependent variable in our regression. Assuming that average tastes for saving do not change systematically through time, following Bernheim (1999), it is thus eliminated. Accordingly, we conclude that the assumptions underlying the approach of Abadie et al. (2002) are met. As compliers in our setting are those individuals who participate in Riester plans if they are eligible and who do not participate if they are not eligible, estimation results apply to the whole group of treated individuals.

# 5 Data, variables and summary statistics

**Data set.** The empirical analysis uses data drawn from the German Socio-Economic Panel (GSOEP) which is a yearly repeated panel survey of around 12,000 private households and 30,000 individuals from the Federal Republic of Germany aged 17 years and older.[14] The GSOEP provides detailed information on a wide range of asset categories, socio-demographic, socio-economic as well as household characteristics. In addition, in several years, it surveys whether individuals have a Riester contract or not.[15] We employ household level data as we assume that savings decisions are agreed upon within households. We combine the household questionnaire with individual data referring to the head of the household. Household wealth data is available for the years 2002, 2007 and 2012. The GSOEP is especially suitable for analyses including wealth as wealth data are multiply imputed. Thus, the GSOEP accounts for measurement errors, item-non responses as well as partial unit-non-responses, which are likely to affect wealth data in population surveys. Our empirical analysis is conducted with the newest wealth data from wave 2012 and is augmented by information from wave 2002. All euro amounts are in 2012 euros.

    **Instrument and treatment variable.** A household is classified as eligible if the head of the

---

[14] For a detailed description of the GSOEP, see Wagner et al. (2007).

[15] Corneo et al. (2008), Corneo et al. (2009), and Corneo et al. (2010) for example, use the same data source to study the effect of Riester participation on savings.

household is eligible for a Riester contract. A household is classified as non-eligible otherwise. The eligibility status is assigned according to the legal requirements illustrated by Labour and (ed.) (2006). Thus, we define households as eligible if the head of the household corresponds to one of the following groups: Blue-collar workers, white-collar workers, civil servants, trainees, persons in military or social service, persons in childcare leave, farmers, registered unemployed, persons having a mini or a midi job, recipients of disability benefits, recipients of subsistence allowance and old-age transition benefits. A household is defined as non-eligible if the head of the household corresponds to one of the following groups: Free-lancers and other self-employed (with dependent employees), recipients of old-age pension, recipients of social welfare and income support, non-working persons and students.[16] The spouse of an eligible person is also defined as eligible. A household is classified as Riester participant if the household head has a Riester pension and as non-participant otherwise.

**Outcome variables.** We study the effect of Riester participation on various measures of wealth. In line with Chernozhukov and Hansen (2004), the focus lies on the effect on total net wealth, net financial assets and net financial assets excluding private insurances which include Riester pensions. To detect wealth components which are associated with potential sources of substitution, we also study the effect on net housing wealth and business assets.[17] Net financial assets are defined as the sum of saving accounts, bonds, shares, investments, building loan agreements, private pensions comprising life insurance policies and private retirement plans including Riester or Rürup pensions less non-mortgage debt. Net housing wealth is the sum of owner-occupied and other property[18] less mortgage debt. Business assets comprise all forms of commercial enterprises, that is companies, shops, offices, practices or farms. Total net wealth is the sum of net financial assets, net housing wealth, business assets and tangible assets[19].

Taking into account the criticism of Engen and Gale (2000) and Pence (2002) on previous US studies on the effects of 401(k) plans on wealth, the dependent variables are not estimated in levels, but in first differences. More precisely, as dependent variable, we use the value of an asset component in 2012 minus the value of the respective asset component in 2002 to control for differences in the initial asset positions of eligibles and ineligibles and thus for remaining differences in tastes for saving between these two groups.[20]

**Covariates.** The set of covariates is largely consistent with that used in previous studies examining the effect of subsidized pension plans on wealth (Abadie (2003), Benjamin (2003), Chernozhukov and Hansen (2004), and Corneo et al. (2010) among others). Specifically, we control for age, income, family size, marital status, education, homeownership status and risk preferences. Risk preferences have been neglected in previous studies so far. However, we argue that risk preferences are a good indicator for saving preferences and are likely to affect long-term

---

[16]This definition of eligibles implies the following three assumptions: First, free-lancers and other self-employed are not compulsorily insured in the statutory pension system. Second, dependent employees are not in professional association pension schemes, nor voluntarily insured in the statutory pension scheme. Third, marginal employees have not been exempted from the mandatory pension insurance.

[17]Engen and Gale (1997) for example find substitution between housing wealth and private pension plans in the US, whereas Engelhardt and Kumar (2011) find that the majority of estimated crowd-out in the upper wealth quantiles in the US are associated with business equity.

[18]Other property contains all forms of real estate apart from own-occupied property such as apartment buildings, vacation homes, or undeveloped land.

[19]Tangible assets contain assets in form of gold, jewelry, coins, or valuable collections.

[20]Note, that the natural logarithm of the dependent variables cannot be used due to negative asset values. An exclusion of those households with negative net wealth would give biased results and would discard too many observations.

wealth accumulation behavior. Besides, it is especially important to control for it in the German context, where Riester eligibility is linked to the employment status of an individual, so that risk preferences also are likely to affect a household's eligibility status. Apart from income, which represents net household income, and family size, all variables refer to the head of the household. Marital status and homeownership status are binary variables. In order to control for age, income, education, family size and risk preferences, we use categorical variables. Age is classified in five age groups. The age intervals are as follows: 17-25, 26-35, 36-45, 46-55, 56-65 years old. Income is also categorized into five groups: ≤€20K, €20-30K, €30-40K, €40-50K, and >€50K. Education is measured by the number of years of educational training completed by the head of the household. For the analysis, we have categorized this variable into the following four groups: <11, 11-13, 14-16, >16 years. Family size measures the number of persons in the household and is controlled for using the following three categorical variables: <3, 3-4, >4 persons in the household. Self-assessed risk preferences are measured on a scale from 0 to 10, where 0 means "not at all willing to take risks" and 10 represents "very willing to take risks". We control for risk preferences through the use of four categorical variables: <3, 3-5, 6-8, >8.

**Sample selection.** Due to different saving behavior of older, retired people, following Chernozhukov and Hansen (2004) and Abadie (2003) among others, we restrict the sample to households in which the head of the household is less than 65 years old. After deleting observations with missing information on one of the relevant variables in wave 2012 or with missing asset values in 2002, we end up with a sample consisting of 2,761 observations.

**Summary statistics.** Tables A1 and A2 report summary statistics for the entire sample as well as by Riester participation and eligibility status. We see that 85 percent of the sample are eligible for Riester contracts and that 24 percent participate in Riester plans. Regarding eligible households only, the participation rate amounts to 28 percent. While Riester participants are less wealthy in both years 2002 and 2012, the value of overall net wealth as well as of all wealth components has increased significantly more than that of non-participants in between these years. The average participant is younger, is more likely to be married, has a greater family and has been in education for a longer time. Additionally, on average, he is more likely to be homeowner, has higher income and is a bit more risk averse. Eligibles are less wealthy than non-eligibles in both years 2002 and 2012 and in between these years, their wealth holdings have grown to a lesser extent. However, it is worth noting that the value of net financial assets including private insurances and Riester pensions has increased more than twice that of non-eligibles. While the groups of eligibles and non-eligibles are very similar with regard to education, homeownership and risk preferences, they are rather different with regard to age, family size, marital status and income: Eligibles are younger, have greater families, are more likely to be married and have higher income. We control for these differences by estimating QTE conditional on these characteristics.

**Table A1 About Here**

**Table A2 About Here**

# 6  Empirical Results

**OLS and 2SLS results.** Table A3 reports OLS and conventional IV (2SLS) estimates for the effect of Riester participation on wealth measures[21] which primarily serve as a benchmark for the QR and CQTE results presented later. However, they are interesting on their own and would be sufficient if treatment effects along the wealth distribution would be constant. While 2SLS estimates account for endogeneity and are likely to have a causal interpretation, OLS estimates rather provide a descriptive comparison of mean earnings for Riester participants and non-participants.

First-stage estimates[22] for Riester participation, which are reported in the bottom of table A3, show a highly significant positive correlation of Riester eligibility and participation, thus confirming the relevance of the instrument. Given the relatively small first-stage estimate, one might be concerned about having a weak instrument. Therefore, we performed an F-test for weak instruments which tests the joint significance of instruments in the first-stage. As the test-statistic amounts to 328.457 and thus is significantly greater than the critical value of 10, the test strongly rejects the hypothesis of a weak instrument.

As expected, the 2SLS coefficients are uniformly smaller than the corresponding OLS estimates, thus confirming the expectation of a positive bias of OLS estimates due to unobserved preferences for saving. While OLS estimates show a positive relation between Riester participation and wealth measures, apart from the estimate on financial wealth, 2SLS estimates are all negative. The magnitude of the 2SLS estimates differs substantially across wealth measures with unreasonably large estimates for total net wealth and business assets. Overall, 2SLS results suggest that the increase in net financial assets from 2002 to 2012 can be largely attributed to substitution from net non-financial assets and more importantly from housing and business assets. The negative effect on total net wealth confirms this evidence: The increase in financial assets does not lead to an increase in overall wealth but rather decreases the value of total assets which is rather counter-intuitive. However, with the exception of the estimate for business assets, 2SLS are not significantly different from zero and standard errors are quite large as well.

With regard to the effect of covariates on the differences in asset measures between 2002 and 2012, OLS and 2SLS estimates exhibit quite similar patterns of results and have the expected signs. While the difference in wealth measures appear to increase with income, homeownership and education, it decreases with family size and is lower for households where the head of the household is married. The effect of age respectively risk preferences largely differs across asset measures. Though the estimates on age are all positive, the differences in total net wealth and business assets from 2002 to 2012 seem to decrease with age suggesting that the gain in total as well as business wealth is relatively larger for younger households. The remaining wealth components show the conventional hump-shaped age-wealth profile. With regard to risk preferences, we find that the difference in financial and non-financial assets decreases with increasing risk preferences, whereas the gain in the remaining wealth measures appears to be highest for households with the

---

[21]The specifications of the OLS and 2SLS regressions are analogous to the empirical specification presented in the previous two sections.

[22]The first stage of 2SLS is a regression of Riester participation on covariates conditional on Riester eligibility. Full results of the first-stage are available upon request from the author. With regard to the covariates in the first-stage regression, the estimated coefficients on age, education and size of the household are positive and highly significant for most of the wealth measures. This means that conditional on eligibility, these variables raise participation in Riester pension plans. The rest of the covariates, i.e. income, marital status, homeownership status and risk preferences, are insignificant given eligibility.

highest risk preferences.

<center>**Table A3 About Here**</center>

**QR and IV CQTE results.** The estimates presented so far provide a summary statistic of the effect of Riester participation on the respective wealth measure but do not give any information on the effects along the wealth distribution in the case of heterogeneous treatment effects. Therefore, in table A4, we report standard QR results and results from the IV conditional quantile regression approach of Abadie et al. (2002) for the 0.15, 0.25, 0.4, 0.5, 0.6, 0.75 and 0.85 quantiles.[23] Owing to non-negligible idiosyncratic variation of eligibles and non-eligibles with extremely low or high conditional wealth, identification at the tails of the conditional asset distributions is troublesome. Thus, in line with Abadie et al. (2002), we abstract from presenting estimates for quantiles smaller than the 15th and greater than the 85th quantile and have this in mind when interpreting results at the margins of the conditional asset distributions.

<center>**Table A4 About Here**</center>

The results provide a number of interesting insights. A comparison of QR and CQTE results reveals substantial differences with regard to the magnitude of estimates. For almost all wealth measures, CQTE estimates are larger for quantiles smaller or equal the 50th quantile.[24] For higher quantiles, conventional QR estimates are larger. This seems to be reasonable as people with high wealth in relation to those with the same characteristics are likely to have higher preferences for saving, so that the upward bias of QR estimates is especially pronounced in the upper part of the asset distributions. In the lower part, unobserved saving preferences appear to be less important.

Whereas the magnitude and the sign of the QR and CQTE estimates differ, results from both estimators provide strong evidence in favor of highly non-constant effects of Riester participation on asset measures. In the following, we concentrate on the interpretation of the CQTE results as they allow for a causal interpretation. The effects of Riester participation on total net wealth, financial and non-financial assets decrease monotonically in the quantile index. For all three wealth measures, the CQTE coefficient is positive for quantiles below the 75th quantile and becomes negative for the 75th quantile and higher ones. This result indicates that households who rank in the lower and upper part of the conditional asset distributions are more affected than those ranking in the middle part. The effects on the 25th to the 75th quantiles for housing wealth and up to the 85th quantile for business assets are all zero, meaning that, conditional on observables, households ranking in the middle part of the respective conditional asset distributions are not affected at all.

A comparison of the effects of Riester participation on financial assets relative to the effects

---

[23]To implement the CQTE estimator, we have non-parametrically estimated (instrument) propensity scores to calculate the weights $\kappa$. In a second step, we used these weights for non-parametric estimation of the non-negative weighting function $\kappa_\nu$. In both steps, the choice of the optimal smoothing parameters was guided by cross-validation. For more details on the implementation of the CQTE estimator see Frölich and Melly (2010).

[24]Note that the coefficients of the QR and CQTE regressions of Riester participation on housing wealth and business assets both are zero in the lower- and upper-middle part of the respective conditional distributions. Among others, this might be explained by the fact that only a small percentage of households in the sample has these assets in their portfolio. When looking at the intensive margin only, i.e. restricting the sample on households who have housing respectively business wealth, treatment effects of Riester participation are non-zero.

<center>14</center>

on other wealth measures, in particular on total net wealth, also reveals interesting insights. For financial wealth, we observe positive highly significant estimates for the 15th to the 40th quantile. The magnitude of the effect for the 15th quantile for example is estimated to be 24,519 euro, whereas that for the 40th quantile is estimated to be 10,482 euro. Hence, Riester participation increased net financial assets from 2002 to 2012 by 24,519 euro for households who rank in the 15th quantile of the conditional distribution and by 10,482 euro for households in the 40th quantile. The effect on total net wealth is also positive and significant for the 15th quantile. Thus, the increase in net financial assets in the low tail of the conditional asset distribution can be interpreted as an increase in overall wealth.

The treatment effects on total net wealth are even larger than those on financial assets. We are tempted to conclude that Riester participation leads to positive spillover effects for households who rank in the lower part of the conditional wealth distribution. It seems that the introduction of Riester plans and household's participation in those plans sensitizes low-wealth households for the need to prepare privately for old-age, so that they do not only conclude Riester contracts but also invest in other financial products and acquire business or housing equity. This explanation is supported by positive estimates on the remaining asset components under consideration, though the estimate on net housing wealth is not significantly different from zero. Further, it is in line with Dolls et al. (2016) who find that both an increase in the level of information about pensions and an increase in the salience of the issue of retirement savings increases contributions to a private retirement account.

Notwithstanding, the estimates on total net wealth remain very large at the tails of the conditional wealth distribution, in particular at its lower tail. The magnitude of the estimates might be explained by the fact that we use the accumulation of asset measures over the period from 2002 to 2012 as dependent variable. It is reasonable to assume that the effect of Riester participation on the gain in total net wealth over a period of 10 years is greater than the effect on the level of wealth as used in Chernozhukov and Hansen (2004) for example.

In the upper part of the conditional asset distribution, the effect of Riester participation on net financial assets is negative and significant on the 10 percent level. Negative estimates for financial wealth are at odds with our intuition. Due to the financial crisis and therewith price fluctuations of financial assets, results for financial wealth should be interpreted with caution. For the other asset measures considered in the analysis, we also find negative estimates in the upper part of the conditional distributions. For the 85th quantile, estimated coefficients of net non-financial, housing and business assets are also significantly different from zero, thus providing weak evidence of crowding-out of other assets in the upper tail of the conditional distribution. As the estimate for total net wealth is insignificant however, results suggest that there is solely a reallocation of the asset portfolio, but that there is no significant effect on overall wealth.

Lastly, it is interesting to see that the 2SLS estimates do not correctly characterize the effects on different points of the asset distributions. The 2SLS estimates rather understate the effects for lower quantiles and overstate the effects in the upper quantiles. The 2SLS estimates correspond more closely to the treatment effects at the 75th quantile of the conditional distributions than to that of the median. In addition, apart from the estimated coefficient on business assets, 2SLS estimates are insignificant. This is consistent with the results of Corneo et al. (2008), Corneo et al. (2009) and Corneo et al. (2010) who investigated median effects and found no significant effect on overall savings. However, our results clearly indicate that restricting the analysis on median

effects is not sufficient to fully characterize the effects of Riester participation.

**Robustness checks.** We have examined the robustness of our CQTE results in a number of ways. First, following Frölich and Melly (2010), we checked the robustness of our final results by trying a number of different combinations of smaller smoothing parameters than those values suggested by cross-validation. Results for one combination of smaller smoothing parameters are presented in table A5.[25] One can observe that in the middle part of the distribution, estimates appear to be robust. At the tails of the conditional asset distributions however, we observe that estimates and standard errors, especially those for total net wealth, are smaller in absolute terms. Moreover, the estimated coefficients of financial assets and non-PI assets for the 85th become insignificant. Second, according to Imbens (2014), we trimmed the sample at a value of 0.1 to avoid giving very high weights to single observations. Accordingly, observations with extreme values of the propensity score, in specific, observations with an estimated propensity score less than 0.1 or greater than 0.1 are trimmed and not used further in the estimation procedure. CQTE estimates using the trimmed sample are shown in table A6. Apart from smaller estimates at the upper tail of the conditional wealth distribution, estimates are largely found to be insensitive to the trimming. We also ran regressions with alternative sets of covariates. None of the alternative specifications changed results significantly. The greatest difference appeared when the homeownership dummy was excluded. In this case, estimates for the 60th and the 75th quantiles of the conditional housing wealth distribution became significant. Summarizing, we conclude that our results are robust at least in the middle-lower and middle-upper parts of the conditional asset distributions, while results at the tails must be interpreted with caution.

# 7 Discussion and Conclusion

In numerous industrialized countries, the demographic change erodes the financial basis of traditional PAYG pension systems. Owing to concerns that individual savings for retirement are not sufficient to compensate for the reduction in public pillar replacement rates, many governments incentivize private saving by means of subsidized retirement plans. Due to the great importance of savings for the personal economic security in old-age as well as for the national economic performance (Bernheim, 1999), policymakers worldwide are highly interested in evaluating the effectiveness of retirement plans and - if necessary - to learn how to improve their design for stimulating thrift. Against this background, this paper examines the effects of participation in Riester plans on several measures of wealth at different points of the distributions. We employ the instrumental quantile regression approach by Abadie et al. (2002) using Riester eligibility as instrument for Riester participation. The analysis is based on microeconomic survey data from the GSOEP of wave 2012.

Results suggest that the effect of Riester participation on asset measures is quite heterogeneous. In the lower tail of the conditional asset distributions, the effect on financial assets as well as on overall wealth is positive and significant, indicating that Riester participation increases total net wealth with the less wealthiest households having the highest returns. Owing to the fact that the estimates for total net wealth are even larger than that for net financial assets, we are tempted to conclude that Riester plans trigger positive spillover effects. This reasoning is in line with Dolls et al. (2016) who show that information and salience about pensions have a positive impact on

---

[25]Results with other smoothing parameters are similar. They are available upon request.

private retirement savings. The presence of the Riester scheme seems to increase the awareness of relatively low-wealth households for the rising need of private old-age provision. For households ranking in the middle part of the conditional asset distributions, treatment effects are smallest and Riester participation does not have a significant impact on asset accumulation as it was found in previous analyses which investigated median effects only (Corneo et al. (2008), Corneo et al. (2009) and Corneo et al. (2010) among others). In the upper tail of the conditional asset distributions on the contrary, we find negative treatment effects. However, the estimated coefficient for total net wealth is not significantly different from zero. Thus, results provide weak evidence in favor of a mere reallocation of the asset portfolio of households in the upper tail of the conditional distributions. In spite of differences in the US and German pension systems and the design of retirement plans, our results are largely in line with recent findings on the effects of participation in 401(k) pension plans on wealth in the US.

Previous analyses which investigated the effects of Riester participation on savings focused on treatment effects at the median. However, our findings clearly indicate that median effects are not sufficient to fully characterize the effect of the Riester scheme on the wealth distribution. In contrast, it obscures treatment effects on those parts of the distribution which are most important from a policy perspective. Contrary to previous findings and beliefs in the German population, our results suggest that Riester pension plans are effective in raising private savings for relatively low-wealth households, among others due to positive spillover effects. This is of great importance for public policy, as the households in the lower part of the financial asset distribution are the main target group of the Riester scheme as they are likely to be those households who are least prepared for retirement. Notwithstanding, descriptives show that the percentage of low-wealth households who participate in Riester at all is relatively low, so that only a small percentage of Germans benefits from these positive effects. Chetty et al. (2014) who investigate the effects of retirement saving policies on wealth for Denmark, find that 85 percent of danish individuals are passive savers who do not respond at all to price subsidies. In this context, the authors propose to use policies that do not rely on individuals to take an action. This could also be worth thinking about for Germany. Chetty et al. (2014) argue that policies such as automatic payroll deductions or savings defaults are less costly, generate less crowding-out and most importantly, are likely to have the largest impacts on individuals who are least prepared for retirement.

Though we think that this paper provides interesting insights in the effects on Riester participation on the wealth distribution, the analysis has some limitations. First, identification at the tails of the conditional asset distributions is troublesome. While eligibles and non-eligibles are similar in the middle-lower and middle-upper parts of the distribution, they are not in its tails. Due to significant idiosyncratic variation, there might still be endogeneity at the tails of the distribution. Second, non-parametric estimation used in the analysis has some drawbacks, most importantly the need to choose smoothing parameters. Estimates of the treatment effects at the tails of the distribution appear to be sensitive to the choice of smaller than the optimal parameters. When drawing conclusions and deriving policy implications, we have to bear this in mind.

The limitations of the analysis lead us to formulate some ideas for further research. It would be useful to investigate treatment effects of Riester participation in different income groups as it has been done in a number of US studies before. We think it could reduce identification problems at the tails of the distribution given that the independence assumption may be more plausible within income intervals (Chernozhukov and Hansen, 2004). Moreover, one could test the hypothesis of

positive spillover effects in the lower part of the conditional wealth distribution. A confirmation of this hypothesis would provide further evidence for the robustness of our results. Both of these research issues require adequate wealth data with a sufficient large number of observations and controls especially at the tails of the wealth distribution. A further extension of the analysis at hand could be to analyze the effects of Riester participation for different socio-demographic groups like gender, age and education among others. Thus, policy makers would get deeper insights about the effectiveness in reaching certain socio-demographic groups and therewith the need for improvements with regard to the design of the Riester scheme.

# References

Abadie, Alberto (2003). "Semiparametric Instrumental Variable Estimation of Treatment Response Models". In: *Journal of Econometrics* 113.2, pp. 231–263.

Abadie, Alberto, Joshua Angrist, and Guido Imbens (2002). "Instrumental Variables Estimates of the Effect of Subsidized Training on the Quantiles of Trainee Earnings". In: *Econometrica* 70.1, pp. 91–117.

Bassett, Gilbert and Roger Koenker (1982). "An Empirical Quantile Function for Linear Models with iid Errors". In: *Journal of the American Statistical Association* 77.378, pp. 407–415.

Behrmann, Jere R., Olivia S. Mitchell, Cindy K. Soo, and David Bravo (2012). "How Financial Literacy Affects Household Wealth Accumulation". In: *The American Economic Review* 102, pp. 300–304.

Benjamin, Daniel J. (2003). "Does 401(k) Eligibility Increase Saving?: Evidence from Propensity Score Subclassification". In: *Journal of Public Economics* 87.5-6, pp. 1259–1290.

Bernheim, Douglas B. (1999). *Taxation and Saving*. Working Paper 7061. National Bureau of Economic Research.

Bönke, Timm, Markus M. Grabka, Carsten Schröder, and Edward N. Wolff (2017). *A Head-to-Head Comparison of Augmented Wealth in Germany and the United States*. SOEPpapers 899-2017. DIW Berlin.

Börsch-Supan, Axel H. and Christina B. Wilke (2004). *The German Public Pension System: How it Was, How it Will Be*. Working Paper 10525. National Bureau of Economic Research.

Börsch-Supan, Axel H., Michela Coppola, and Anette Reil-Held (2012). *Riester Pensions in Germany: Design, Dynamics, Targetting Success and Crowding-In*. Working Paper 18014. National Bureau of Economic Research.

Börsch-Supan, Axel H., Tabea Bucher-Koenen, Michela Coppola, and Bettina Lamla (2014). *Savings in Times of Demographic Change: Lessons from the German Experience*. Discussion Paper 18-2014. Max Planck Institute for Social Law and Social Policy.

Bucher-Koenen, Tabea (2011). *Financial Literacy, Riester Pensions, and Other Private Old Age Provision in Germany*. Discussion Paper 250-2011. MEA, Max-Planck-Institute for Social Law and Social Policy.

Carroll, Gabriel D., James J. Choi, David Laibson, Brigitte Madrian, and Andrew Metrick (2009). "Optimal Defaults and Active Decisions". In: *The Quarterly Journal of Economics* 124.4, pp. 1639–1674.

Chernozhukov, Victor and Christian Hansen (2004). "The Effects of 401(K) Participation on the Wealth Distribution: An Instrumental Quantile Regression Analysis". In: *The Review of Economics and Statistics* 86.3, pp. 735–751.

– (2005). "An IV Model of Quantile Treatment Effects". In: *Econometrica* 73.1, pp. 245–261.

Chetty, Raj, John N. Friedman, Søren Leth-Petersen, Torben H. Nielsen, and Tore Olsen (2014). "Active vs. Passive Decisions and Crowd-Out in Retirement Savings Accounts:

Evidence from Denmark". In: *The Quarterly Journal of Economics* 129.3, pp. 1141–1219.

Coppola, Michela and Martin Gasche (2011). *Die Riester-Förderung - Das Unbekannte Wesen*. MEA Discussion paper 244-2011. Max Planck Institute for Social Law and Social Policy.

Coppola, Michela and Anette Reil-Held (2009). *Dynamik der Riester-Rente: Ergebnisse aus SAVE 2003 bis 2008*. Tech. rep. 195. Mannheim Research Institute for the Economics of Aging, University of Mannheim.

Corneo, Giacomo, Matthias Keese, and Carsten Schröder (2008). *Can Governments Boost Voluntary Retirement Savings via Tax Incentives and Subsidies? A German Case Study for Low-Income Households*. Economics Working Papers 2008,18. Christian-Albrechts-University of Kiel, Department of Economics.

– (2009). "The Riester Scheme and Private Savings: An Empirical Analysis based on the German SOEP". In: *Schmollers Jahrbuch: Journal of Applied Social Science Studies / Zeitschrift für Wirtschafts- und Sozialwissenschaften* 129.2, pp. 321–332.

– (2010). *The Effect of Saving Subsidies on Household Saving – Evidence from Germany*. Ruhr Economic Paper 170. University of Duisburg-Essen.

Corneo, Giacomo, Carsten Schröder, and Johannes König (2015). *Distributional Effects of Subsidizing Retirement Savings Accounts: Evidence from Germany*. Discussion Paper 2015,18. School of Business and Economics: Economics.

Courant, Paul, Edward Gramlich, and John P. Laitner (1984). "A Dynamic Microeconomic Estimate of the Life-Cycle Model". In: *Retirement and Economic Behavior*. Ed. by Henry J. Aaron and Gary Burtless. Wahington, DC: Brookings Institution, pp. 279–313.

Dolls, Mathias, Philipp Doerrenberg, Andreas Peichl, and Holger Stichnoth (2016). *Do Savings Increase in Response to Salient Information about Retirement and Expected Pensions?* Working Paper 22684. National Bureau of Economic Research.

Engelhardt, Gary V. and Anil Kumar (2011). "Pensions and Household Wealth Accumulation". In: *Journal of Human Resources* 46.1, pp. 203–236.

Engen, Eric M. and William G. Gale (1997). *Debt, Taxes, and the Effects of 401(k) Plans on Household Wealth Accumulation*. Tech. rep.

– (2000). *The Effects of 401(k) Plans on Household Wealth: Differences Across Earnings Groups*. NBER Working Papers 8032. National Bureau of Economic Research, Inc.

Engen, Eric M., William G. Gale, and John K. Scholz (1994). "Do Saving Incentives Work?" In: *Brookings Papers on Economic Activity* 25(1994-1), pp. 85–180.

– (1996a). *The Effects of Tax-Based Saving Incentives on Saving and Wealth*. Working Paper 5759. National Bureau of Economic Research.

– (1996b). "The Illusory Effects of Saving Incentives on Saving". In: *The Journal of Economic Perspectives* 10.4, pp. 113–138.

Feldstein, Martin (1974). "Social Security, Induced Retirement, and Aggregate Capital Accumulation". In: *Journal of Political Economy* 82.5, pp. 905–926.

Fisher, Irving (1930). *The Theory of Interest*. New York: Macmillan.

Frölich, Markus and Blaise Melly (2010). "Estimation of Quantile Treatment Effects with Stata". In: *Stata Journal* 10.3, pp. 423–457.

Haan, Peter and Victoria Prowse (2014). "Longevity, Life-Cycle Behavior and Pension Reform". In: *Journal of Econometrics* 178, Part 3, pp. 582 –601.

Harrod, Roy F. (1948). *Towards a Dynamic Economics*. London: Macmillan.

Imbens, Guido W. (2014). *Matching Methods in Practice: Three Examples*. IZA Discussion Paper 8049. IZA.

Klaauw, Wilbert van der and Kenneth I. Wolpin (2008). "Social Security and the Retirement and Savings Behavior of Low-Income Households". In: *Journal of Econometrics* 145.1–2. The use of econometrics in informing public policy makers, pp. 21 –42.

Labour, Federal Ministry of and Social Affairs (ed.) (2006). *Zusätzliche Altersvorsorge*. Publikation.

Lang, Oliver (1998). *Steueranreize und Geldanlage im Lebenszyklus: Empirische Analyse zu Spar- und Portfolioentscheidungen deutscher Privathaushalte*. Ed. by Zentrum für empirische Wirtschaftsforschung Mannheim. Vol. 32. ZEW Wirtschaftsanalysen. Nomos.

Modigliani, F. and R. Brumberg (1954). *Utility Analysis and the Consumption Function: An Interpretation of Cross-Section Data*. Ed. by Post-Keynesian Economics. New Brunswick, NJ: Rutgers University Press.

Pence, Karen M. (2002). *401(k)s and Household Saving: New Evidence from the Survey of Consumer Finances*. Finance and Economics Discussion Series 2002-6. Board of Governors of the Federal Reserve System (U.S.)

Pfarr, Christian and Udo Schneider (2013). "Choosing between Subsidized or Unsubsidized Private Pension Schemes: Evidence from German Panel Data". In: *Journal of Pension Economics and Finance* 12.01, pp. 62–91.

Poterba, James M., Steven F. Venti, and David A. Wise (1995). "Do 401(k) Contributions Crowd Out Other Personal Saving?" In: *Journal of Public Economics* 58.1, pp. 1 –32.

– (1996a). "How Retirement Saving Programs Increase Saving". In: *Journal of Economic Perspectives* 10.4, pp. 91–112.

– (1996b). *Personal Retirement Saving Programs and Asset Accumulation: Reconciling the Evidence*. Working Paper 5599. National Bureau of Economic Research.

Prinz, Aloys, Alexandra Reichardt, and Katharina Wrohlich (2003). *Mikroökonomische Analyse der "Riester-Rente"*. deu. Aufsatz in Zeitschriften, Article in journal. München.

Shefrin, Hersh M. and Richard H. Thaler (1988). "The Behavioral Life-Cycle Hypothesis". In: *Economic Inquiry* 26.4, pp. 609–643.

Wagner, Gert G., Joachim R. Frick, and Jürgen Schupp (2007). "The German Socio-Economic Panel Study (SOEP) - Scope, Evolution and Enhancements". In: *Schmollers Jahrbuch* 127.1, pp. 139–169.

White, Buttrill B. (1978). "Empirical Tests of the Life Cycle Hypothesis". In: *The American Economic Review* 68.4, pp. 547–560.

Wilke, Felix (2012). "Riester-Vorsorge zwischen Theorie und empirischer Evidenz: Wie hilfreich ist das Lebenszyklusmodell?" In: *WSI-Mitteilungen* 03, pp. 189–197.

# 8 Appendix

Table A1: Summary statistics: Means, standard deviations, medians

| | | By Riester Participation | | By Riester Eligibility | |
| --- | --- | --- | --- | --- | --- |
| | Entire Sample | Participants | Non-Participants | Eligibles | Non-Eligibles |
| *Treatment:* | | | | | |
| Participation in Riester | 0.24 | | | 0.28 | 0.00 |
| | (0.43) | | | (0.45) | (0.00) |
| *Instrument:* | | | | | |
| Eligibility for Riester | 0.85 | 1.00 | 0.80 | | |
| | (0.36) | (0.00) | (0.40) | | |
| *Outcome variables:* | | | | | |
| Δ Total wealth | 32,493 | 62,710 | 23,114 | 31,604 | 37,529 |
| | (653,449) | (248,871) | (734,860) | (687,142) | (414,039) |
| | [9,246] | [19,266] | [5,918] | [12,178] | [0] |
| Δ Financial assets | 10,641 | 15,436 | 9,152 | 11,537 | 5,556 |
| | (114,924) | (133,479) | (108,513) | (100,328) | (176,225) |
| | [2,036] | [8,261] | [57] | [3,707] | [-509] |
| Δ Non-PI assets | 15,491 | 20,127 | 14,052 | 15,591 | 14,928 |
| | (103,951) | (127,968) | (95,264) | (86,491) | (172,396) |
| | [3,619] | [6,603] | [3,000] | [4,450] | [0] |
| Δ Housing wealth | 22,827 | 25,675 | 21,944 | 21,092 | 32,665 |
| | (237,624) | (184,636) | (251,846) | (244,788) | (191,976) |
| | [0] | [0] | [0] | [0] | [0] |
| Δ Business assets | 51 | 9,699 | -2,944 | -3,586 | 20,669 |
| | (444,548) | (198,977) | (496,668) | (468,295) | (272,880) |
| | [0] | [0] | [0] | [0] | [0] |
| *Covariates:* | | | | | |
| Net income | 39,763 | 42,670 | 38,861 | 41,035 | 32,556 |
| | (50,987) | (23,855) | (56,807) | (53,820) | (29,292) |
| | [34,800] | [38,400] | [33,600] | [36,000] | [23,520] |
| Age | 49.79 | 46.47 | 50.82 | 48.83 | 55.27 |
| | (8.86) | (7.31) | (9.04) | (8.45) | (9.13) |
| Family size | 2.65 | 3.08 | 2.52 | 2.77 | 1.96 |
| | (1.25) | (1.26) | (1.21) | (1.24) | (1.05) |
| Married | 0.65 | 0.71 | 0.64 | 0.70 | 0.41 |
| | (0.48) | (0.45) | (0.48) | (0.46) | (0.49) |
| Years education | 12.77 | 13.12 | 12.66 | 12.79 | 12.65 |
| | (2.73) | (2.71) | (2.73) | (2.71) | (2.86) |
| Home owner | 0.56 | 0.60 | 0.55 | 0.56 | 0.54 |
| | (0.50) | (0.49) | (0.50) | (0.50) | (0.50) |
| Risk preferences | 4.83 | 4.69 | 4.88 | 4.83 | 4.84 |
| | (2.13) | (2.00) | (2.16) | (2.10) | (2.28) |
| | | | | | |
| Observations | 2,761 | 654 | 2,107 | 2,347 | 414 |

Standard deviations are in parentheses and medians for asset measures and income are in brackets. Source: GSOEP v29, own calculations.

Table A2: Means, standard deviations and medians for asset measures in levels for 2002 and 2012

| | 2002 | | | | | 2012 | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | By Riester Participation | | By Riester Eligibility | | | By Riester Participation | | By Riester Eligibility | |
| | Entire | | Non- | | Non- | Entire | | Non- | | Non- |
| | Sample | Participants | Participants | Eligibles | Eligibles | Sample | Participants | Participants | Eligibles | Eligibles |
| Total wealth | 190,432 | 154,771 | 201,501 | 183,875 | 227,607 | 222,925 | 217,481 | 224,614 | 215,479 | 265,136 |
| | (1,476,567) | (369,969) | (1,677,602) | (1,590,208) | (451,910) | (978,585) | (425,830) | (1,094,886) | (1,030,838) | (601,179) |
| | [42,213] | [50,450] | [40,984] | [38,665] | [75,779] | [88,300] | [103,120] | [80,440] | [87,467] | [91,932] |
| Financial assets | 39,628 | 38,200 | 40,071 | 36,263 | 58,700 | 50,268 | 53,636 | 49,223 | 47,801 | 64,256 |
| | (118,078) | (161,869) | (100,733) | (105,957) | (170,213) | (142,318) | (116,185) | (149,513) | (102,293) | (275,112) |
| | [14,901] | [17,564] | [14,286] | [14,599] | [17,564] | [20,000] | [27,220] | [17,242] | [21,320] | [11,258] |
| Non-PI assets | 13,052 | 9,754 | 14,075 | 10,395 | 28,113 | 28,543 | 29,881 | 28,127 | 25,985 | 43,041 |
| | (93,939) | (128,204) | (80,400) | (78,944) | (152,655) | (126,701) | (100,738) | (133,757) | (81,016) | (264,100) |
| | [0] | 2,871 | [0] | [0] | [0] | [6,770] | [10,000] | [5,280] | [7,500] | [1,865] |
| Housing wealth | 56,325 | 43,951 | 60,166 | 53,162 | 74,256 | 79,152 | 69,626 | 82,109 | 74,254 | 106,921 |
| | (303,529) | (179,362) | (332,720) | (315,983) | (219,423) | (245,798) | (220,446) | (253,127) | (244,199) | (253,188) |
| | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [10,000] |
| Business assets | 45,594 | 26,579 | 51,496 | 46,462 | 40,672 | 45,645 | 36,278 | 48,552 | 42,876 | 61,341 |
| | (1,145,403) | (223,376) | (1,305,276) | (1,239,888) | (186,766) | (803,206) | (214,335) | (911,703) | (863,461) | (275,604) |
| | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] | [0] |

Standard deviations are in parentheses and medians are in brackets. Source: GSOEP v29, own calculations.

Table A3: OLS and 2SLS estimates of Riester participation

| | Δ Total wealth | | Δ Financial assets | | Δ Non-PI assets | | Δ Housing wealth | | Δ Business assets | |
|---|---|---|---|---|---|---|---|---|---|---|
| | OLS | 2SLS | OLS | 2SLS | OLS | 2SLS | OLS | 2SLS | OLS | 2SLS |
| Riester participation | 12,136 | -179,981 | 1,307 | 347 | 5,474 | -6,815 | 643 | -58,336 | 3,102 | -182,431* |
| | (16,517) | (145,424) | (5,450) | (39,208) | (5,000) | (36,660) | (9,354) | (56,968) | (11,394) | (102,439) |
| Net income | | | | | | | | | | |
| ≤€20K | | | | | baseline category | | | | | |
| €20-30K | -6,904 | 2,777 | 8,270** | 8,319* | 6,265* | 6,884 | -3,528 | -556 | -7,021 | 2,328 |
| | (12,697) | (13,874) | (3,835) | (4,956) | (3,413) | (4,627) | (7,307) | (8,127) | (7,473) | (8,640) |
| €30-40K | -534 | 10,022 | 14,121*** | 14,173** | 12,304** | 12,980** | -1,497 | 1,744 | -8,055 | 2,140 |
| | (17,846) | (18,199) | (5,181) | (6,397) | (4,820) | (6,130) | (11,789) | (12,485) | (9,828) | (10,292) |
| €40-50K | 44,862* | 57,633** | 19,991*** | 20,055*** | 13,814*** | 14,631** | 12,360 | 16,280 | 10,819 | 23,152 |
| | (26,732) | (25,688) | (5,845) | (7,329) | (5,016) | (6,635) | (11,256) | (12,262) | (20,278) | (19,441) |
| >€50K | 39,610 | 48,595 | 45,442*** | 45,487*** | 40,604*** | 41,179*** | 32,216 | 34,974 | -23,892 | -15,214 |
| | (72,062) | (68,737) | (9,629) | (10,661) | (8,861) | (9,956) | (21,703) | (21,275) | (49,081) | (47,049) |
| Age | | | | | | | | | | |
| 17-25 | | | | | baseline category | | | | | |
| 26-35 | 63,827* | 12,4011* | 3,153 | 3,454 | -1,555 | 2,295 | -9,283 | 9,193 | 45,127 | 10,3247* |
| | (36,700) | (75,102) | (7,942) | (14,605) | (7,032) | (12,787) | (14,963) | (26,150) | (29,384) | (56,496) |
| 36-45 | 48,566 | 106,268 | 2,744 | 3,033 | -954 | 2,737 | -4,692 | 13,022 | 22,163 | 77,887 |
| | (37,905) | (74,463) | (8,592) | (15,030) | (7,445) | (12,767) | (14,083) | (25,575) | (28,092) | (52,300) |
| 46-55 | 27,596 | 84,617 | 7,336 | 7,621 | 5,319 | 8,967 | 10,974 | 28,479 | 19,408 | 74,475 |
| | (42,501) | (76,760) | (6,499) | (133,589) | (5,260) | (11,250) | (15,086) | (26,331) | (29,020) | (52,648) |
| 56-65 | -22,733 | 3,954 | 414 | 547 | 7,571 | 9,278 | 10,729 | 18,921 | -3,771 | 22,002 |
| | (25,385) | (38,367) | (7,836) | (10,999) | (6,927) | (9,907) | (12,873) | (16,239) | (19,362) | (27,400) |
| Family size | | | | | | | | | | |
| 1-2 | | | | | baseline category | | | | | |
| 3-4 | 37,282 | 51,440 | -178 | -107 | -6,495* | -5,590 | 15,108 | 19,454 | 16,417 | 30,089 |
| | (33,446) | (40,819) | (4,782) | (5,678) | (3,565) | (4,433) | (12,115) | (13,462) | (22,302) | (27,823) |
| >4 | 27,044 | 47,981 | 13,231 | 13,336 | 2,096 | 3,435 | -14,025 | -7,598 | 45,809 | 66,027 |
| | (91,557) | (94,918) | (15,989) | (16,584) | (15,059) | (15,695) | (28,294) | (29,171) | (63,893) | (66,230) |

*(Continued)*

(Table A3 *Continued*)

| | Δ Total wealth | | Δ Financial assets | | Δ Non-PI assets | | Δ Housing wealth | | Δ Business assets | |
|---|---|---|---|---|---|---|---|---|---|---|
| | OLS | 2SLS | OLS | 2SLS | OLS | 2SLS | OLS | 2SLS | OLS | 2SLS |
| Married | -42,188** | -41,648** | -9,268 | -9,265 | -2,488 | -2,453 | -13,725 | -13,560 | -15,796 | -15,275 |
| | (17,876) | (17,874) | (6,889) | (6,792) | (6,596) | (6,494) | (8,652) | (8,639) | (10,367) | (10,757) |
| Years education 7-10 | | | | | baseline category | | | | | |
| 11-13 | -3,582 | 5,695 | 5,910 | 5,956 | 4,340 | 4,933 | -8,916 | -6,068 | -344 | 8,615 |
| | (17,788) | (16,552) | (4,862) | (5,193) | (3,537) | (3,882) | (10,483) | (10,215) | (12,183) | (12,007) |
| 14-16 | 29,485 | 45,878 | 8,198 | 8,280 | 555 | 1,603 | 4,451 | 9,484 | 17,700 | 33,531 |
| | (26,448) | (34,329) | (6,193) | (6,882) | (4,547) | (4,825) | (14,494) | (15,382) | (16,718) | (22,922) |
| >16 | 44,027 | 60,598 | 21,668** | 21,751 | 9,179** | 10,239 | 12,366 | 17,454 | 11,622 | 27,626 |
| | (52,595) | (59,581) | (9,387) | (10,710) | (8,149) | (9,905) | (21,725) | (22,130) | (30,263) | (36,442) |
| Home owner | 56,415** | 57,250** | 2,430 | 2,434 | 8,170*** | 8,223*** | 33,494*** | 33,750*** | 4,535 | 5,341 |
| | (22,513) | (22,677) | (3,724) | (3,752) | (3,065) | (3,142) | (9,002) | (9,060) | (11,688) | (12,007) |
| Risk preferences 0-2 | | | | | baseline category | | | | | |
| 3-5 | 5,909 | 9,738 | -6,278 | -6,258 | -4,503 | -4,258 | 7,507 | 8,682 | 1,056 | 4,753 |
| | (12,331) | (13,539) | (4,075) | (4,146) | (3,030) | (3,134) | (8,729) | (8,927) | (7,182) | (8,774) |
| 6-8 | -19,250 | -21,958 | -3,689 | -3,703 | -319 | -492 | 2,452 | 1,620 | -18,737 | -21,353 |
| | (29,916) | (31,158) | (5,870) | (5,654) | (5,197) | (4,954) | (11,974) | (12,181) | (19,252) | (20,389) |
| 9-10 | 160,091 | 147,337 | -13,033 | -13,097 | -12,150 | -12,966* | 11,658 | 7,743 | 148,802 | 136,486 |
| | (155,751) | (155,880) | (9,126) | (9,354) | (7,379) | (7,678) | (16,173) | (16,657) | (154,887) | (154,838) |
| Constant | -34,344 | -64,246 | -11,360 | -11,510 | -7,146 | -9,059 | -8,431 | -17,610 | -11,735 | -40,612 |
| | (25,861) | (41,438) | (7,303) | (10,306) | (5,681) | (8,532) | (15,759) | (18,851) | (15,780) | (27,494) |
| First stage | | | | | 0.213*** | | | | | |
| | | | | | (0.012) | | | | | |
| F-statistic | | | | | 328.457 | | | | | |

$^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$. Robust standard deviations are in parentheses. Source: GSOEP v29, own calculations.

Table A4: QR and CQTE estimates of Riester participation

| Quantile | Estimator | Δ Total wealth | Δ Financial | Δ Non-PI | Δ Housing | Δ Business |
|---|---|---|---|---|---|---|
| 15th | QR | 6,094 | -549 | 482 | 8,354 | 0 |
| | | (4,434) | (4,138) | (2,080) | (8,850) | (1,066) |
| | CQTE | 168,706* | 24,519*** | 46,195*** | 9,663 | 9,721*** |
| | | (96,236) | (9,226) | (15,988) | (12,772) | (3,451) |
| 25th | QR | 4,095 | -217 | 739 | 0 | 0 |
| | | (3,547) | (2,292) | (964) | (2,553) | n.a. |
| | CQTE | 79,601 | 18,756*** | 23,569** | 0 | 0 |
| | | (80,133) | (6,019) | (11,025) | (8,821) | (2,683) |
| 40th | QR | 2,204 | 2,581** | 919 | 0 | 0 |
| | | (2,223) | (1,245) | (728) | (1,081) | n.a. |
| | CQTE | 29,682 | 10,482** | 5,349 | 0 | 0 |
| | | (32,616) | (4,858) | (5,872) | (9,965) | (2,837) |
| 50th | QR | 1,767 | 3,036** | 2,072*** | 0 | 0 |
| | | (1,782) | (1,330) | (795) | (2,374) | n.a. |
| | CQTE | 15,778 | 7,620 | 3,591 | 0 | 0 |
| | | (28,368) | (4,803) | (6,352) | (9,813) | (3,055) |
| 60th | QR | 2,523 | 3,738*** | 2,725*** | 0 | 0 |
| | | (2,355) | (1,240) | (986) | (17,043) | n.a. |
| | CQTE | 7,429 | 6,253 | 1,057 | 0 | 0 |
| | | (29,659) | (5,045) | (7,056) | (11,356) | (3,344) |
| 75th | QR | 3,685 | 4,244*** | 3,735** | -321 | 0 |
| | | (3,079) | (1,400) | (1,860) | (4,591) | n.a. |
| | CQTE | -888 | -5,067 | -13,709 | -27,680 | 0 |
| | | (35,234) | (6,449) | (8,344) | (21,073) | (3,876) |
| 85th | QR | -778 | 2,602 | 4,933** | -6,144 | 0 |
| | | (4,423) | (2,730) | (2,027) | (8,717) | (15,523) |
| | CQTE | -89,255 | -14,630* | -28,959* | -60,685** | -25,000*** |
| | | (240,151) | (8,074) | (17,042) | (27,949) | (4,781) |

$^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$. Robust standard deviations are in parentheses. Source: GSOEP v29, own calculations.

Table A5: CQTE estimates of Riester participation with smaller smoothing parameters

| Quantile | Δ Total wealth | Δ Financial | Δ Non-PI | Δ Housing | Δ Business |
|---|---|---|---|---|---|
| 15th | 61,099*** | 16,014** | 15,190*** | -1,222 | 12,564*** |
| | (18,289) | (6,775) | (4,628) | (4,681) | (3,379) |
| 25th | 31,473** | 14,307*** | 3,833 | 0 | 0 |
| | (12,208) | (4,773) | (2,805) | (4,928) | (2,506) |
| 40th | 15,318 | 9,831** | 1,931 | 0 | 0 |
| | (10,049) | (4,107) | (2,880) | (4,696) | (2,697) |
| 50th | 9,135 | 7,567* | 3,776 | 0 | 0 |
| | (10,043) | (4,086) | (2,953) | (5,111) | (2,943) |
| 60th | -279 | 5,956 | 3,893 | 0 | 0 |
| | (10,425) | (4,206) | (3,076) | (5,404) | (3,260) |
| 75th | -6,178 | 266 | 165 | 0 | 0 |
| | (11,605) | (5,087) | (3,759) | (5,718) | (3,830) |
| 85th | -22,893 | -9,666 | -1,100 | -16,159*** | -20,000*** |
| | (13,969) | (6,159) | (4,640) | (5,761) | (4,151) |

$^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$. Robust standard deviations are in parentheses. Source: GSOEP v29, own calculations.

Table A6: CQTE estimates of Riester participation with 0.1 trimming

| Quantile | Δ Total wealth | Δ Financial | Δ Non-PI | Δ Housing | Δ Business |
|---|---|---|---|---|---|
| 15th | 161,613* | 30,334*** | 36,205** | 15,891 | 642 |
| | (93,660) | (8,718) | (17,187) | (18,908) | (2,659) |
| 25th | 66,230 | 13,417** | 10,264 | 0 | 0 |
| | (84,909) | (6,324) | (7,483) | (15,725) | (2,593) |
| 40th | 26,233 | 11,847* | 4,629 | 0 | 0 |
| | (35,416) | (6,102) | (7,486) | (14,872) | (2,802) |
| 50th | 13,650 | 8,945 | 4,201 | -5,302 | 0 |
| | (30,604) | (6,193) | (8,236) | (15,268) | (3,059) |
| 60th | 12,690 | 4,834 | -1,683 | -14,004 | 0 |
| | (32,846) | (6,694) | (8,251) | (14,872) | (3,387) |
| 75th | -1,064 | -1,640 | -17,882* | -46,398 | 0 |
| | (35,536) | (7,018) | (9,110) | (32,905) | (3,768) |
| 85th | -17,215 | -14,485* | -24,736** | -56,206 | 0 |
| | (41,191) | (8,182) | (10,608) | (37,816) | (4,830) |

$^{*}$ $p < 0.1$, $^{**}$ $p < 0.05$, $^{***}$ $p < 0.01$. Robust standard deviations are in parentheses. 1,355 observations are left after trimming. Source: GSOEP v29, own calculations.