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ARTICLE

Targets missed: three case studies exploiting the linked SHARE-RV data

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Abstract

Targeting is an important aim of social policy. Three case studies in this paper reflect typical shortcomings in the targeting design of pension reforms. The first case study examines how well work disability and receipt of disability insurance match in Germany. We show that the 2001 reform has not systematically improved target quality. The second case study examines whether the 2014 introduction of a new pathway of early retirement without actuarial adjustments has reached individuals who are less healthy because they have worked a long time in an arduous job. We find that the target population is actually healthier than the comparison group. Third, a much discussed supplemental pension benefit for households in the risk of poverty will miss its target population in both relevant directions: Regarding the first, 23% of those pensioners who are not eligible are nevertheless poor in the sense of the new law. Regarding the other direction, 21% of the eligible pensioners belong to the wealthier half of German pensioners. Since similar reforms are currently debated in many European countries, the three German case studies may serve as examples of how to better target public pension policies.

Key words: Disability insurance; old-age poverty; retirement; social security and public pensions; work disability

JEL codes: H55; J21; J26

Introduction

Targeting is an important aim of social policy. Since tax money is a precious resource, social expenditures need to be carefully targeted to those who are in need as defined by the policy makers. Social policy can err on both sides: by giving too little to those who need help, and too much to those who are not in need of help. This paper has two aims. It examines the targeting success of three public pension policies in Germany, and it demonstrates the usefulness of linked survey-administrative data for this purpose. We define targeting success by the aims that policy makers have set, i.e., we do not apply general welfare criteria but simply compare the outcome of certain pension policies with what the policy makers have claimed to be their aims.

We choose pension policies since in almost all developed countries public pensions are the largest social policy area in terms of individuals covered and resources involved. The most important pension policy instruments are the eligibility for retirement pathways (e.g., various types of old-age pensions, disability insurance (DI)), the full pensionable age, and the replacement rate of pension benefits. Reforms of these key parameters have been made in Germany in 2001 when the eligibility criteria for disability benefits have been changed; in 2014 when earlier retirement without actuarial

adjustments was introduced for those whose health may have suffered from an exceptionally long work history. A third reform was hotly debated but was eventually passed by the parliament. The reform will come into force on January 1, 2021. Its intention is to provide pension supplements for individuals who have pension incomes that are above the eligibility threshold for social assistance but below the threshold defined by being at risk of poverty.

All three case studies use the German subsample of the Survey of Health, Ageing and Retirement in Europe (SHARE) with its linkage to the administrative records of the German public pension system (SHARE-RV). The SHARE survey data contain a rich array of policy outcome variables such as household income and health after retirement while the administrative data measure precisely who is eligible for benefits and who was or will be affected by the three reforms.

The paper begins with a very brief sketch of the German public pension system and a description of our data. The three case studies then form the core of the paper. In the first study, we use the linked SHARE-RV data to examine whether the reform of the DI program in 2001 has changed the relationship between reporting a work disability (WD) and receiving disability benefits. We compare health, duration of benefit receipt and labor market behavior of recipients of DI benefits before and after the reform. We find that the match quality, defined as the match between those who report a WD and receive DI benefits, has not improved after the 2001 reform. About a quarter of the population between 50 and 65 report a WD and do not receive DI benefits. After the 2001 reform, individuals receive DI benefits later in their career but not have worse health than before the reform. Finally, while the duration of DI benefit receipt is shorter after the reform, this only reflects a faster transition into old-age pensions rather than an uptake of employment.

The second study examines the targeting success of an early retirement pathway aimed at individuals who have worked in an arduous job for a long time. We compare the health status of individuals who qualify for this pathway with a comparable group which does not qualify but has a similar working career. Our main finding is that those who qualify on average do not have worse health, which is in contrast with the intended aim of the policy. We also find that eligible pensioners do not have lower incomes compared to non-eligible but otherwise similar pensioners.

Focus of the third case study is the introduction of a public pension supplement targeted at pensioners with 'modest incomes'. This controversial supplement has a long history of previous attempts which all failed to target as intended. This new attempt includes a complex set of requirements to target more precisely. It requires a minimum of service years and a maximum of household income other than the individual pension but ignores wealth. All this information is available in the SHARE-RV data but only partially to the public pension authority. We find that eligible households indeed have on average lower household incomes and wealth. However, the service-years requirement leads to a large number of pensioners with little income to be ineligible; in turn, many eligible pensioners have considerable wealth. Hence, targeting success is low on both sides: the new law reaches too few individuals who are in need of support and grants eligibility to too many who are not in need.

The paper finishes with a short overall conclusion. As the paper's title suggests, our conclusion is somewhat muted. Since similar reforms are currently debated in many European countries, the three German case studies may serve as examples of how to better target public pension policies.

Retirement pathways and public pension benefits in Germany

The German public pension system is by far the largest pillar of old-age provision and delivers about 80% of retirement income in Germany.[1] It features four main pathways to receiving old-age pensions:

(a) Workers are vested for normal retirement benefits once they have contributed 5 years to the system. This includes contributions on behalf of the worker during times of unemployment and child care. Eligibility starts at age 65 which is being gradually increased to age 67.

[1]See Börsch-Supan *et al.* (2018*a*) and OECD (2017) for detailed descriptions of the German pension system. Further details are given in each of the three case studies.

(b) Workers with at least 35 insurance years can retire up to 2 years earlier but their benefits are reduced by 3.6% for each year of earlier retirement.
(c) A reform in 2014 introduced a third pathway which is substantially more generous: Workers with at least 45 service years can receive full pension benefits at age 63 without actuarial deductions. This pathway's eligibility age of 63 will increase gradually to 65 in parallel to the increase of the normal retirement age. This reform is the subject of the second case study.
(d) Finally, there is DI. Benefits are given to workers with a medically-documented WD. The reform of these rules in 2001 is subject to the first case study. DI benefits correspond to the level of old-age pension benefits that would have been achieved if the individual had worked until the normal retirement age. Actuarial adjustments apply but are capped at 10.8%.

Contributions to the pension system are proportional to earnings. Similarly, benefits are proportional to earnings points which play a central role in the German public pension system. In every year of the individuals' contribution histories, the individuals earn one point if they receive average earnings. For lesser or higher amounts, earnings points change in proportion.[2] The German public pension system thus does not redistribute between richer and poorer workers. There is, however, social assistance which effectively serves as a minimum pension. Social assistance is financed by general taxes. Since social assistance benefits are substantially below the EU-defined threshold for being at risk of poverty, currently discussed reform proposals intend to make parts of the German public pension system more redistributive. This is the subject of the third case study.

Main data sources: SHARE, SHARE-RV, and SHARELIFE

The SHARE includes a wide range of micro-data on socio-economic status, social and family networks, as well as health across European countries. SHARE Release 7.0.0 provides a multidisciplinary and cross-national database with currently about 140,000 individuals aged 50 or older in 28 countries. A detailed description can be found in Börsch-Supan *et al.* (2013).

The German SHARE subsample has been linked with the official employment history records of the German public pension system. The resulting data set is called SHARE-RV (Börsch-Supan *et al.*, 2018*b*). The combination of accurate administrative data and rich information about different aspects of the respondents' lives in SHARE-RV provide a wide range of research possibilities. SHARE-RV is based on direct linkage, meaning that the records of exactly the same SHARE respondents were linked using the respondents' Social Security Number (SSN) as a unique identifier. Respondents are asked for written consent during the interview on a form, which also collects the respondent's SSN and some basic demographics to identify persons if the SSN is erroneous. Since not all respondents give consent and not all Germans are enrolled in the public pension system, SHARE-RV is a subset ($N = 2{,}937$) of the German SHARE data ($N = 4{,}933$). One limitation of the data is therefore that the sample size is relatively small, once we look at certain income or health segments. On the other side, however, SHARE-RV has a much richer data set than the larger data set of administrative records of the German Social Security system. In particular, SHARE offers data on socio-demographics not available in administrative data. For retirement analyses, for instance, SHARE obtains information about the household context, rich socio-economic characteristics, education, and very detailed health measures. In turn, the administrative data part of SHARE-RV carries very precise information on employment and contribution histories. This permits the identification of eligibility for different retirement pathways and information on benefit entitlements.

In Waves 3 and 7, SHARE fielded a life-history questionnaire (SHARELIFE). Retrospect questions included the family, health, employment, and earnings history, childhood conditions, and parental information.

Since the data requirements for each case study are slightly different, we give in each section detailed information on our analytical samples and describe the specific variables used.

[2]Contributions and benefits are capped at about two earnings points per year.

Targeting disability insurance

This first case study investigates the targeting quality of the DI system in Germany. The purpose of DI is to protect people with functional impairments that limit their ability to work. On the one hand, DI is a welcome and necessary part of the social safety net as it prevents income losses for those who lose their ability to work before they are eligible to ordinary old-age pension benefits. On the other hand, DI may be misused as an early retirement route even if the normal ability to work is not affected at all. Proper targeting is therefore an important issue.

Earlier research on WD in an international perspective showed that the targeting quality is very different across countries (Börsch-Supan *et al.*, 2020). In many countries, the rates of self-reported WD and DI benefit receipt match each other more or less. In some countries, DI benefit rates are much higher than the rates of self-reported disability (e.g., Sweden and the Czech Republic) while in other countries the fraction of persons with self-reported disabilities is much higher than those receiving DI benefits (e.g., France and Germany).[3] Counterfactual simulations showed that most of the variation between countries is explained by differences in DI policies.

In Germany, the disability pathway provided a frequently used option into early retirement before the age of 65, at which disability benefits are converted into old-age pensions. Figure 1 shows that the proportion of individuals who have entered the German public pension system via the disability pathway was very high in the 1980s but then shrank considerably. This may suggest that targeting was initially poor and has improved. Since the early 1980s, there was a string of technical reforms, enforcing stricter medical examinations and tighter eligibility criteria for disability pensions of at least three contribution years in the last 5 years. At the same time, the requirements for regular old-age pensions were relaxed and from 1985 onwards only five contribution years were sufficient instead of 15 years. Both measures produced the sharp decline in DI receipt among women after 1982 (OECD, 2003; Börsch-Supan and Jürges, 2012; Burkhauser *et al.*, 2016).

Our first case study exploits the fact that the DI system became less generous after the reform of the German DI system in 2001. We follow Hanel (2012) and use administrative records of DI receipt and can therefore reliably assign the persons into two groups depending on whether their first DI receipt was before or after the year 2001. In addition, we employ the German SHARE data to better describe the characteristics of those who receive DI benefits and those who do not. We then compare these two groups to evaluate the impact of the reform on the DI receipt and the matching quality.

The reform in 2001 fundamentally changed the nature of the German DI (Table 1) with the aim to 'better target work disabled individuals and to terminate insuring labor market risks' (Deutscher Bundestag, 2000). Before 2001, DI distinguished between occupational disability (Berufsunfähigkeitsrente) and general disability (Erwerbsunfähigkeitsrente). Persons who were not able to work in their former job or a job requiring a similar degree of qualification received occupational disability pensions amounting to two-thirds of full old-age pension entitlements. Persons who were not able to perform any kind of job received general disability benefits amounting to the full old-age pension entitlements. The medical assessment is performed by specialized insurance physicians who assess the working capacity based on a physical examination. In addition to this assessment, the medical files of the applicant are taken into account. They include the history of earlier treatments and insurance claims (OECD, 2003).

After 2001, the two different types of disability pensions were replaced by a unified disability pension (Erwerbsminderungsrente), which no longer considers the work qualification of the person concerned, but solely considers the number of hours the person is still able to work (6 or 3 hours a day). In addition, all disability benefits are reduced by 10.8% if claiming takes place prior to age 60. Most importantly, after 2001 disability benefits are granted only up to a maximum of 3 years, requiring a re-examination every 3 years. Unlike before the reform, unlimited allowances are only possible if

[3]The paper reports the percentage of respondents for which work disability and DI receipt coincide, similar to Table 2 below: Austria 79.7%, Germany 77.3%, Sweden 88.4%, the Netherlands 83.9%, Spain 87.0%, Italy 90.4%, France 79.9%, Denmark 82.0%, Switzerland 91.2%, Belgium 83.2%, Czech Republic 88.2%, UK 84.1%, USA 81.3%.

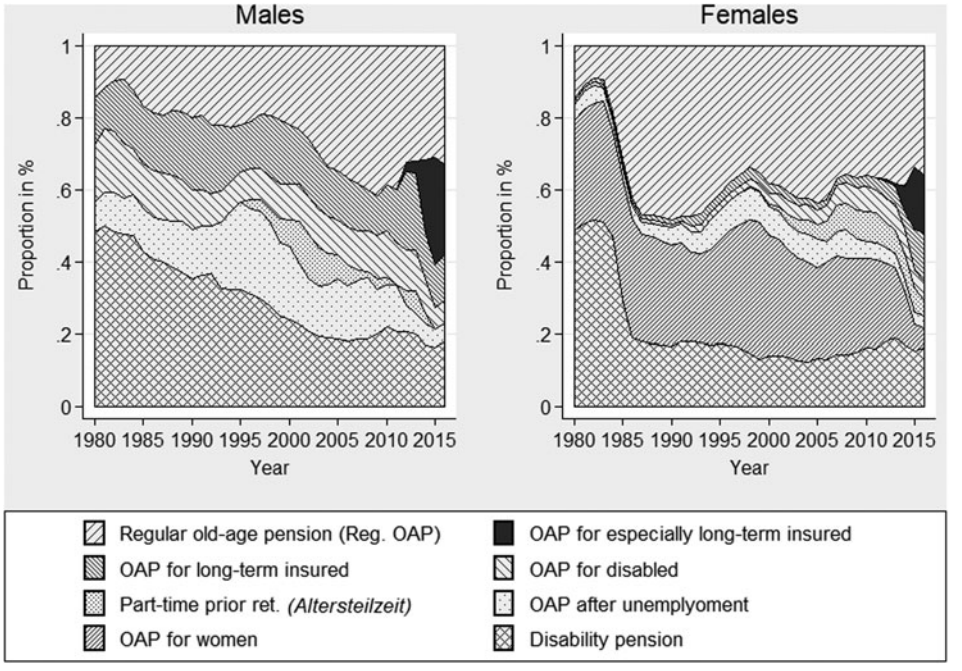

Figure 1. Pathways to retirement (percentage of newly claimed pensions in each year).
Source: Deutsche Rentenversicherung, (2017).

the earnings incapacity is deemed irrevocable. The medical screening process remains unchanged. The reform applies to individuals who enter disability retirement after January 1, 2001. The benefits of individuals entering prior to that date remain unchanged.

In a first step, we use the framework of Börsch-Supan *et al.* (2020) and measure target quality by comparing self-reported WD and receipt of DI benefits for each year in SHARE Waves 2–6. Our sample unit is therefore person-years and comprises all person-years in SHARE which have been merged with the administrative data of the German public pension system. It includes 5,125 person-wave observations.

We define WD by using information from the question '*Do you have any health problem or disability that limits the kind or amount of paid work you can do?*' in the SHARE data.

Based on the exact date of the interview, we merge the corresponding employment status from the administrative data which are available on a monthly basis. We therefore have reliable information on DI receipt at the time of the SHARE interview. This is important since benefit receipt data are subject to considerable measurement error because respondents are often ill-informed about the pathway to retirement they have taken.

Table 2 shows the match between the two binary variables WD and DI:

If the DI system would work perfectly and there would be no reporting errors or bias, we should see a perfect match between the fraction of people with a WD and the fraction of people with disability receipt. That is, everyone with a limitation should receive benefits and nobody without a limitation should receive benefits (assuming that there are no reporting errors in WD and DI receipt). In our sample, 74.65% are correctly matched in the sense that they have a WD and receive DI or have no WD and do not receive DI. In total, 1,182 individuals (24.60%), however, have a self-reported WD but receive no DI benefits. In turn, 37 individuals (0.76%) receive DI but do not report any WD.

Table 3 examines whether the matching quality between WD and DI receipt has improved after the 2001 reform. We split the sample by the starting date of DI receipt.

Table 1. Reform of the disability insurance system in Germany

	Before reform in 2001	
	Occupational disability	*General disability*
Recipients	Persons who are not able to work in their former job or a job requiring a similar degree of qualification	Persons who are not able to perform any kind of job, regardless of his/her qualifications
Amount	Two-thirds of full old-age pension entitlements	Full old-age pension entitlements
Duration	No defined limitation	
Assessment	Social-medical consultants assess capability by medical examinations and based on medical files	
	After reform in 2001	
	Partial disability	*Full disability*
Recipients	Persons who are not able to work at least 6 hours per day in the general job market and whose disabilities are unlikely to change in the future	Persons who are not able to work at least 3 hours per day in the general job market and whose disabilities are unlikely to change in the future
Amount	Disability benefits depend on old-age pension entitlements, which are reduced by 10.8% if claiming takes place prior to age 63	
Duration	Up to a maximum of 3 years; can be extended if the requirements are fulfilled based on the medical assessment. Unlimited allowances only possible if the earnings incapacity is irrevocable (e.g., after 9 years of temporary pensions)	
Assessment	Social-medical consultants assess capability by medical examinations and based on medical files.	

Table 2. Matching self-reported work disability (WD) and disability insurance receipt (DI)

	WD = 0	WD = 1
DI = 0	3,495 71.36% ('Matched')	1,205 24.60% ('WD without DI')
DI = 1	37 0.76% ('DI without WD')	161 3.29% ('Matched')

Table 3. Matching self-reported work disability (WD) and disability insurance receipt (DI) by DI benefit begin

	DI begin before 2001		DI begin after 2001	
	WD = 0	WD = 1	WD = 0	WD = 1
DI = 0	3,495 73.66% ('Matched')	1,205 25.40% ('WD without DI')	3,495 72.02% ('Matched')	1,205 24.83% ('WD without DI')
DI = 1	6 0.13% ('DI without WD')	39 0.82% ('Matched')	31 0.64% ('DI without WD')	122 2.54% ('Matched')

The number of matches is virtually identical in both subsamples (74.48 vs. 74.56). Given DI receipt, the percentage of individuals with a WD is slightly smaller for those who began receiving DI benefits after 2001 (79.7% vs. 86.7%); however, this difference in match quality is not statistically significant.

It is not correct to interpret this difference as a (negative) causal effect of the 2001 reform. Since the SHARE data collection began only in 2004, we observe the match between WD and DI receipt only in the years after the reform. We do not have information on the initial match quality. Moreover, the subsample of individuals who began receiving DI benefits before 2001 are older and have a longer DI benefit duration. This is seen in Table 4. The unit of observation is now individuals (unlike person-years as before), and the study sample includes all DI recipients in SHARE Wave 6 who have been merged with the administrative data and where additional life-course data from SHARELIFE are available. This sample contains $N = 512$ individuals.

In spite of the small sample size, there are many economically important and statistically significant differences between the two subsamples. While gender does not differ much, age at the time of the first DI receipt is by 3 years lower for those who receive DI for the first time before 2001 while they are around 10 years older in Wave 6 than those who received DI only after 2001. The duration of DI receipt differs significantly between the two groups by 4.5 years. This is explained by the fact that DI benefits before 2001 were granted for an indefinite period, whereas after 2001 the allowances were restricted to 3 years and an extension requires a medical re-assessment.

All six health variables are worse for those who began receiving DI benefits earlier. First, we employ the interviewee's self-reported health status which is a categorical variable on a five-point scale from poor (1) to excellent (5). The self-reported health status is one of the most commonly used measures in public health surveys; it captures various physical, emotional, and social aspects of health and has been found to predict mortality (e.g., Idler and Benyamini, 1997; Jylhä, 2009). Self-reported health may, however, suffer from justification bias (Bound, 1991; Sen 2002). Justification bias exists if retired pensioners report a worsening of the individual health status to justify retirement. Therefore, we additionally include further objective health measures. Grip strength (in kg) is our most objective measure of health. The test is performed during the interview. It reflects the overall muscle status of the respondent and has been linked to mortality in previous research (e.g., Gale *et al.*, 2007). Functional health is measured by the number of limitations to perform (instrumental) activities of daily living (ADL and IADL). We also include the number of chronic diseases. Finally, EURO-D measures signs of depression (Prince *et al.*, 1999).

Table 4. DI recipients' characteristics by DI benefit begin

Variable (source)	First DI before 2001		First DI after 2001		Difference	
	Mean	Std. dev	Mean	Std. dev	Delta	*t*-stat
Gender (Wave 6)	0.50	0.50	0.43	0.50	0.07	(1.65)
Age at first DI receipt (VSKT)	55.89	8.25	59.08	5.02	−3.19***	(−5.01)
Age at interview (Wave 6)	76.02	7.97	66.90	6.30	9.13***	(13.87)
Duration of DI receipt in years (VSKT)	7.03	6.91	2.42	3.14	4.61***	(9.05)
Self-reported health (Wave 6)	1.18	0.82	1.27	0.92	−0.10*	(2.38)
Grip strength (Wave 6)	31.24	10.30	36.13	11.34	−4.89***	(−4.87)
Number of ADL limitations (Wave 6)	0.63	1.33	0.26	0.79	0.37***	(3.59)
Number of IADL limitations (Wave 6)	1.14	2.06	0.36	0.99	0.78***	(5.12)
Number of chronic diseases (Wave 6)	2.87	1.93	2.60	1.83	0.27	(1.60)
EURO-D (Wave 6)	2.56	1.87	2.55	2.14	0.02	(0.09)
Number of sickness days (VSKT)	13.05	13.27	12.50	16.20	0.55	(0.42)
Self-reported child health (SHARELIFE)	2.81	1.17	2.65	1.06	0.16	(1.54)
Ever had physical injury (SHARELIFE)	0.16	0.36	0.14	0.35	0.02	(0.53)
Number of illness periods >1 year (SHARELIFE)	0.58	1.17	0.42	0.91	0.16	(1.66)
Observations	211		301		512	

*** $p<0.01$, * $p<0.1$.

In addition, we measure lifetime health status in four dimensions: number of sickness days as reported in the administrative data, self-reported childhood health status, physical injuries, and number of illness periods that lasted more than 1 year as reported by SHARELIFE.

While there are no significant differences in the lifetime health measures, all physical health measures in Wave 6 indicate a worse health status for those who received DI benefits before 2001: Self-reported health is worse, grip strength is significantly lower, and the number of ADL and IADL is significantly higher. There is no significant difference in the number of chronic diseases and the number of depressive symptoms.

One obvious explanation for the worse health of the individuals in the first group is the 10-years of age difference between the two groups. However, more interesting is the question whether the health status is worse once we condition on that age difference and other competing explanations. We therefore perform linear regressions with different health variables as dependent variables and control for the age in Wave 6.[4]

Results are shown in Table 5. Our main result is that the dummy variable indicating whether someone received DI benefits for the first time before or after 2001 has insignificant, ambiguous effects on the health status in Wave 6. We therefore do not find evidence for a better targeting quality, i.e., for the hypothesis that DI benefits after 2001 were granted to persons with worse health and thus more of a need for DI benefits.

Gender has a significant effect only on grip strength. Females have less grip strength than males, and the later in life the first DI benefits are received, the higher is the grip strength in Wave 6. As expected from the summary statistics, age at Wave 6 plays an important role for the health status. The higher the age in wave 6, the higher are the number of chronic diseases, ADL, and IADL. Grip strength is significantly lower with increasing age while self-reported health is not significantly affected. Duration has no significant effects on the health status in Wave 6. Lifetime health measures like childhood health, the number of sickness days and injuries significantly influence the number of chronic diseases and self-reported health.

We finally examine whether the duration of DI receipt has changed after the 2001 reform. We use information from the administrative records of SHARE-RV. We keep only those individuals who have at least one spell of DI receipt and who have spells in the data for at least 4 years after the first time of

[4]The variable 'duration' is the duration of actual benefit receipt. Since benefit receipt can be interrupted, we can control for age at first DI receipt, age at interview and duration simultaneously.

Table 5. Health status in Wave 6 for DI recipients

	Number of chronic diseases	Number of ADL	Number of IADL	Grip strength	Self-reported health
First DI after 2001	0.104	−0.170	−0.251	1.953	−0.160
	(0.263)	(0.151)	(0.220)	(1.089)	(0.123)
Gender	0.165	−0.039	0.087	−16.263	0.091
	(0.165)	(0.095)	(0.138)	(0.688)**	(0.077)
Age first DI receipt	0.018	0.003	−0.011	−0.035	0.001
	(0.020)	(0.011)	(0.016)	(0.083)	(0.009)
Age Wave 6	0.020	0.011	0.042	−0.225	−0.007
	(0.016)	(0.009)	(0.014)**	(0.068)**	(0.008)
Duration	0.038	0.022	0.022	0.069	0.014
	(0.022)	(0.013)	(0.018)	(0.092)	(0.010)
Child health	0.224	−0.033	−0.002	−0.813	0.030
	(0.074)**	(0.042)	(0.062)	(0.309)**	(0.034)
Sickness days	0.020	0.008	0.005	−0.005	0.010
	(0.006)**	(0.003)*	(0.005)	(0.023)	(0.003)**
Ever had injury	0.603	−0.062	−0.085	−0.782	0.257
	(0.233)**	(0.134)	(0.195)	(0.971)	(0.109)*
Illness periods	0.025	0.041	0.029	−0.326	0.038
	(0.084)	(0.048)	(0.070)	(0.350)	(0.039)
Constant	−0.980	−0.525	−1.689	60.319	3.829
	(1.269)	(0.727)	(1.062)	(5.227)**	(0.594)**
R^2	0.08	0.05	0.08	0.59	0.10
N	512	512	512	475	512

*p < 0.05; **p < 0.01; Standard errors in parentheses.

DI receipt.[5] This leads to a study sample of $N = 720$ individuals. We divide our sample into two groups depending on whether the first time of DI receipt is before ($N = 362$) or after the year 2001 ($N = 358$). Figure 2 displays a sequence analysis for the employment status after the first DI receipt.

Figure 2 shows that those persons receiving DI benefits for the first time before 2001 are granted benefits much longer than those receiving benefits for the first time after 2001. Most of the persons from the second group transfer into old-age pension even before the first year of DI benefit receipt is over. This means that DI benefit receipt is still a pathway into retirement, but it seems that this happens at a later age than before the reform.

We draw the following conclusions: Matching quality in Germany is low (24.60% report a WD, but do not receive DI benefits), so the target of protecting people with functional impairments is partly missed. The match quality has not improved after the 2001 reform. While the individuals who have received DI benefits after the reform, are healthier, this effect is not significantly related to the 2001 reform. In general, individuals are receiving DI benefits later after the 2001 reform but not with worse health than before the reform. Finally, the duration of DI benefits is shorter after the reform. However, this only reflects a quicker transition into old-age pensions rather than an uptake of employment.

Targeting early retirement without actuarial adjustments

One of the main insights of the economics of aging is that longer life times need to be accompanied by longer working lives in order to keep pension systems sustainable and to maintain living standards for the entire aging economy. Indeed, in most aging countries, reforms have increased the normal retirement age, closed early retirement pathways, and/or reduced other incentives to retire early (Börsch-Supan, 2013). Previous literature has shown that these retirement reforms and reforms of the unemployment insurance scheme actually have changed individual behavior of older workers, and have caused lower retirement rates and increasing employment rates (see e.g., Engels *et al.*,

[5]The SHARE-RV data are cut at the age of 65. For those individuals who receive regular old-age pension at the age of 65, we continue the data up to 4 years and fill in the information of old-age pension receipt.

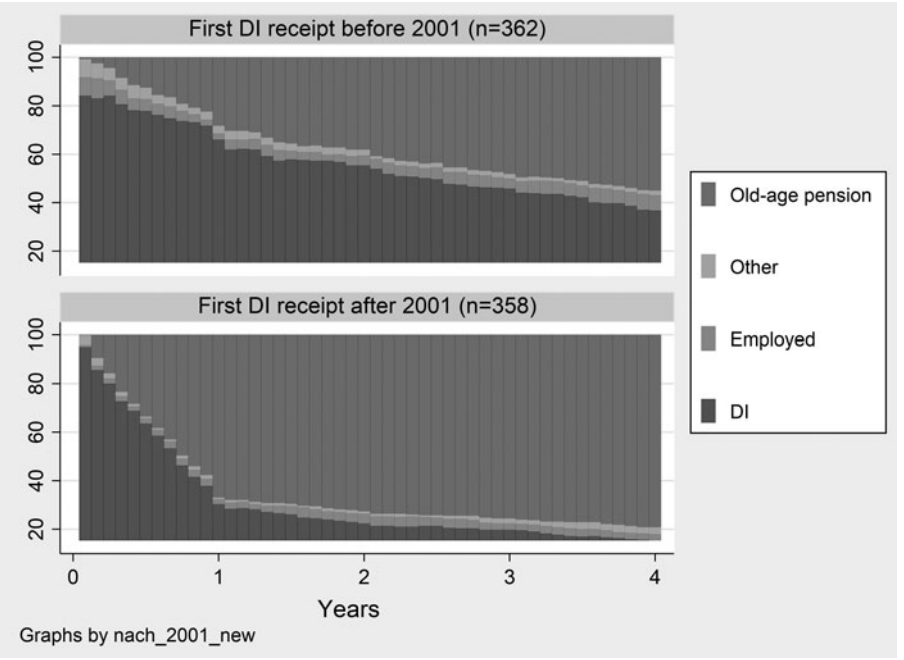

Figure 2. Sequence analysis for employment status after first DI receipt.
Note: 'Other' includes unemployed, on sickness leave, and homemakers.
Source: SHARE-RV.

2017; Geyer *et al.*, 2020; Geyer and Welteke, 2021; Riphahn and Schrader, 2020). In Germany, the 2007 reform increased the normal retirement age from 65 gradually to 67. Only workers with a long insurance history (35 years including various non-employment spells, see Table 6) can receive pension benefits up to 2 years earlier with an actuarial adjustment of 0.3% per month of earlier retirement.

Recently, however, several countries have experienced backlashes to such reforms – among others Germany. In 2014, Germany re-introduced early retirement at age 63 without actuarial adjustments for workers with 45 service years in the pension system (Deutscher Bundestag, 2014). The main motivation was 'to honor the achievement of especially hard working individuals who have modest earnings, are burned out and often in bad health'. The implicit assumption is that these workers suffer from a lower than average life expectancy, and the 2014 reform would give them 'a better deal' in the pension system. The subject of this section is whether the reform achieved the aim of targeting less healthy workers with modest earnings and long careers.

In 2007, Germany decided to increase the statutory pension age from 65 to 67 gradually between 2012 and 2029. At the same time, an early retirement pathway for individuals with at least 45 service years was introduced in order to exempt individuals with long working histories from the burden of working longer. As a consequence, individuals who qualified could claim full pension benefits at age 65 and pensions with an actuarial deduction of 7.2% at age 63.

The 2014 reform in the focus of this case study further increased the generosity of this pathway (called 'retirement at 63') by reducing the eligibility age for full benefits from 65 to 63. This effectively raises benefits for those qualified by 7.2%. The 45 service years are broadly defined and include periods of upbringing of children, education, and short-term unemployment, among others (see Table 6). The new pathway's eligibility age of 63 will increase gradually to 65 until 2029 in parallel to the increase of the statutory retirement age from age 65 to 67. Hence, the main advantage of this new pathway is the ability to retire 2 years earlier with full benefits once the 45 service years have been reached.

Table 6. Contribution, insurance, and service years in the pathways to retirement

		(i) Contribution years	(ii) Insurance years	(iii) Service years for retirement at 63	(iv) Service years for pension supplement
Full and partial contribution periods (*vollwertige und beitragsgeminderte Zeiten*)	Employment	X	X	X	X
	Self-employment	X	X	X	X
	Military service	X	X	X	X
	Education (up to 8 years)	X	X	X	X
	Upbringing of children	X	X	X	X
	Care of family members	X	X	X	X
	Sickness, rehabilitation	X	X	X	X
	Short-term unemployment	X	X	(X) except 2 years before claiming	
	Other (e.g., voluntary contributions)	X	X	X	
Non-contributory supplementary periods (*Zurechnungszeiten*, e.g., in case of disability before reaching normal retirement age)			X		
Creditable periods (*Anrechnungszeiten*, e.g., long-term unemployment)			X		
Credited substitute periods (*Ersatzzeiten*, e.g., war captivity)			X	X	X

Note: The German public pension system has different types of pensions. Their eligibility depends on different minimum contribution periods. *Contribution years* (Column i) are years in which contributions have been paid (e.g., while employed) or are considered as being paid (e.g., while bringing up children); *Insurance years* (Column ii) add periods in which no contributions were paid but which are still taken into account for acquiring eligibility (e.g., disability). Only a subset of insurance years (see Column iii) counts toward eligibility for the new early retirement pathway discussed in this section. Even fewer years count toward eligibility for the new pension supplement (Section 6).
Source: German Social Security Code VI, Deutsche Rentenversicherung (2018), Börsch-Supan *et al.* (2015*a*)

Börsch-Supan *et al.* (2015*a*) provided a first analysis of the planned reform during the design phase of the reform. They showed that the employees who are eligible for the new retirement pathway have, on average, higher pension entitlements as well as more continuous and stable working histories, higher incomes, but shorter periods of employment with social insurance contributions than those not eligible. Moreover, they found no evidence that eligible employees are more likely to be unhealthy at the end of their working life – at least when measured by the days reported as sick leave. Rather, the contrary is the case. Dolls and Krolage (2019) analyzed the same reform and showed that individuals who are eligible for the new retirement pathways claim benefits on average 5.4 months earlier than non-eligible individuals with identical characteristics. In addition, they illustrated that the reform comes along with enormous additional costs for the pension system.

A drawback of both analyses is that they are based solely on administrative data and no direct information on health and the household context is available to evaluate the overall effectiveness of the reform. A further drawback of Börsch-Supan *et al.* (2015*a*) is that it is based on hypothetical eligibility only, since it was written during the design phase.

In this paper, we fill this gap by analyzing the group of individuals who actually chose the new early retirement pathway since its introduction on July 1, 2014. Moreover, by using the linked SHARE-RV data, we have detailed health information and information on the household context. The combined data set can thus more comprehensively answer the question of whether the eligible workers are indeed underprivileged and in worse health.

Our study sample of 1,519 individuals is based on the SHARE-RV data with the regular SHARE waves 5, 6, and 7. The administrative data allow identifying eligibility for and/or take-up of the new early retirement pathway. In turn, SHARE data admit assessing the health and socio-economic status. Our study sample includes pensioners, employed or self-employed individuals, unemployed, permanently sick or disabled, homemakers, and others. The pension information is based on administrative data only. We restrict the group of pensioners in our sample to those pensioners who started to claim pension benefits for the first time between July 2014 and 2017. Since the new early retirement

pathway was introduced on July 1, 2014, we keep only those pensioners who had the same options regarding pathways to retirement and retired similarly recently. This sample restriction thus addresses the concern that there might be a systematic difference in the distance between the time at which pensioners started to receive benefits and the time of interview. This would bias our results if health depended on retirement duration ('honeymoon effect', see Eibich, 2015 or Belloni *et al.*, 2016).[6]

We use monthly information on the individual employment history between the age of 14 and 65 to determine eligibility for drawing pension benefits. We restrict the sample to individuals who are at least 55 years old. The average age is 60.6 years and equal for males (43%) and females (57%). Eighty percent of the sample individuals live in the same household with a partner. Thirty-one percent claim public pension benefits.

We split the sample into five groups according to the chosen pathway to retirement and employment status:

(1) *Long insurance history and still working*: The first group includes employees with 35–44 insurance years who are still working. We exclude individuals who report being self-employed or civil servants in their main job since they have special old-age provisions.
(2) *Long insurance history and retired*: The second group includes pensioners with at least 35 insurance years who already claim pension benefits. Individuals in this group have claimed old-age pension benefits for long-term insured pensioners with actuarial deductions.
(3) *Very long service history and still working*: The third group includes employees who feature at least 45 service years, have already reached the eligibility age for the new 'retirement at 63' pathway with full pension benefits but are still working.
(4) *Very long service history and retired*: The fourth group includes pensioners with at least 45 service years who have actually chosen the new pathway for especially long-term insured since July 2014.
(5) *Short employment history and others*: The fifth group is included for completeness and consists of all sample members who are not in groups 1 through 4. This heterogeneous group includes pensioners who use pathways to retirement which require less than 35 insurance years, self-employed individuals, unemployed, permanently sick or disabled individuals, homemakers, and others.

Table 7 presents group sizes and some descriptive statistics. The first line shows a first result: Once eligible for the generous new early retirement pathway, workers take this pathway and do not work any longer. The group of individuals with 45 service years who are still working is very small ($N = 7$). Therefore, we do not include the group with very long service histories and still working in the analysis below.

The group of main interest is the group who actually have used the new pathway for especially long-term insured since July 2014 and are not working. This is our target group. As control group, we choose pensioners with at least 35 insurance years. Both groups are homogenous in a sense that they already claim pension benefits (with/without actuarial adjustments) and are not employed any more. The main difference between the two groups is the number of years that count in calculating the retirement age: 35 insurance years versus 45 service years.

There are, however, differences in the main socio-demographic characteristics. Fifty-seven percent (38%) of the target group (control group) are males. Ninety-five percent of males in the target group live together with a partner in the same household, while this number is with 76% for females clearly

[6]We are grateful to an anonymous referee to stress this aspect of the retirement literature. While the immediate effect of retirement on health can be positive, the long-lasting effect may be negative. If the individuals in the target group systematically had a shorter retirement duration than those in the control group, this difference would explain better health in the target group. In addition, we calculated the average time distance between the time at which pensioners started to receive benefits and the time of the interview for both target and control group. For the target group, we find an average distance of 9.7 months and for the control group of 9.3 months (p-value of *t*-test 0.70).

Table 7. Subsample size and socio-demographic characteristics by group, percentages

	Long employment history		Very long employment history		Short employment history
	Still working	Retired Control group	Still working	Retired Target group	All
Individuals	343	92	7	115	962
Proportion of males	0.45	0.38	..	0.57	0.39
With partner in household					
Males	0.91	0.77	..	0.95	0.77
Females	0.82	0.79	..	0.76	0.78
Education					
Low educated	0.05	0.11	..	0.09	0.10
Medium educated	0.68	0.53	..	0.70	0.54
High educated	0.27	0.36	..	0.21	0.36

Source: SHARE-RV.

lower. Education is based on the ISCED-1997-classification. Low education corresponds to ISCED 0-2, medium education to ISCED 3-4, and high education to ISCED 5-6. For target and comparison group, the data show opposite proportions: While the proportion of medium-educated pensioners is higher in the target group (70%) compared to the control group (53%), the proportion of highly-educated pensioners in the comparison group is higher (36%) than in the target group (21%).

We conducted several tests to see whether these differences are statistically significant, and many are. In the target group are more males compared to the control group (p-value 0.0057). Moreover, more males in the target group live with a partner in the household compared to the comparison group (p-value 0.0054). For females, we do not find statistically significant results. Regarding education, the target group contains more medium-educated and less high-educated individuals compared to the comparison group (p-value 0.033).

Figure 3 addresses the first target of the policy, namely providing more generous pensions to those who are less healthy. We use the same health variables as in the previous section on DI. There are some large differences in the six health measures but they are statistically insignificant as indicated by the error bars. Moreover, all differences point in the wrong direction for males, i.e., health of male pensioners in the target group is better than in the control group. For female pensioners, the comparison is often reversed but remains insignificant in all cases.[7]

Figure 4 addresses the second target of the policy, namely providing more generous pensions to those who have earned a more modest life-time income and less wealth. We measure lifetime earnings in terms of the average annual number of earnings points. It is calculated as the sum of earnings points an individual has accumulated from age 14 to 65, for the target group divided by the number of service years and for the other groups divided by the number of insurance years as defined in Table 6. Wealth is measured as the households' net worth. It is the sum of net financial assets (i.e., the sum of bank accounts, bonds, stocks, mutual funds, savings for long-term invests, minus financial liabilities) and household real assets. The latter is the total value of the household's main residence (adjusted for the percentage of house owned), value of the own business (adjusted for the share of own business), value of cars, value of other real estate minus mortgage on the main residence. The variable thus broadly captures the households' net worth.[8]

Figure 4 provides evidence suggesting that also the second target of the reform has not been achieved. The target group, on average, has earned a higher number of annual earning points. The

[7]We also ran multinomial logit regressions with the retirement pathways as dependent variable and all health variables as well as age, education, earnings points, and wealth as controls, which are available upon request. None of the health variables show effects which are significantly different from zero.

[8]We use the fully imputed data set.

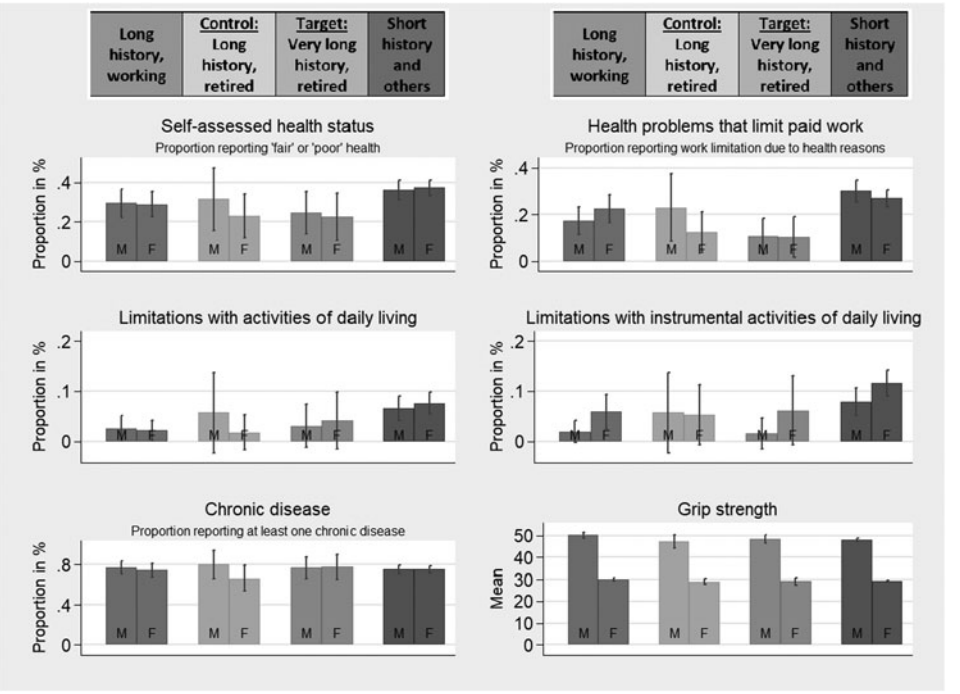

Figure 3. Health status by group.
Note: Figure shows proportions and 95% confidence intervals.
Source: SHARE-RV.

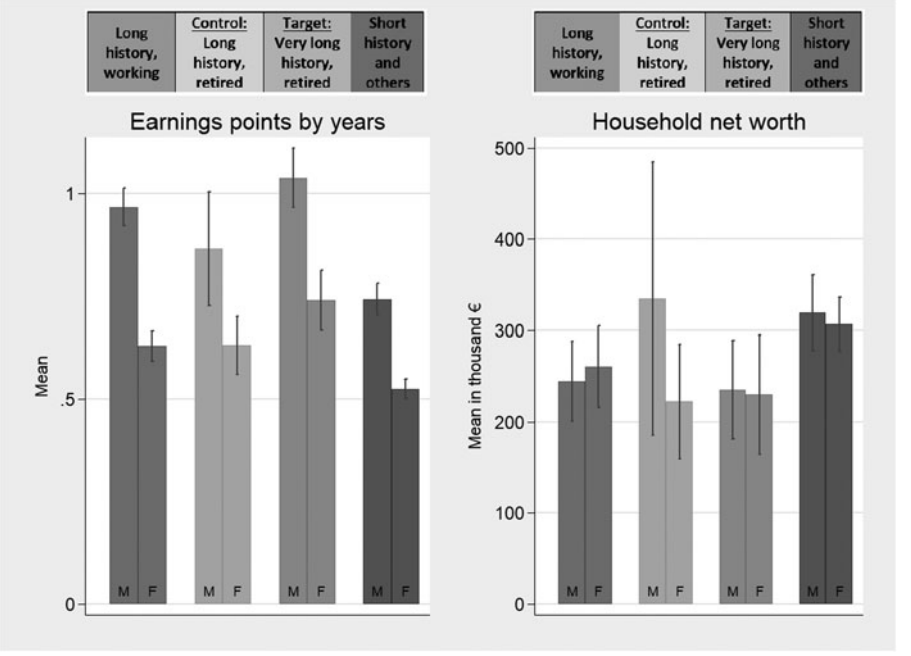

Figure 4. Earnings points by year and household net worth.
Note: Figure shows proportions and 95% confidence intervals.
Source: SHARE-RV.

difference is significant for both males (p-value 0.0159) and females (p-value 0.0332). This finding is in line with Börsch-Supan *et al.* (2015*a*) and persists in a multivariate regression. Household wealth is not significantly different for the target and control group, neither for males (p-value 0.1207) nor for females (p-value 0.8684). Therefore, the reform does not target a less wealthy group as it had been intended by the policy makers.

A final point we would like to mention is shown in Table 7. Compared to the control group, the proportion of high-educated pensioners is lower in the target group. This might point into the same direction as in Börsch-Supan *et al.* (2015*b*). The authors find that the proportion of specialists (highly qualified workers without a university education but in a highly skilled occupation) is higher among the eligible for the new early retirement pathway (target group) compared to the group of individuals eligible for early retirement after 35 contribution years (comparison group). Our sample size is, unfortunately, too low to replicate the approach to identify specialists as in Börsch-Supan *et al.* (2015*b*).

Overall, we find that pensioners in the target group mostly have medium education and have higher lifetime earnings. Health does not play a role for retiring via the new pathway at age 63. These results produce a clear picture. If the aim of the new German early retirement pathway was to target the underprivileged with bad health and modest earnings, then the SHARE-RV data provide no evidence that the policy achieved this aim – rather, the contrary appears to be the case.

Targeting supplemental pension benefits

German public pension benefits are strictly proportional to the 'earnings points' which are in turn strictly proportional to the contributions paid in each year into the German public pension system. In addition, the German social assistance system provides a minimum income to prevent old-age poverty. Our third case study examines the target quality of a recent reform which supplements this two-tier system with a third tier between social assistance and normal public pension benefits ('Grundrente'). This reform has been very controversial; it will come into force on January 1, 2021 (see Deutscher Bundestag, 2020). This reform provides supplemental benefits for those who have earned more than the poverty threshold of social assistance but who only have 'a modest income' (Bundesministerium für Arbeit und Soziales, 2019). It therefore changes the strict proportionality between contributions and benefits in the German pension system in the 'modest' income range. The definition of 'modest income' has not been consistently used. In the public discussion, the law was advertised as preventing poverty. While Germany has no official 'poverty line' such as the USA, the average social assistance including housing allowances is about €850 for a single individual. The OECD defines poverty as 60% of median income which corresponds to about €990 for a single individual, approximately the boundary of the lowest tercile in the income distribution. In Germany, this line is called 'in danger of poverty' and is often used as benchmark. The new law to be discussed in this section is even more generous and provides full pension supplements to single individuals whose income do not exceed €1,250.

Similar attempts to smoothen the kink between social assistance and public pensions have been attempted earlier. In almost all cases, they were abandoned due to bad target quality. Ye (2018) provides an analysis of an earlier reform that implemented supplemental pension benefits in Germany in 1992. Ye shows that €100 additional monthly pension benefits induced female recipients to claim pension benefits by approximately 10 months earlier. Many of these women, however, lived in households with substantially more than modest household incomes for any of the above definitions.

Eligibility definitions and benefit computation of the new pension supplement are complex. Eligibility for supplemental benefits requires at least 33 service years, see the rightmost column in Table 6. Technically, the supplement will be implemented as an increase in earnings points. Earnings points are accumulated over the working life by contributing to the German pension system. Contributions are paid as a percentage of earnings. One earnings point in a given year corresponds to the contributions of the average earner in that year. Hence, a worker with 80% of the average earnings will be credited 0.8 earnings points. The new rule will lead to a deviation from this linear relationship

between annual earnings and earnings points. Annual earnings points between 0.3 and 0.8 in up to 35 service years will be doubled, capped at 0.8 earnings points.[9] The lower threshold of 0.3 excludes part-time and mini jobs[10]; the upper threshold of 0.8 may be interpreted as one element to implement the 'modest income' definition. In addition, the law includes a means test related to household income. Eligible pensioners may not have a monthly household income exceeding €1,250 if single, and €1,950 if a couple. For incomes between €1,250 and €1,600 for singles (€1,950–€2,300 for couples), there is a 60% clawback.

This design has two serious shortcomings. First, the requirement to have at least 33 service years and the lower threshold of 0.3 annual earnings points will exclude retirees with small incomes, contradicting the much heralded aim of reducing old-age poverty. Second, the administration of the means test is not only cumbersome administratively, since the public pension system has no data on household income, but also disregards wealth. Target quality may thus fail on both sides: reaching too few individuals who are in need of support but granting eligibility to too many who are not in need. This section therefore aims to answer two questions: How many retirees are income poor but not eligible for the supplement? And how many retirees are eligible for the supplement but are wealthy?

We use SHARE-RV data with data from the regular SHARE waves 5, 6, and 7. From the administrative data, we obtain precise monthly information on the individual insurance career from age 14 to 65 which is necessary to determine eligibility for the supplement. Data from the regular SHARE interviews provide information on the household context, wealth, and health information. The reform targets pensioners at the point in time when they claim pension benefits for the first time. Our study sample of 2,337 individuals therefore includes pensioners only. We restrict the sample to individuals who are at least 55 years old. Average age for males in the sample is 72.2 and 71.9 years for females; 51% in the sample are females; 75% live with a partner in the same household.

In a first step, we evaluate who is eligible for the supplement. We find that 7.1% of our sample are eligible for the supplement. This is slightly higher than the government estimate of 6.1% (Bundesministerium für Arbeit und Soziales, 2020). Eighty-one percent of the eligible pensioners are women. About two-thirds live together with a partner in the same household. In a second step, we analyze which years over the life course are counted toward the required 33 years of service, stratified by supplement eligibility (Figure 5). Years with contributions from employment are only a part of the overall service time: for men 33.2 out of 52.8 years (63%); for women 24.8 out of 47.2 years (53%). For women, contribution periods for the upbringing of children are a substantial part of the insurance history (16%). Together with periods devoted to the care of family members (7%), this represents an important factor to determine eligibility. At the same time, however, only women with a high share of contributions from employment can benefit from the supplement: 57.5% compared to 51.8% of total service time for those non-eligible. For both men and women, employment periods are decisive for supplement eligibility.

The average number of earnings points is 21.6 in the group of eligible pensioners. The number is clearly higher in the non-eligible group, see Table 8. However, the standard deviation is much higher in the latter group, indicating that the earnings points are spread over a wider range with comparably more low and high values. In addition, we calculate the hypothetical supplement that eligible pensioners would get according to the new law. The average supplement would be 4.1 earnings points. In order to calculate the Euro value of the supplement, we multiply the earnings points with the expected point value in 2021 which is €34.09 in West Germany, slightly lower in East Germany, resulting in an average supplement of about €139 per month, or a pension benefit increase of around 19% for the average eligible pensioner. However, this supplement will be reduced for pensioners with a

[9]For pensioners with service years between 33 and 35, the law imposes much lower upper thresholds for annual earnings points.

[10]Mini jobs in the sense of the German law are a form of marginal employment with monthly earnings in the amount of €450 at the most, or work effort of maximum 3 months or 70 days per calendar year. For mini jobs, specific rules regarding social insurance contributions apply (see German Social Security Code IV).

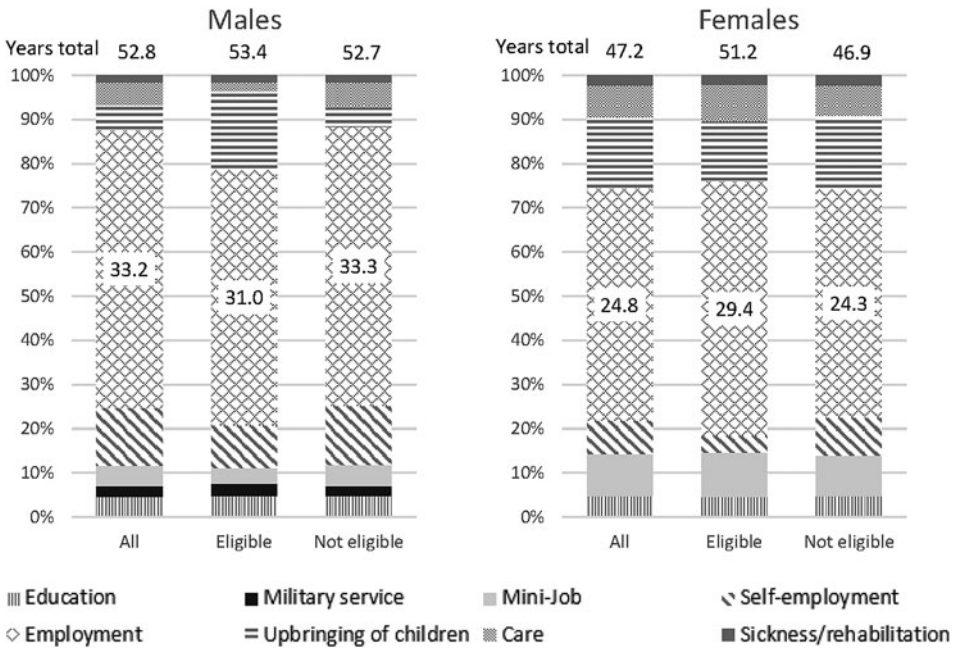

Figure 5. Composition of service years.
Source: SHARE-RV.

Table 8. Earnings points and household income: eligible versus not-eligible pensioners

		Mean	Std. Dev.
Earnings points before supplement	Eligible	21.6	7.2
After supplement	Eligible	25.7	7.0
Earnings points	Not eligible	32.8	19.2
Mean monthly net household income (€)	Eligible	1,289	406
	Not eligible	2,701	1,983
Median monthly net household income (€)	Eligible	1,286	
	Not eligible	2,276	

Source: SHARE-RV.

household income exceeding the income thresholds mentioned above. Taking this into account, the expected supplement is on average €106 per month, or a pension benefit increase of around 14%.

Besides pension income, pensioners can have additional income sources available in the household they belong to. Table 8 shows monthly household net income by eligible and non-eligible households.[11] Mean (median) monthly household net income of eligible pensioners is around €1,400 (almost €1,000) lower than that of non-eligible pensioners. These differences are large. Nevertheless, both the mean and the median of household net income among eligible pensioners are above the OECD definition of 'in danger of poverty' (about €990). This is the first indicator of poor target quality, because the policy also reaches a substantial fraction of pensioners who have more than a 'modest' income if we define 'modest' as below this frequently used threshold.

In the next step, we will investigate the target quality in more detail by analyzing the distribution of household net income. Figure 6 depicts the household net income distributions of pensioners eligible for the supplement versus not-eligible pensioners. Due to the means test, the distribution is much

[11]Household net income is based on the 'one shot' question in the SHARE module on household income.

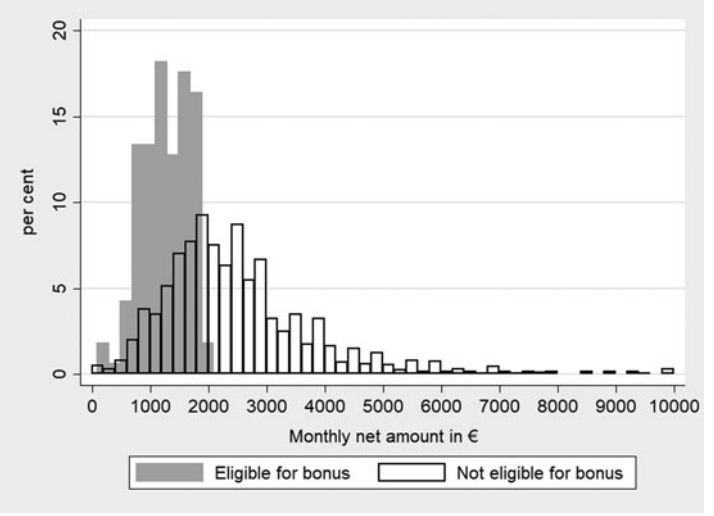

Figure 6. Distribution of household income of pensioners.
Source: SHARE-RV.

narrower for eligible retirees, an indication of good target quality in one direction: pensioners from income-rich households are not eligible. However, Figure 6 also reveals that the policy fails in the other direction: There is a substantial overlap between the two distributions. This implies that 23.9% of retirees who are income-poor as defined by the new law are actually not eligible for the new supplement since they do not have a sufficient number of service years.

We now investigate the other direction of target quality and compare the wealth situation of eligible and non-eligible pensioners (Table 9 and Figure 7). Some pensioners may have little income but have other assets such as owner-occupied housing (see Angelini *et al.*, 2014 who studied income-poor and house-rich pensioners). Household net worth is defined as in Section 5. It includes financial and real assets, e.g., the value of the household's main residence. Household net financial assets are defined as the sum of bank accounts, bonds, stocks, mutual funds, and savings for long-term invests, minus financial liabilities. While household net worth and household net financial assets are substantially lower among eligible pensioners compared to non-eligible pensioners, net worth is still considered among eligible pensioners. It amounts to almost 103,000€ on average while the median is 40,575€. On the one hand, this is substantially lower than the median value among pensioners (139,800€), and the SHARE population (152,000€), and even more so if compared to the average net worth of non-eligible pensioners which is about 251,000€.[12] On the other hand, Figure 7 shows that there are many eligible pensioners, actually 21%, who have a net worth that is above the median wealth of all pensioners.

[12]In order to put the wealth indicators into a wider context, we compare the average wealth among the analysis sample and the whole German subsample of SHARE. This sample comprises not only retirees, but also employees/self-employed, permanently sick or disabled individuals, unemployed, homemaker, and a small mixed group of others, who are at least 55 years old. Among the German subsample from SHARE Waves 5, 6, and 7, the average household net worth is €254,303 (median: €152,000). Average net financial assets amount to €55,709 in this comparison sample (median: €24,175). However, SHARE focuses on individuals 50+ and does not facilitate insights on the German population as a whole. We therefore broaden the picture by also comparing results from Deutsche Bundesbank's 'Panel on Household Finances' (PHF). Deutsche Bundesbank (2019) shows that households in Germany had an average net wealth of €232,800 in 2017 (median: €70,800). The definition of household net worth in Deutsche Bundesbank (2019) is comparable to the SHARE variable we use.

Table 9. Wealth situation: eligible versus not-eligible pensioners

		Mean	Std. Dev.
Mean household net financial assets (€)	Eligible	20,982	64,977
	Not eligible	51,226	101,059
Median household net financial assets (€)	Eligible	4,760	
	Not eligible	21,771	
Mean household net worth (in €)	Eligible	102,943	179,349
	Not eligible	251,224	361,983
Median household net worth	Eligible	40,575	
	Not eligible	151,850	

Source: SHARE-RV.

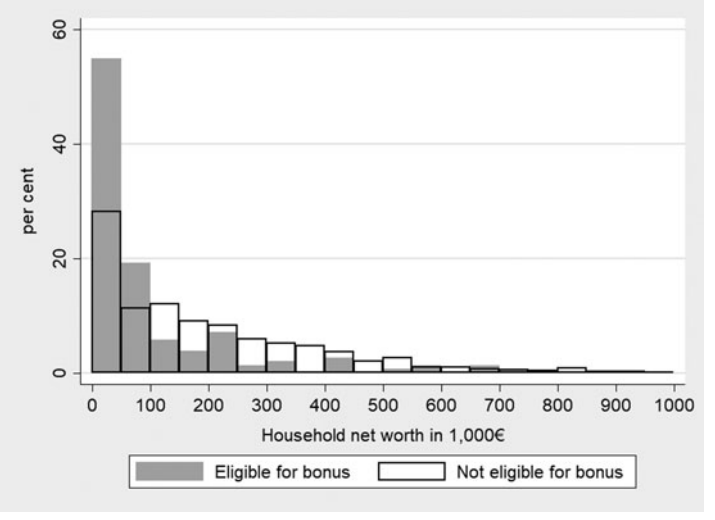

Figure 7. Distribution of household net worth of pensioners.

Median net worth may be an arbitrary threshold for a wealth test although belonging to the upper half the wealth distribution may not be considered in need of public support. If we rather take twice the median net worth as our maximum wealth threshold, this includes still 9.4% of eligible pensioners. As an alternative threshold, we approximately annuitize household wealth by using a 3% conversion factor and add this as capital income to the reported household income. This assumes that most wealth is from sources that are not already included in the household income definition relevant for the new law, e.g., owner-occupied housing or whole life-insurance, which are by far the dominant assets in Germany. Using this modified household income, only 2.2% rather than 7.1% of pensioners would be eligible for the new supplement. In other words, according to these criteria, 69% of eligible pensioners have a wealth level that lifts them above the 'moderate income' threshold as defined by the new law.

Overall conclusions

As the title of the paper suggests, the three case studies in this paper have been chosen to reflect typical short-comings in the design of pension reforms in Germany. Since similar reforms are currently debated in many European countries, these case studies may serve as examples of how to better target public pension policies.

Summarizing in reverse order, the case study on the newly introduced pension supplements shows that badly designed policies can fail in both relevant directions: not helping those in need while at the

same time giving subsidies to those who do not need them. While 23% of non-eligible pensioners are nevertheless poor in the sense of the new law, 21% percent of the eligible pensioners have an above median net worth, hence belong to the wealthier half of German pensioners.

The main lesson from the case study on early retirement without actuarial adjustments is that the three-way association between length of service life, average income, and health (and therefore life expectancy) is more complex than often assumed. The beneficiaries of the 2014 reform in Germany had long service lives but were a selection of relatively healthy and well-to-do workers. We speculate that the less healthy and not so well-to-do workers have retired before the early eligibility age via the disability pathway or special agreements between the social partners.

Finally, while the matching quality between WD and receipt of a DI benefit is particularly low in Germany (24.60% report a WD, but do not receive DI benefits) as compared to other countries (Börsch-Supan *et al.*, 2020) and has not improved after the 2001 reform, earlier reforms which concentrated on the strictness of medical exams have effectively improved matching quality as could be seen in Figure 1. The lesson here is that DI systems require effective medical exams to achieve good targeting.

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