

Empirical Article

Broken promises? Trust and pension savings in turbulent times

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Abstract

Using survey data on household savings and trust, we investigate the determinants of trust in one's pension fund and its effect on the decision to build up additional retirement savings. Key in our approach is the realization that trust in itself may respond to the usage of additional savings instruments, through learning, experience, and information acquisition, for instance. We therefore use an instrumental variables approach, based on exogenous shocks arising from pension cuts and indexation. We also account for the potential spurious relation between funds' equity and trust, that could arise in a period of financial crisis. We do so using information on fund size, as this is an important proxy for funds' economies of scale. These instruments allow identifying the unbiased effect of trust in pension funds on participation in voluntary pension saving plans. We disentangle the effects of age, birth cohort, and time in the determination of trust, and counter previous findings of a positive age gradient with trust. This implies that in the future the level of trust in pension funds will decline. Our main result is to find a positive effect of trust on additional pension savings.

Keywords: trust, pension policy, additional retirement savings, cohort-time effects

Established trust is at the root of long-lasting human, social, or economic partnerships as well as of stable financial and monetary systems. Trust is critical in defined benefit (DB) pension plans where current workers rely on the promise of a stable and often indexed income stream in retirement. Whether and how such workers adjust their private savings when trust in the collective DB system erodes is the significant question of this paper.

We examine trust in Dutch pension funds, which are part of one of the world's largest capital-funded occupational DB pension sectors, known for its generosity and resilience. However, the Dutch pension system faces challenges like an aging population, low-interest rates, and a rise in alternative employment forms, causing some workers to leave the system. Pension funds often struggle to meet future payment obligations, prompting supervisory authorities to intervene by halting inflation adjustments, or by prompting to cut benefits or increase premiums. These interventions, though necessary for long-term financial stability and solvency of funds, may actually erode participants' trust as previously made promises cannot be upheld.

We explore the evolution of trust in pension funds and investigate its impact on retirement savings. We identify the causal relationship from trust to voluntary pension saving.

Our study therefore builds on those who have studied the correlation between trust and observables and investigates how trust might affect participation in voluntary saving plans that qualify for similar tax treatment as pensions. Our analysis uses data starting in 2007, following a decline in trust in the Dutch financial sector, especially insurers that were implicated in usurious practices in 2006. The fallout resulted in numerous unresolved claims, some of which lingered until 2023–2024. However, confidence in pension funds waned mostly during the Great Financial Crisis of 2008–2012. Against this backdrop, the Dutch government initiated a structural reform of the pension system. In July 2023, the new pension law took effect, replacing promises of future pension benefits with individual retirement accounts that have no future income guarantees. The transition, foreseen to be completed by 2028 will potentially impact trust in the pension system.

Previous studies have highlighted the relation between perceived and actual fund performance on trust. [Van Dalen and Henkens \(2018\)](#) identified low trust in the insurance industry, contrasting with higher trust in the pension fund sector. [Van der Crujssen and Jonker \(2019\)](#) find a negative relationship between trust in the ability of pension funds to pay benefits consistently and the belief that such funds needed recovery measures. Similarly, [Van Zaal \(2017\)](#) shows

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a significant correlation between pension cuts and lack of indexation on trust, noting age-related effects of cuts and the importance of indexation for the working population. [Van Dalen and Henkens \(2023\)](#) show a positive relation between funding ratios (ratio of a fund's assets to its future liabilities) and trust in pension funds.

Understanding the correlates and determinants of trust is an important building block in the quest to design resilient retirement systems, but needs to be complemented by studies that probe into the implications of changing or eroding trust for saving behavior. Trust in pension funds can affect voluntary pension savings through various pathways. For instance, it affects the decisions about how much to save for those who do, but also whether to participate or not in pension systems. Low trust may discourage such savings, while higher trust could reduce participation in voluntary schemes as individuals may rely on their pension fund.

[Agnew et al. \(2012\)](#), for instance, show a positive association between trust and willingness to participate in 401(k) savings. Many studies acknowledge the complexity of establishing a causal relationship between trust and saving behavior, as both may be influenced by various unobservable factors such as risk attitudes and consumption/saving preferences. [Ricci and Caratelli \(2017\)](#) highlight the challenge of determining the causality between financial literacy and trust in financial institutions regarding pension decisions due to limited access to secondary data, that could grant the needed exogeneity. They note the difficulty in merging information about trust and pension scheme specifics, as they are often found in separate sources, and propose utilizing pension fund affiliation in survey data and supervisory data on pension funds.

We contribute to the development of this second strand of literature that focuses on savings. Our approach involves analyzing 15 years of survey data on household wealth and saving combined with supervisory data on the pension sector and pension fund-specific characteristics. We utilize micro panel data from the Dutch Central Bank (DNB) Household Survey, along with linked data from the DNB Trust Survey and pension funds' balance sheet data, including recovery plans, indicators for raising pension premiums, suspending indexation, or reducing benefits. Our observation window spans periods of financial distress, and we recognize that during crises, trust and uncertainty, and hence saving, maybe endogenously related.

We propose to employ an instrumental variable estimation framework to determine the unbiased impact of trust on the decision to voluntarily save for pensions. The approach rests on the assumption that corrective actions of pension funds are exogenous to the choices of individual employees ([Van Santen, 2019](#)). Our instruments that shift participants' trust in their funds without directly impacting individual savings behavior include pension funds' economies of scale (measured by the number of participants), responses to external shocks in investments (indicated by benefit indexation), and member perceptions (awareness indicators) of these investment shocks. Economies of scale play a role because larger funds may navigate crises more effectively, accessing better investment opportunities, and distributing financial burdens across a broader participant base. While evidence suggests larger funds typically yield better returns ([Clifford et al., 2018](#); [Humphery-Jenner, 2012](#)), challenges such as increased insurance costs during crises also exist.

Our data and approach help us to shed new light on previous findings, including the determinants of trust in pension funds such as participants' age. Whereas [Van Dalen and Henkens \(2015\)](#) find a positive gradient with individual aging, our results, leveraging the individual-level panel data structure, suggest a cohort-time effect rather than an age effect, explaining lower trust among younger generations. In turn, trust in one's pension fund strongly and positively drives participation in voluntary pension savings. If we were to ignore the endogeneity, we would find a much-attenuated effect. The positive, complementary effect of trust in a quasi-mandated system on the propensity to save voluntarily hints at individual preference heterogeneity being important.

The remainder of the study is organized as follows. The next section provides background information on the institutions in the Dutch pension system, including key aspects of proposed policy changes. The following section presents the data and the descriptive analysis. The empirical approach and results of the empirical analyses are presented in *Empirical strategy*. The final section summarizes our results and offers conclusions.

Institutional context

In the Netherlands, a capital-funded occupational pension system supplements a flat-rate state pension organized as a pay-as-you-go system. Although employers are not legally required to offer an occupational pension, approximately 90% of employees are covered, largely due to strong advocacy by trade unions ([Van der Crujssen & Jonker, 2019](#)), effectively making occupational pensions quasi-mandatory ([Westerhout et al., 2021](#)). In addition, fund participants cannot choose their pension fund unless through switching employer, occupation, or even industry. It is these fund participants that are asked about their trust levels in the present study.

Dutch occupational pensions are of the defined benefit (DB) type at the fund level, with contributions aligned to expected target payouts, involving risk-sharing, and redistribution. The primary aim is to provide retirees with a stable real income. This involves a commitment to indexation (typically to prices), yet actual benefits will depend on funds' financial performance. Whereas indexation is not binding, it consistently occurred until the Great Financial Crisis. This differs from the United States where employer pensions may not always include indexation. In the Netherlands, funds with funding ratios of 110% or above have the option to index benefits. The Dutch Central Bank oversees recovery modes, which include indexation freezes, benefit cuts, and increased premiums for funds with inferior funding ratios. Such adjustments occur during financial crises ([Beetsma et al., 2015](#)).

In addition to the collective two-tier mandatory retirement system, rules exist for voluntary private pension savings. This third or ancillary pillar involves individual financial products with some tax advantages ([Beetsma, 2015](#)). While tax-preferred, these savings lack liquidity and flexibility.¹

¹Examples include employer-sponsored programs, additional contributions, and private pension subscriptions. These products may not be solely for life-cycle savings but possibly for fiscal arbitrage. If private pensions resemble life insurance, participation might be influenced by opaque advice ([Van Dijk et al., 2008](#)). Consequently, retirement savings are defined as financial products receiving similar institutional treatments as pensions, regardless of specific acquisition reasons.

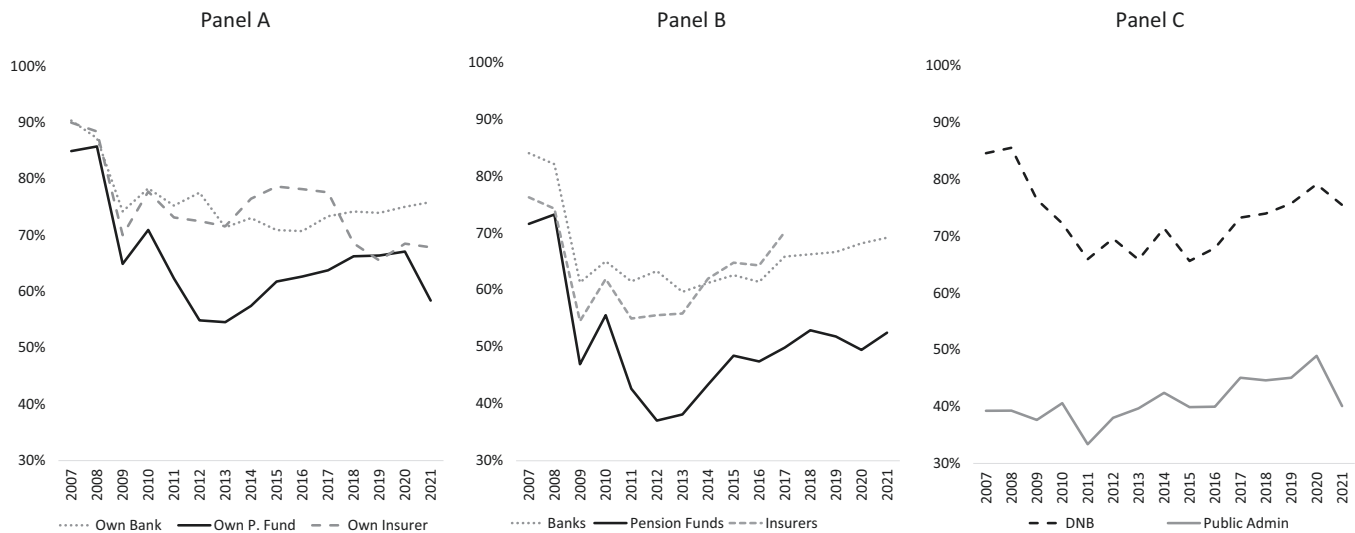


Figure 1. Share of respondents with trust in financial institutions. Source DTS 2007–2021. Panel (A) shows trust in one’s personal bank, pension fund, and insurer. Panel (B) shows trust in general in banks, pension funds, and insurers. Panel (C) shows trust in the Dutch Central Bank (DNB) and public administration in general. DTS, DNB Trust Survey.

Though primarily intended for self-employed workers or those without occupational pensions, these accounts are not very popular (CBS, 2020). Self-employed workers, for instance, also rely on non-tax-preferred personal assets and on homeownership for additional pension savings (Damman et al., 2020).

Data and descriptive analysis

Data

For our analysis, we use the DNB Household Survey (DHS), a sample that is representative of the Dutch population, and available at annual frequency. The DHS has a cross-sectional and a panel component. We investigate data from 2007 to 2021. DHS is administered by CentERdata. It collects information on household wealth and saving, and on economic and psychological determinants of household saving (Teppa & Vis, 2012). Among others, survey participants are asked which pension fund they participate in. We link this information to published balance sheet data of the various pension funds, collected by DNB from 2014. For the years before, we used internal DNB data coming from the administration of recovery plans. Important for our purposes is that we merge the DHS data sets at a person-year level to one of its special modules, the so-called DNB Trust Survey (DTS).²

Descriptive statistics

In the DTS, respondents are asked to evaluate how much trust they have in a number of financial institutions.

We first turn to descriptive evidence for pension funds, banks, insurers, the public administration (government in general), and the DNB. The wording of the survey questions

pertaining to different institutions varies somewhat. For pension funds, respondents are asked: “Do you have confidence that the pension fund (or pension funds) where your pension is managed will be able to pay out your pension when the time comes?”—notice that yearly all pension fund members must receive an overview stating the future pension benefit that they will receive at the statutory retirement age. For banks, the poll probes whether they will be able to repay deposits, and for insurers whether they can meet their obligations. The other questions are more general. For DNB it is asked “How much do you trust DNB?” and for the public administration the question is “How much do you trust the civil service?” The answers are categorical on a five-point ordinal scale. Depending on expositional needs, we present this variable either as dichotomous—equal to 1 if a respondent reports any form of trust, as in our logit model later on—or trichotomous, separating the cases with no trust from those where the respondent is neutral. “Don’t know” answers (only 3% in the whole sample) are mostly discarded.

Figure 1 shows that, prior to the financial crisis, respondents had equal trust in their own pension fund, insurer, and bank, whereas, during the crisis, trust in one’s own pension fund diminished most. This finding seems to contradict Van Dalen and Henkens (2018), who find lower trust levels for insurers and banks. But the wording of the question they use, refers to how much one trusts insurers and banks in guaranteeing a comfortable pension (narrow scope trust),³ while here we ask about trust in these financial institutions per se (trust with no direct relationship) or in the own financial institutions performing their own tasks (broad-scope trust). Van der Crujssen et al. (2023) show that there is a positive association between these different scopes, but that the relationship among these measures can be also context-dependent and linked to the behavior of financial institutions. They show a similar pattern for trust

²DHS data are available at <https://www.dhsdata.nl/>. Pension fund balance sheet data of DNB from 2014: available at <https://www.dnb.nl/en/statistics/data-search/#/> searching for “Individual pension fund data.” Pension fund balance sheet data of DNB in the period 2007–2013 and DTS data: restrictions apply to the availability of these data. For access contact <https://www.dnb.nl/en/statistics/>.

³The exact wording of the question is “To what extent do you trust [pension funds/banks/insurance companies] in guaranteeing a comfortable pension?”; answer categories are (a) no trust; (b) little trust; (c) neutral; (d) some trust; and (e) a lot of trust.

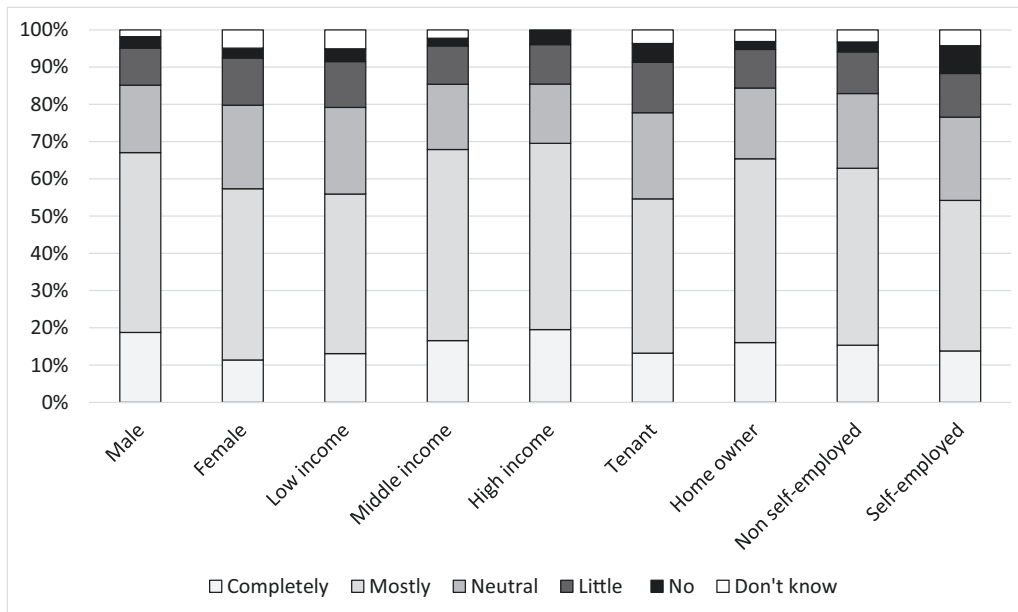


Figure 2. Trust levels of various groups, the year 2021. Sample period year 2021. Source: DTS and DHS, own computations. DNB, Dutch Central Bank; DTS, DNB Trust Survey.

as elicited by these questions as we do. This suggests that trust had somewhat recovered after the financial scandals that plagued (mostly) insurances during the 1990s, before deteriorating again, and never to totally recover after the financial crisis. [Van Dalen and Henkens \(2022\)](#) also include a time dimension. They use a repeated cross section and show that financial stability, measured by the funding ratio, affects trust positively. Until the present day, trust has not recovered to pre-crisis levels for any of the financial institutions. The public administration scores lowest. Trust in one's own pension fund is heterogeneous across the population and associated with the socio-economic status of the respondent (see [Van der Crujisen & Jonker, 2019](#)).

[Figure 2](#) shows the distribution of trust across gender, income, and employment status. It shows that trust increases with income and is higher for males, homeowners, and for respondents who are not currently self-employed.

Of particular interest is the breakdown of trust by age, not least because the young and the old contributors are treated differently in the system, and again differently from retired beneficiaries. Cross-sectional analyses by [Van Dalen and Henkens \(2023\)](#) and [Van Zaal \(2017\)](#) finds a positive age gradient with trust. The left panel of [Figure 3](#) appears to confirm this for the DTS respondents. In the right panel, however, we show that much of the age patterns can be attributed to cohort-time effects. Older cohorts show higher levels of trust, which, except for the shock due to the financial crisis, tends to stay quite constant. While the positive age gradient may suggest that trust increases as respondents approach retirement, the positive cohort-time effects suggest that this might not happen. In general, older cohorts appear to be endowed with higher average levels of trust: they trust pension funds more than younger cohorts do, even when still far from retirement (also see [Robinson & Jackson, 2001](#)).

Since we use pension fund balance sheet data as an instrument in our regression analyses, we present some data on the financial health of the pension funds in [Table 1](#). The table

shows that nominal pension cuts are relatively rare, but also no more than a quarter of the pension funds observed between 2007 and 2020 had a sufficiently high funding ratio to index benefits to inflation at any point. About 27% of them applied no indexation at all. Cuts in real terms were thus common.⁴

[Figure 4](#) presents the relationship between trust, pension cuts, and indexation. For funding ratios that allow indexation, participants are more likely to trust their pension fund. Similarly, the level of distrust (lack of trust) is highest for funds that had to cut benefits, compared to funds that did not. This is in line with previous findings by [Van Zaal \(2017\)](#).

In [Figure 5](#), we combine the information on indexation cuts by the respondents' pension fund to the questions in the DHS data on whether respondents are aware of having suffered any cuts. Some respondents appear to be unaware of the cuts that have actually been applied by their funds (about 3% of the sample, regardless of age). The opposite situation, where respondents mistakenly think that indexation was suspended or benefits were cut, is far less common. Real and (correctly or wrongly) perceived indexation will be used as additional instruments to explain participation in voluntary pension savings.

In our analysis, we also test, using DHS data, whether respondents with low trust participate in voluntary pension arrangements. To start, [Figure 6](#) shows the distribution of additional voluntary pension-saving vehicles, broken down by respondent characteristics. The figure shows that less than 50% of individuals have additional pension savings. Annuities are the most common type of voluntary arrangement, followed by life insurance and other (unspecified) arrangements; arrangements via one's employer (buying additional entitlements or signing in on higher contributions)

⁴In our estimating sample, about 70% of respondents belong to one of the 32 largest funds that are listed as options in the DHS questionnaire. Smaller funds are reported in an open-ended question. Altogether, we have 52 different pension fund affiliations. About 45% of respondents report participating in one of the two largest funds.

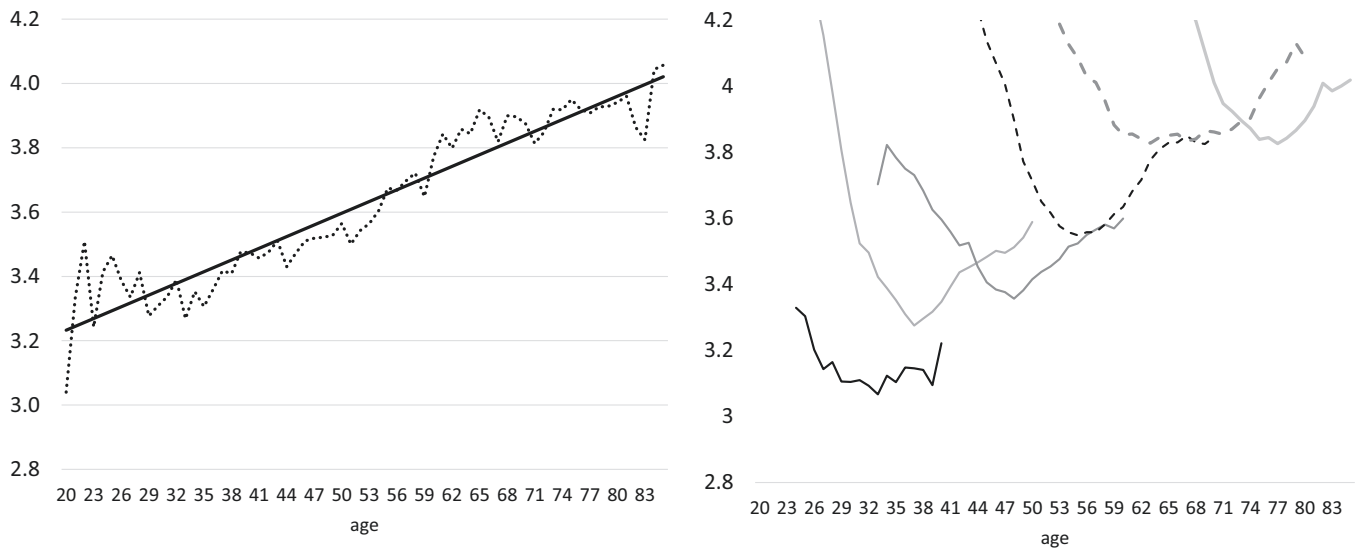


Figure 3. Trust by age (left) and cohort time (right). The solid line in the left panel is a linear interpolation showing the positive age gradient. In the right panel, the dotted lines represent the 5-year moving averages of the solid lines, where the age-time pattern is heterogeneous across cohorts. The legend shows the oldest year of birth of a 10-year cohort (e.g., the label “1970” corresponds to birth years 1970–79). Source DTS and DHS, own computations. DTS, DNB Trust Survey. DHS, DNB Household Survey; DNB, Dutch Central Bank; DTS, DNB Trust Survey.

Table 1. Pension fund indexation and participants’ age group.

	Cuts	No indexation	Indexation
Age 20–40	16%	27%	57%
Age 41–55	20%	27%	53%
Age 55–99	23%	28%	48%
N	19,871		

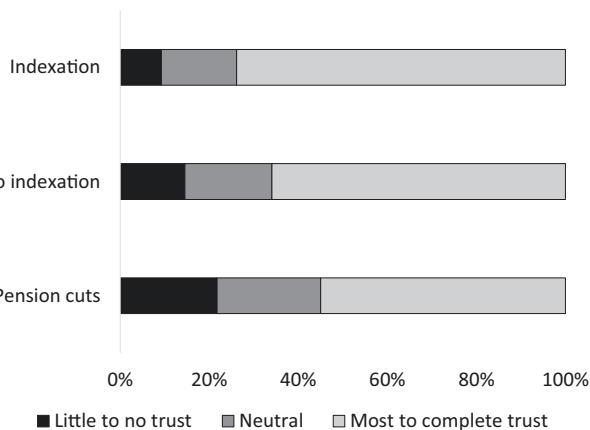


Figure 4. Trust in the pension fund and indexation. Statistics based on households in the DTS and DHS merged to balance sheet data (DNB). 2007–2021. DHS, DNB Household Survey; DNB, Dutch Central Bank; DTS, DNB Trust Survey.

are the least popular. Figure 6 also shows that there is a relationship with socio-economic status. Most voluntary savings are observed among respondents with high income, older respondents, and homeowners (see also Bassett et al., 1998; Jansen, 2020). The savings balance on these voluntary accounts is not reported in the data. We therefore only study the incidence of participation in these arrangements.

Finally, Figure 7 shows the relationship between trust and an indicator for additional pension savings that captures the

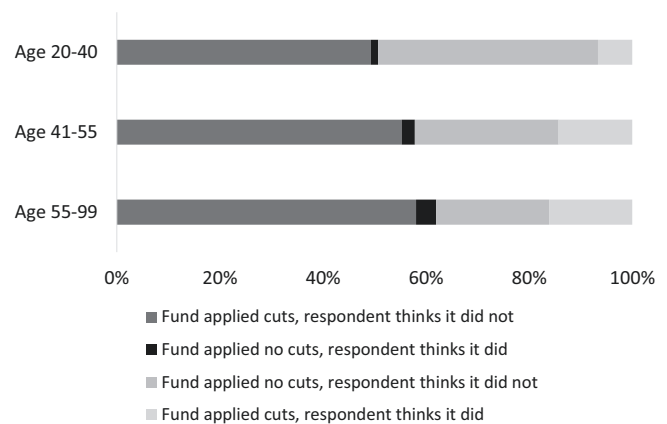


Figure 5. Awareness and pension fund indexation. Statistics based on households in the DTS and DHS merged to balance sheet data (DNB). 2007–2021. DHS, DNB Household Survey; DNB, Dutch Central Bank; DTS, DNB Trust Survey.

ownership of the annuities, life insurances, and arrangements via one’s employer as just discussed. It appears that higher levels of trust in one’s own pension fund are positively related to this indicator for additional pension savings. This could reflect a general attitude of respondents towards believing in the importance and efficacy of the retirement system: those who trust the system at large will have no direct way of increasing their contribution towards their own fund and may seek alternative forms of pension savings. Those that are skeptical that the retirement system works for them, may abstain from committing savings in long-term products of any sort.

Empirical strategy

Determinants of trust

The descriptive evidence above suggests some intuitive relationships between trust in one’s own pension fund and

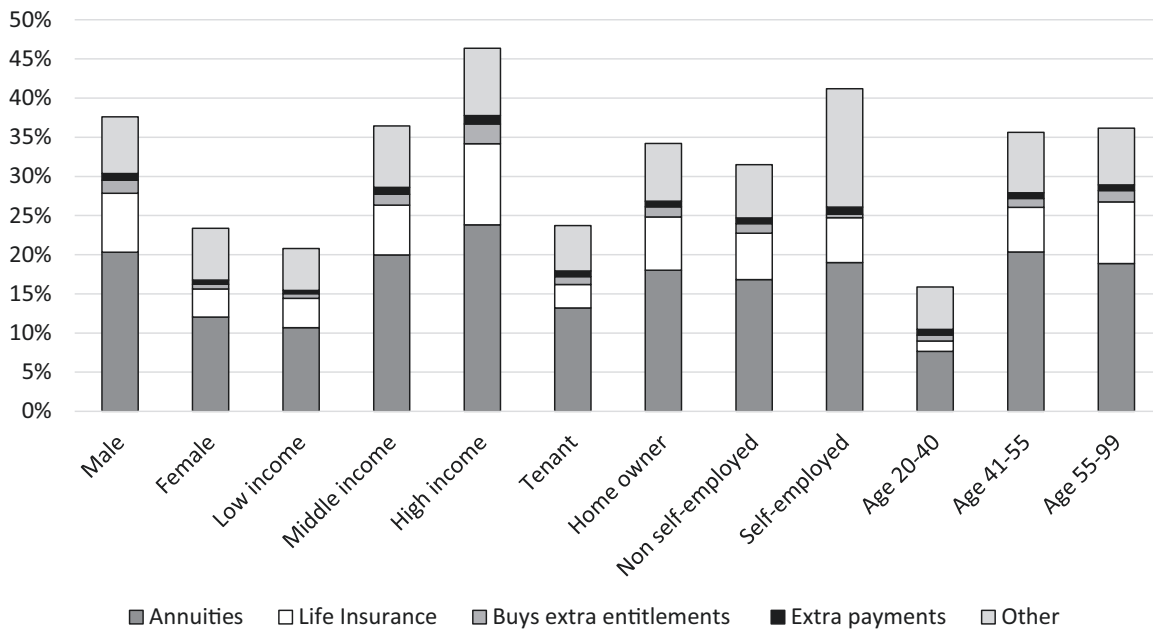


Figure 6. Voluntary pension arrangements and observable household characteristics. Year 2021. Source, DHS data, own computations. DHS, DNB Household Survey; DNB, Dutch Central Bank.

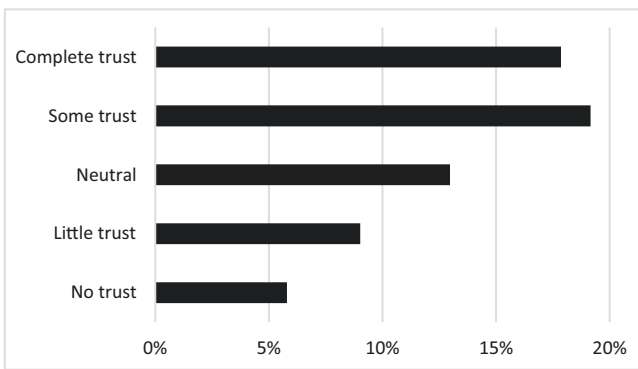


Figure 7. Voluntary pension savings and trust in one's personal pension fund in 2021. Statistics based on households in the DTS merged to DHS data. Year 2021. DHS, DNB Household Survey; DNB, Dutch Central Bank; DTS, DNB Trust Survey.

observable characteristics. We test whether these relationships are significant within a multivariate analysis by estimating the following equation:

$$T_{i,t} = \gamma_0 + \gamma_1 Z_{f,i,t} + \gamma_2 X_{i,t} + \gamma_3 Y_t + \gamma_4 C_i + v_{i,t}. \quad (1)$$

Here, T stands for trust of individual i at time t . This variable takes integer values with trust levels 1 (no trust) to 5 (full trust). On the righthand side of (1), Z includes the level of indexation, a continuous measure expressed in percentage points (negative in case of nominal cuts) per pension fund f in period t , as well as the fund's size (number of covered workers), complemented with individual respondent-level indicators of (wrongly) perceived indexation, as described above. We use pension fund size as a proxy for economies of scale. Larger funds have the potential to both alleviate the administrative costs for their participants and access larger, potentially more lucrative investment opportunities. Conversely, fund size could also signal larger hedging costs,

or even indicate that the possibility to immunize is lacking (Kim & Mastrogiacomo, 2022), due to incomplete insurance markets. The effect of fund size therefore is a priori unclear. X is a vector containing individual characteristics, including age and trust institutions other than one's own pension fund; Y proxies business cycles effects that are relevant for fund investments, captured by GDP (gross domestic product) growth,⁵ and C contains individual-level time invariant variables such as birth cohort or gender.

In [Supplementary Table A1](#), we present detailed empirical results from five different specifications of (1), namely a simple OLS (ordinary least squares) regression using trust on a linear scale (Model 1), and then a series of (first stage) estimation results for RE (random effect) and FE (fixed effect) models for the whole sample (Models 2 and 4) and for employed individuals (Models 3 and 5).

The table shows coefficients for the two exclusion restrictions that we use later on. First, the recovery measures point to a positive association with trust in all models. There is a significant positive relation between the level of benefit indexation (which includes cuts too) and whether the participants trust their pension fund. Second, the size of the fund, proxied by the number of participants, is instead negatively related to trust. As noted, trust and financial performance were positively related, but larger funds had a prolonged worse performance during the financial crisis. We mention two reasons. (a) Large funds might find it more difficult to deal with sudden drops in asset prices as they must spend more to protect themselves (hedge) against these drops in the short term. (b) An alternative to hedging could be immunization—the practice whereby the investments in the fund match up with when the fund needs to pay out money, for example, for pensions. For bigger funds, it is harder to find long-term investments that line up well with when they have

⁵We cannot use year dummies because we are already correct for age and year of birth.

to pay out money over many years, as such long-term financial products are scarce.

While size also indicates positive impacts through economies of scale, our findings suggest that size-related factors negatively affecting financial performance, and trust outweighed the positive effects. We get back to this in our heterogeneity analysis.

We also include here two ancillary variables that measure perceptions. The first is the (wrongly) perceived indexation, where participants unaware of actually applied cuts have higher trust in their fund. The second embodies the opposite situation, namely the wrong belief that funds applied cuts. The first is significantly related to trust, and the second is generally not significant in itself, but both parameters are jointly significant.

We also see that trust in other financial institutions is positively related to a lack of trust in one's own pension fund, in accordance with the evidence in [Figure 1](#) that shows diverging levels of trust relative to pension funds over time. This is also true for the general government, but the estimated coefficient is lower. This could suggest a role for unobservable factors, whereby trusting individuals also have more confidence in all other institutions. This might explain the somewhat lower size of the trust indicators in Model 5, as in the fixed effect estimation these types of unobserved individual-fixed characteristics are filtered out, at least if trust stays constant over time at the person level. So, while unobservable factors seem to affect trust in pension funds as well as in financial institutions, they do not fully explain the relationship. The cohort effects, where the youngest cohort serves as a reference group, suggest that older cohorts have more trust, while the age-time effects are more negative for younger respondents. The age function is a linear spline. We find that participants between 18 and 30 become approximately 0.07 less trusting with each year of age, while for older individuals the reduction is at most about 0.02. The remaining factors to have a similar impact in all models are related to income and gender ([Chaudhuri & Gangadharan, 2002](#)), with the exception of the fixed effect specification. The effect of GDP growth is instead positive in all models. The latter is a time effect and shows that respondents are more trusting in periods of higher growth. All the results are similar in the whole sample and in the sample that includes only employed individuals. The effect of pension cuts and indexation on trust is somewhat smaller in the sample that is only composed of current workers. This result may be driven by retirees who see their expected real benefits shrink at a point when they are unable to adjust (possibly being disappointed by a broken promise).

Sample simulations with these results show that if indexation had been one percentage point higher across the entire sample period (which is a large increase given the average indexation being 1.4%), trust would have increased only very slightly, from an average value of 3.66 to 3.72.

Effects on voluntary savings

We have so far concentrated on explaining trust levels from observables, using a range of different empirical models. Qualitatively, all empirical results point in the same direction: trust suffers when benefits are cut or are not (fully) indexed to wages and/or inflation. Does it matter for observed financial behavior? That is, do respondents whose trust in their

pension fund's promise erodes adapt their savings response? This question is of much larger economic significance since policymakers need to understand whether communication that aims at trust-building can have the desired effects.

To provide a meaningful answer to the question, we take into account that trust is potentially endogenous to savings in financial markets. For example, it is possible that respondents who use voluntary retirement saving vehicles learn about financial markets, the pension system and pension policy, which in turn affects their level of trust in their own pension fund. Such confounders can invalidate the empirical exercise of regressing savings on trust, when there is reversal of the direction of causality.

In order to take the endogeneity concern into account, we pursue an instrumental variables (IV) approach that uses shifters of trust unrelated to the savings decision. We use model specifications similar to those in [Supplementary Table A1](#) as a first stage, where the changes to indexation (and pension cuts), as well as fund size, are used as instruments for trust to explain participation in voluntary pension savings in a second stage. We leave out the variables related to the respondent's erroneous perception of fund performance.^{6,7} Thus, we assume that the IV that affects or characterizes pension funds and their policies are related to the individual's saving decision only through trust, but not directly so. In terms of [equation \(1\)](#), these instruments were denoted with the symbol Z .

For a valid IV regression, two conditions must hold: instrument relevance and exogeneity. Formally, the first condition boils down to there being a (strong) correlation between instruments and the instrumented variable, $\text{Cov}(T_{i,t}, Z_{f,i,t}) \neq 0$. The second assumption of exogeneity implies that conditional on the instrument, the unobservable factors ε in the main equation have expectation zero for any value of the instrument, $E(\varepsilon_{i,t} | Z_{f,i,t}) = 0$. The first condition, namely that the IV do matter in explaining the variation in trust, was tested in *Determinants of trust*. The second condition is essentially untestable in exactly identified models (single instrument for trust), but as we have several instruments, we can use the canonical Sargan–Hansen overidentifying restriction tests. We shall comment on them below.

The second stage then models the relationship between trust and voluntary savings and estimates the following equation:

$$s_{i,t} = \beta_0 + \beta_1 T_{i,t} + \beta_3 X_{i,t} + \beta_4 Y_t + \beta_5 C_i + \varepsilon_{i,t} \quad (2)$$

Here, s is a dichotomous variable capturing voluntary pension savings participation, and β_1 is the effect of trust (in one's own pension fund), variable (T). Above, we discussed how trust in one's pension fund could be endogenously related to trust in other financial institutions. When we look at voluntary savings participation, this endogeneity could be even stronger, as individual factors affecting saving decisions that are unobserved here—for instance, risk aversion, the propensity to save—could affect trust in the pension funds

⁶The actual first stage corresponding to [Supplementary Table A2](#), without the two additional instruments, is very similar to what we show in [Supplementary Table A1](#), as the coefficients on other variables are hardly affected by the omission.

⁷In robustness checks we also use the awareness of indexation as additional instruments for trust. This means that the final column in [Supplementary Table A1](#) is the complete first stage of the last model in [Supplementary Table A5](#).

as well. Linde (2019) found that individuals who are more risk-averse are more likely to engage in additional pension savings for precautionary reasons. Controls X , Y , and C are defined as in equation (1) and are expected to affect voluntary pension. Instruments Z from equation (1) are left out from equation (2) (exclusion restrictions). Results for estimates of equation (2) are in Supplementary Table A2, with a series of linear probability models. That is, we treat the dichotomous indicator of voluntary pension savings participation as linear variable.⁸

We present the results of the second stage regression for Models 2–5 where only indexation and fund size are used as instruments. These are random effect IV models (Models 2 and 3), and fixed effect IV models (Models 4 and 5). Models 2 and 4 are again estimated on a smaller sample of employed workers only, leaving out non-active pension fund members. We compute robust standard errors, clustering at the respondent level. We include the OLS regression to be able to gauge the size of an endogeneity bias that we hope to remove using the instrumental variable specifications. Supplementary Table A2 shows a positive and statistically significant relationship between trust in one's own occupational pension fund and participation in voluntary pension savings in all IV models. This is our main result. The OLS coefficient on trust is more than a magnitude smaller than the IV coefficient, indicating substantial endogeneity bias. In other words, we underestimate the effect of trust on voluntary pension savings when not allowing for the possibility that trust responds to pension fund policy changes and pension fund characteristics. For the IV models, we already discussed the relevance of the instruments when commenting on results in Supplementary Table A1.

Supplementary Table A2 also shows the results of the Sargan–Hansen tests, allowing us in all cases to reject the null hypothesis that the instruments are not valid at the 5% level. So, the positive correlation found can be interpreted as an unbiased effect of trust on participating in voluntary pension savings.

Except for the uninstrumented case (Model 1), the relationship between savings, and low trust in banks and DNB is generally negative (Models 2–5). This means a positive direct relation between pension savings and bank savings, that are seen as complementary.

Lastly, it is of interest to distinguish within the sample of respondents that we use in Models 2 and 4 a subsample consisting only of people currently employed (Models 3 and 5, respectively). The latter are contributors to the system, who may be engaging in additional saving for retirement. They are arguable more likely to be motivated by life-cycle considerations. Retirees instead who see their real pension level cut are more likely to respond in the form of precautionary savings (thus motivated by uncertainty) as, because of their age, they have little room and incentive to contemplate additional life-cycle saving during retirement. Hence, we would expect the savings response to variation in trust to be larger among the current workers. This appears to be the case as a comparison of the trust coefficient between Models 2 and 3, and between Models 4 and 5, suggests.

Self-employed workers are less likely to answer that they participate in a voluntary arrangement, but in the FE models,

this estimate is not significant. This might be because some of these arrangements (buying extra entitlements and paying extra premiums) are only available for workers who have an employer, although the finding is common to other studies as well (Mastrogiacomo & Alessie, 2014). Cohort-time and age effects reveal higher participation among older cohorts and a negative age gradient for older ages. All variables connected to the socio-economic status show positive and often significant coefficients.

The results suggest that the likelihood of having additional pension savings rises when an individual's trust level increases by one step on the five-point scale. One caveat may be in order at this point: our linear model treats trust as a continuous variable, whereas one might argue that the cardinal differences between any two answer values are essentially without meaningful interpretation, and the variable should be treated as a categorical, ordinal variable. On ordinal scales, answer values only indicate rankings. In addition, individuals may interpret the various answer categories and their associated adjectives very differently. For instance, "complete trust" can mean different things to different individuals. In a similar line of reasoning, a step from complete lack of trust to predominant lack of trust cannot be viewed as a step of equal length as, for example, from neutral to predominant trust. Our focus on the linear specification stems from the need to accommodate an IV estimation setup. But the ordinal nature of the response calls for a test of non-linear specifications. One could use the information on trust to create an indicator that takes value 1 only if some trust is observed and zero otherwise. Alternatively, one could use the ordered scale provided in the answer. In the first case, we would estimate a logit model and in the second an ordered logit. Supplementary Table A2 provides robustness results obtained from ordered logit models of the first stage that do not share the ordinal caveat. This strategy is similar to that in Van Dalen and Henkens (2018). The authors relate trustworthiness to information about the importance of perceived integrity, competence, stability, and benevolence of pension providers, characteristics that we do not observe in our data. Some variables are instead the same as ours, and these deliver similar results. The dependent variable "trust" is ordered on the same five points as ours, and they use sex as a regressor as well. Their result, whereby males trust pension funds more, resembles ours, both in direction and magnitude. They also observe a positive increase in trust with age in their cross-section, which we can attribute to the cohort-time effects in our panel, as explained earlier.

To give an additional idea of the magnitude of the estimated effects, we also perform a within-sample simulation using Model 5, for the increase in the share of individuals who would have additional pension savings if everybody were to have complete trust in pension funds.⁹ This suggests a very large response, as participation in voluntary savings would then increase from the current 21% to about 60%. This means that having complete trust in one's pension fund encourages additional private pension savings. Therefore, compulsory and discretionary saving are complementary for many respondents, and not substitutes. However, not everyone would be induced to save more even with full trust.

⁸It is econometrically challenging if not impossible to properly account for a multi-categorical instrumented variable in panel data. We investigate and comment on the potential nonlinearity in the Supplementary Appendix.

⁹This is merely a hypothetical scenario since it is unrealistic to consider policy instruments capable of instilling such "complete trust."

Table 2. Heterogeneity analysis for effect trust on savings (employees, based on Model 5).

	Coeff	St. err.	N	Group share (%)
Male	0.212 ^a	0.083	7,542	56
Female	1.087 ^b	0.273	5,972	44
Age <45	0.491 ^b	0.149	6,236	46
Age 45–60	0.845 ^b	0.236	5,661	42
Age >60	1.629	1.438	1,617	12
Home owner	0.532 ^b	0.102	10,899	81
Tenant	1.308 ^a	0.665	2,615	19
Monthly Gross income ≤4,000	0.582 ^b	0.201	6,341	53
Monthly Gross income >4,000	0.656 ^b	0.141	7,173	47
Fund participants: <10k	0.261	0.174	4,575	34
Fund participants: 10k–500k	–0.054	0.124	3,594	27
Fund participants: >500k	0.174 ^b	0.055	5,345	40

a = 5% and b = 1% significance level

Heterogeneity analysis

The results in [Supplementary Table A3](#) reveal that the effect of trust on savings is positive and it is stronger for the sample of employed individuals. In [Table 2](#), we test how heterogeneous this effect is when we take as baseline the fixed effect specification in Model 5 above.

The results show that the effect is mostly driven by females, older workers, and tenants. Also, the effect is only significant for members of larger funds. This is again in line with the idea that larger funds had a more protracted, low level of funding ratio, possibly due to their low level of immunization (Kim & Mastrogiacomo, 2022). There are no large differences between income groups (above and below median incomes).

Summary and conclusions

Trust is crucial for pension systems that promise a steady income in retirement. In the past, studies recognized trust's role in pensions but did not consider how trust might change in response to the system's actual returns. We deal with this by using two new measures to explain how trust affects participation in voluntary pension savings that we derive from supervisory data of pension funds.

One of these measures is fund size, that is, the number of participants, as this can affect the financial performance of a fund. Larger funds may have better investment opportunities or face fewer challenges in dealing with market fluctuations.

Using Dutch household survey panel data, we find that trust is related to these measures and increases with pension benefit indexation (inflation adjustment). In turn, fund size may be linked to lower trust. Our main finding is that trust has a positive impact on additional pension savings in particular when we correct for the possibility of a potential spurious relationship (for instance because of reverse causality).

People's trust in their pension funds does not necessarily increase as they get older. It seems that different generations start adulthood with varying levels of trust, and younger cohorts generally have less trust. This means that as older generations are replaced by younger ones, the overall trust in pension funds might go down. Our evidence should serve as a warning about the limitation of using purely cross-sectional

data on trust (van Dalen & Henkens 2018, p. 488), here we show that a positive relationship with age may be uninformative on the life-cycle evolution of trust.

This is important because if trust is mainly influenced by age, policymakers might think that young workers' perceptions will naturally change over time when one gets closer to retirement. However, if trust levels strongly differ between generations, then participants, especially young ones, need information about how the pension system accumulates and redistributes resources and shares risks across generations. In the ongoing transition towards a contribution-based system in the Netherlands, the way pension funds communicate about future benefits becomes vital for establishing trust in the new system. This holds significance not just for the Netherlands but also for many other countries contemplating or implementing similar systemic changes.

Supplementary material

Supplementary material is available online at *Music Therapy Perspectives* (<http://mtp.oxfordjournals.org/>).

Author contributions

Madi Mangan (Data curation, Formal analysis, Investigation, Writing – original draft, Writing – review & editing), Mauro Mastrogiacomo (Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Project administration, Writing – original draft, Writing – review & editing), Stefan Hochguertel (Methodology, Supervision, Writing – original draft, Writing – review & editing), and Floor Goedkoop (Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing)

Conflicts of interest

The authors have no conflicts of interest.

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