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The displacement effect of compulsory pension savings on private savings. Evidence from the Netherlands, using pension funds supervisory data

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ABSTRACT

We show heterogenous displacement effects of mandatory occupational pension savings on private household wealth for different groups. Richer households in particular show larger displacements. This contributes to explaining why empirical studies often come with different estimates of this effect. We study the case of the Netherlands, where wage employed and self-employed workers are differently exposed to compulsory pension savings, and the institutional setting provides exogenous variation in pension wealth that can be used as instrument in the analysis. We use rich administrative data on (pension) wealth and income combined for the first time to supervisory data of pension funds. Our results show a displacement effect of −37% for wage employed and of −61% to −77% for self-employed people. The higher displacement effect we find for the self-employed might be explained by the fact that self-employed workers are arguably more aware of their pension accrual, or lack thereof, because there is no employer who organizes and (partly) pays this for them.

Introduction

A mandatory retirement system can affect private savings through the displacement effect, and by inducing early retirement (Feldstein, 1974). The effects on early retirement have been extensively documented by e.g. Gruber and Wise (1999, 2008). Our paper further investigates the displacement effect of compulsory pension savings on private (discretionary) savings. More information on the displacement and wealth effects – and the heterogeneity thereof – can be of guidance to policy makers who are looking for ways to help vulnerable groups to better prepare for retirement or to make the pension system more robust in light of an ageing society.

Many studies have appeared on this subject, resulting in a wide range of estimates for the displacement effect. This large variety in outcomes reflects the heterogeneity among the research subjects. The studies vary, for example, in the periods, the countries and the pension schemes (public and/or private) they examine. Part of the deviation in estimates will stem from the biases and measurement errors that challenge this field of research, but in part it is also inherent to the institutional setting to which different groups are exposed, for instance because of their occupation. In fact, we argue that a large range of displacement effects in the literature can actually represent the large true heterogeneity in displacement effects over subgroups, provided that the identification of these effects is plausible. Several studies have already explicitly mentioned the potential underlying heterogeneity they found among subgroups. Attanasio and Brugiavini (2003) provided one of the first micro-based studies of the displacement effect, which they identified using the 1992 Italian pension reform. They exploit the variability in exogenous changes in pension wealth across groups of Italian households to identify the effect that pension wealth has on saving rates. Based on estimated pension wealth they find a displacement effect of −35% on average, but close to −100% for workers aged between 35 and 45. Attanasio and Rohwedder (2003) perform a comparable analysis using UK pension reforms over the period 1975–1981, with comparable results. They find substantial displacement effects (–55% to –75%), primarily among the older and higher income households. They state that the lower displacement among the poorer and younger households might be caused by liquidity constraints.

Engelhardt and Kumar (2011) study the 1992 wave of the US Health and Retirement Study to estimate the displacement effect. They also find that displacement is higher for the higher wealth quintiles. Using a large Danish panel data set over the period 1995 to 2009, Chetty et al. (2014)

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show that the effects of retirement savings policies on wealth accumulation depend on whether these policies change savings rates as an active or passive choice. They find that approximately 85% of individuals are passive savers who save more when induced to do so by an automatic contribution, but do not respond at all to price subsidies. Such subsidies lead to little action at all and, if so, than primarily by individuals who are planning on saving for retirement already and who respond by shifting savings across accounts, which leads to almost full displacement.

Hurd et al. (2012) use micro data sets from 12 countries to construct income replacement rates and private saving measures by education level and marital status, as proxies for lifetime earnings. They estimate the displacement effect by using cross-country differences in the progressivity of the pension formula and the average generosity and find that an extra dollar of public pension displaces 22 cents of accumulated financial assets. Alessie et al. (2013) estimate the displacement effect for 13 European countries, including the Netherlands, based on SHARELIFE data. Their data include retrospective data on lifetime earnings. They suggest a displacement effect of 47 percent. They also explore IV estimates, which suggest full displacement, but with less precision. Van Santen (2019) uses survey data from the Netherlands. Using exogenous variation in pension fund performance as an instrument for the expected retirement replacement rate, the author finds that uncertainty in pension income drives households to save significantly more. Not controlling for uncertainty would bias the estimated displacement effect of pensions on private savings towards zero.

Our study adds to the literature by using pension wealth directly as reported in administrative data for a large and representative sample of the Dutch population. The rich administrative datasets on pension participation and wealth in the Netherlands allow us to analyze different subgroups, characterized by their income, wealth, education, household composition, sector of employment and more. In survey data some groups, such as self-employed workers with compulsory pension savings, cannot be identified, or their sample size is too small. In our study, we can assess the displacement effect for the self-employed as well, and compare this to the displacement effect for the wage employed. We include supervisory data of the Dutch National Bank (DNB, tasked supervisor of pension funds) where not only the financial performance of the pension fund is included, but also information on characteristics of the fund, such as the number of participants, along with reporting supervisory actions that funds in financial distress must enact in accordance with DNB. Our link of balance sheet and supervisory data of pension funds to our micro data is also very precise, as we identify workers in several binding labor agreements, which in turn also allows us to set up different robustness and specification checks.

In our analyses, we use panel data over the period 2007–2010. This timeframe includes the financial crisis, which represented an unexpected and exogenous shock to pension wealth. In the Netherlands, the asset price crisis impacted pension funds in 2008 first, and most households only in 2009 when house prices started falling. In 2010 the Dutch Central Bank finished negotiating all recovery plans with the Dutch pension funds. In our data, we do not have a measure for the subjectively expected replacement rate to proxy pension wealth. However, this variable, due to anchoring, has been found to vary unrealistically little in Dutch survey data (see van Duijn et al, 2010). We use an instrumental variable approach, where we instrument pension wealth using two ex-ante measures of pension plan profitability, namely the size of the company and the number of active fund members in the pension fund. We find an average displacement effect for couples of −37% for wage employed and of −61% to −77% for self-employed people. The higher displacement effect we find for the self-employed might be explained by the fact that self-employed workers are arguably more aware of their pension accrual, or lack thereof, and might have developed a habit in savings (Alessie and Teppa, 2010) for reasons related to their business.

The remainder of this paper is organized as follows. We start with a short introduction of the Dutch pension system in Section “The pension system in the Netherlands”. In Section “Data”, we describe our data sources. Section “Empirical implementation”, on the empirical implementation, contains our identification strategies and our primary results. We conclude in Section “Conclusion”.

The pension system in the Netherlands

The Dutch pension system consists of three pillars. The first pillar is the state pension (AOW), which provides a flat rate base income for retirees, only depending on the period someone has lived or worked in the Netherlands in the 50 years before the statutory retirement age and on the household composition (couples receive a lower benefit per person than singles). The statutory retirement age was historically set at 65, but has been steadily increased since 2013. There is no option for early retirement in the first pillar. The state pension is financed through pay-as-you-go.

The second pillar consists of the – capital funded – occupational pension schemes. The pension premiums are tax-deferred, the benefits are subjected to income tax at payout. Early retirement is possible within certain bandwidths, depending on the specific occupational pension scheme, with an actuarially fair impact on the pension benefits. New legislation in 2006 effectively abolished implicit or explicit subsidies on early retirement schemes.[1] Tax benefits depend on, and generally rise with, the income level. There is no general obligation to participate in an occupational pension scheme, but social partners can take the initiative for a pension scheme and ask the government to make this scheme mandatory for an entire sector or profession. Effectively, over 90% of all employees participate in the second pillar. Yet, among the self-employed participation is less than 10%. This dichotomy requires separate analysis of these two groups.

Many of the self-employed that do accrue an occupational pension belong to the close to a dozen mandatory professional pension funds for independent professionals like medical specialists, general practitioners, physiotherapists and notaries. These funds were mostly founded in the 1970s and have about 50.000 active participants in total. Next to these professional funds there is an industry pension fund for painters, carpenters and glaziers (founded in 1951) where the self-employed who are active in that industry are also obliged to participate. This fund had about 30.000 active participants in 2014, among whom a substantial number of self-employed workers (possibly more than half).

Not only is quasi-mandatory participation in the second pillar almost ubiquitous in the Netherlands, the average pension accrual is also relatively high. According to the Global Pension Assets Study by the Thinking Ahead Institute, The Netherlands have the highest ratio of pension assets to GDP (166%) in the world in 2022. Also, it is currently mandatory for all second pillar pension savings to be fully annuitized at retirement, as insurance against the longevity risk.[2] This translates into substantial average pension replacement rates. Knoef et al. (2016) estimated actual replacement rates, based on a large administrative data set, and found a median gross and net replacement rate of 71% and 84%, respectively, for the combination of the first and second pension pillar income. The contribution of both pillars is roughly equal in size.

Over time, the number of pension funds has been dropping, from about 600 at the beginning of the century to half of that as of 2023. This

[1] Since 2006 there has been a continued, gradual increase of the average effective retirement age for wage-employed from 61 year in 2006 to 64 year in 2014. Meanwhile, the average effective retirement age for self-employed remained almost stable at close to 66 year over that period (Statistics Netherlands, January 2015).

[2] Only very small pension savings are exempted from full annuitization, for efficiency reasons. Currently, a bill is debated to make the option available to take out up to 10 percent of the accrued pension wealth as a lump sum at retirement.

Table 1
Selection criteria and available number of observations 2007–2010.

Selection criteria	$N \times t$
Number of households in IPO wealth with head age 18 to 90	357,764
Number of households with head employed	224,873
Selection with head age 40 to 60	155,460
Selection head WE or SE dropping hybrids	144,851
Selection due to loss in merging, missing values, etc	99,403
of which WE couples	75,121
of which WE singles	14,756
of which SE couples	9,526

Note: We drop households composed of more than one family and those with children above 25 still living in the household. We also drop the top and bottom 1% for household wealth, household occupation pension wealth and household income. Additionally, there is some loss of observations due to merging with other datasets. The group of self-employed singles was too small (only 1500 observations), and was dropped as it did not allow the heterogeneity analysis presented later on.

is partly induced by regulations that, starting around the turn of the century, made it hard for very small pension funds to exist. These have often migrated their assets to insurers. Also, several pension fund merges have taken place, indirectly testifying that the size of the fund, and more in general economies of scale, are relevant for performance. This is important to highlight because this will be pivotal in the choice of our instrumental variables later on.

The third pillar consists of capital funded individual pension products. This pillar is relatively small in the Netherlands. Those without a (full) second pillar pension can take advantage of the available tax benefits with these products. Based on preliminary data of Statistics Netherlands (CBS) self-employed workers hold 10% of the third pillar policies, but 20% of the total value. The relative weight of the three pillars is 50–45-5 (CBS, 2010; van de Grift and de Rooij, 2008).

Data

Our analysis is based on the Dutch Income Panel Study with Wealth ("Inkomens Panel Onderzoek met Vermogen" in Dutch, hereafter IPO Wealth) over the period 2007 to 2010. IPO Wealth is an administrative dataset containing yearly records obtained from various government registers on almost 100,000 households, or approximately 1.5% of the entire Dutch population. This is a highly accurate and representative panel, where only migration or death could cause attrition. The panel structure is such that a key person in the household is followed over time. The longitudinal dimension is always exact in following the key person, but one should keep in mind that household composition can change, and thus also some household characteristics such as wealth – that we use here – can change due to this. In the IPO, there is no information on pension wealth. This can be elicited using occupational pensions files, where those observed contributing are reported and those not observed are imputed by CBS using relevant background information. However, to make this information precise, one needs to identify those who are not observed paying pension premiums because they are not affiliated to a pension fund, separately from those whose unobserved premiums are actually being paid by the employer. This is the reason why we focus on the 2007–2010 period because in that period we also have information on these cases through specific files made available by CBS on request of the ministry of social affairs (Mooij de et al., 2012). Later on, we show descriptive evidence to highlight how important it is to identify these groups separately in order to properly asses their pension wealth. After merging with these micro datasets,[3] the sample we use contains detailed information on personal wealth and income and the affiliation to the compulsory occupational pension, augmented with various background variables, such as gender, age, household composition, country of birth, municipality of residence, homeownership, wage-employment and self-employment status and sector. Finally, we also merge the data with pension-fund level balance sheet and supervisory information through the corresponding binding labor agreements. Although we will make use of the information on both partners in households with couples, we make some selections of households based on characteristics of only the household head, such as the age and labor market status. We define as the household head the oldest male in the household, or the oldest female when there are no males in the household. We focus our analysis on households with a household head aged 40 to 60, because at later ages early retirement might bias the sample and at younger ages respondents have accumulated very little pension wealth.

As our aim is to highlight heterogeneity across groups, we need to precisely identify one's employment status. Following the administrative data from the tax office, we define individuals as self-employed if they have non-zero income from their own business. Additionally, we define those who have income from both their own company and wage-employment as hybrid self-employed, and we remove them from our dataset to get clear comparisons between pure wage employed (WE) and pure self-employed workers (SE). We only consider singles and couple households (with or without children) and drop the otherwise composite households, for a clearer interpretation of household wealth and financial planning. Table 1 shows what the selection criteria mean for our available observations.

Previous studies on the Dutch case typically used survey data for their analyses. Euwals (2000) used the CentER Savings Survey, Alessie et al. (1997) and Kapteyn et al. (2005) used the Dutch Socio-Economic Panel, Alessie et al. (2013) used SHARELIFE and Van Santen (2019) used the DNB Household Survey and the Pension Barometer, administered by CentERdata. Using administrative data means that we lack the less tangible but also very valuable information that surveys can provide, such as information on the expected replacement rate or on preferences for saving and risks (van Santen, 2019). We do not observe expected or planned retirement age. However, Disney (2006) shows that, the more actuarially fair the pension scheme is, the more it will lead to the displacement of private assets and the less it will result in changes in the retirement age. The saving propensity and relative risk-aversion of individuals is also not observed in our data. We partly correct for the between-group heterogeneity by separating the analyses by occupation and pension fund affiliation, which is correlated with these preferences. We will also use dummies for having stocks, for having third pillar pension savings and for homeownership, to approximate relative risk-aversion and saving preference within the groups.

The primary dependent variable in our analyses is household wealth (in euro). Table A.1 in Appendix 1 lists the composition of private wealth, at the household level. Financial wealth is the sum of checking accounts and savings accounts, bonds and stocks, minus financial liabilities. The net value of housing wealth and business equity are available too. However, a limitation of our measure of the housing wealth is that we do not observe saving deposits accrued to the mortgage.

[3] We enriched the IPO data with several other administrative datasets from CBS: 1) "Witte vlekken onderzoek", which contains information about the current occupational pension fund affiliation (Mooij et al., 2012), 2) Pensioenaanspraken and Pensioendeelnemingen, which contain information on occupational pension entitlements, 3) Zelfstandigentab, which contains information about self-employment, and 4) SSBbaankenmerkenbus, which contains information about wage-employment.

Table 2
Pension funds, funding ratios and participants, by recovery status (2007–2010).

Year		Recovery plan	
		No	*Yes*
2007	Number of pension funds	19	0
	Average actual funding ratio	150%	–
	Average required funding ratio	105%	–
	Number of active participants (x 1,000)	3,966	0
2008	Number of pension funds	8	11
	Average actual funding ratio	110%	99%
	Average required funding ratio	105%	105%
	Number of active participants (x 1,000)	564	3,406
2009	Number of pension funds	6	13
	Average actual funding ratio	123%	108%
	Average required funding ratio	113%	118%
	Number of active participants (x 1,000)	211	3,757
2010	Number of pension funds	4	15
	Average actual funding ratio	124%	108%
	Average required funding ratio	114%	117%
	Number of active participants (x 1,000)	95	3,917

Note: A participant is considered active if paying pension premiums (thus not retired). Sources: DNB, CBS and authors' calculations.

Additionally, we include an approximation for the savings in private commercial (third pillar) pension products, based on the available data on the premiums paid to these products over the period 2000–2010.[4] This proxy will be an underestimation of the true third pillar accrual, but given the on average relatively small third pillar pension deposits, we expect the impact on our estimates to be limited, as we explain later on. The total household wealth is defined as the value of assets net of liabilities (see Table A1 in the Appendix).

The primary independent variable is the accumulated occupational pension wealth at the household level. Statistics Netherlands sampled information from pension funds and insurance companies on occupational pension entitlements for everyone in the Netherlands between the age of 15 and 64. The dataset contains information on the gross pension annuity that participants receive at retirement age (which was still 65 for the period we study), both as accrued at the reference date and as accrued at the retirement age, assuming the current job and wage remain unchanged. These two annuity values are also what pension funds typically communicate to their participants yearly, in what is called the 'Uniform Pension Overview' (UPO). The annuity at retirement as accrued at the reference date is also converted into a net present value at the reference date and we use this as our proxy for net pension wealth. Because first pillar entitlements in the Netherlands are not income related and the full benefit level only varies between single and coupled households – which we study separately – we ignore this in our analyses. Only first generation immigrants miss a part of their first pillar pension build-up if they entered the country after age 15. We control for this by using several dummies on country of origin.

Later on, we propose to instrument pension wealth using the (log of) company size and the (log of the) number of active fund members.

Our information on the number of active members covers 19 of the biggest Dutch pension funds over the period 2007–2010, and also reports whether or not they implemented a recovery plan in these years. The 19 pension funds we were able to incorporate in our analysis serve a majority of the active Dutch pension scheme participants. We were able to link this to our dataset through the corresponding labor agreement (CAO) identifiers.[5]

Table 2 shows the pension funds, the average actual and required funding ratios and the numbers of active and observed participants, by year and recovery plan status. Overall, 15 funds needed a recovery plan within our observation period, that came into effect in either 2008, 2009 or 2010. No recovery plan ended during these years. This is evidence of the exogenous shock that helps our identification strategy.

Current pension scheme participation

For a correct determination of the variable 'pension wealth' we need to look at the current pension scheme participation status of the households we study. The pension scheme participation status – and thus also the accumulated amount of pension wealth – strongly depends on occupational choices. Yet, while most Dutch wage employed are compulsory affiliated to the occupational pension system and most self-employed people are not, both groups include a substantial minority with a divergent pension regime. This is typically unavailable in survey data – and often even in administrative data – but can be identified in our dataset thanks to the link with ad hoc CBS data (Mooij et al., 2012) that specifies, among others, how much of the premium is paid by the employee and how much by the employer.

Among wage employed there is a group, largely invisible in both official statistics and academic studies that use survey data, who do not participate in a mandatory pension scheme. The ad hoc CBS data identify this group over the period 2007–2010 only. The data showed that in 2010 about 9% of all male employees aged 25–64 did not participate in an occupational pension scheme. Wage employed without compulsory pension are relatively overrepresented among those with an income that is over about twice the median income (15%), those working in the commercial service sector (15%) or those working at a small company (21% for companies with less than 10 employees, 6% for companies with over 100 employees), and should not be included in an estimate of the displacement effect for pension funds participants (Mooij et al., 2012). This is relevant because in survey data, when information about pension fund affiliation is not available, one does not know whether the

[4] We proceeded in a similar fashion as Knoef et al. (2017). When we observe a premium paid after 2000, we assume that is the first premium being paid. We assigned to it a fixed rate of return (in our case 3% per year) and we add additional premiums only when observed. Once a premium is added, this also will deliver a fixed return year to year (again 3%). We have also conducted some sensitivity analysis to the assumed return of 3%. When we modify this in the range 0% to 5%, this naturally leads to a difference in the proxy for third pillar pensions, but we notice no relevant difference in the estimation of the displacement effect.

[5] The individual pension fund affiliation is not available in the datasets of Statistics Netherlands, so we linked respondents to pension funds through their labor agreement identifier, as described by Eberhardt and Bosch (2014), Bijlage Achtergronddocument Pensioenpremiedatabase, CPB. They mapped how the biggest Dutch pension funds are connected to the top 110 Dutch labor agreements.

Table 3
descriptive statistics selected variables, 2007–2010.

Variable	Wage employed				Self-employed			
	with pension		without		with pension		without	
	mean	***s.d.***	**mean**	***s.d.***	**mean**	***s.d.***	**mean**	***s.d.***
Household wealth	168,044	187,429	178,043	234,736	405,211	363,335	347,774	363,706
Value of the house	282,220	143,061	307,927	166,075	425,700	224,056	341,020	171,371
Financial wealth	49,404	89,115	63,882	152,027	123,777	179,821	66,309	112,738
Private pension (3rd pillar)	8719	19,579	10,471	27,873	46,770	92,876	26,376	67,465
Mortgage debt outstanding	178,099	122,865	211,206	147,587	274,053	216,830	200,668	149,402
HH occupation pension wealth	103,029	107,853	47,519	75,977	105,927	101,841	32,352	50,802
HH net income	41,877	16,501	45,937	21,764	83,286	45,776	48,280	24,758
HH average total compensation (yearly)	47,175	19,555	47,710	23,141	99,073	56,992	49,145	25,205
Age	48	5.65	47.2	5.51	48.6	5.53	47.6	5.69
Non-temporary contract	98%	0.14	94%	0.23				
Full-time contract	79%	0.41	81%	0.39				
Stock ownership	29%	0.45	36%	0.48	38%	0.49	34%	0.47
3rd pillar pension wealth ownership	44%	0.50	43%	0.50	69%	0.46	53%	0.50
Home ownership	80%	0.40	79%	0.41	95%	0.21	83%	0.38
Year 2007	23%	0.42	26%	0.44	24%	0.43	23%	0.42
Year 2008	25%	0.43	26%	0.44	25%	0.43	25%	0.43
Year 2009	26%	0.44	25%	0.43	25%	0.44	26%	0.44
Household size	3.32	1.27	3.33	1.32	3.90	1.16	3.78	1.14
High urbanization	15%	0.36	15%	0.36	13%	0.33	14%	0.35
Western immigrant 1st gen	3%	0.16	4%	0.20	3%	0.18	3%	0.17
Western immigrant 2nd gen	5%	0.22	6%	0.24	9%	0.29	4%	0.19
Non-Western immigrant 1st gen	6%	0.24	8%	0.27	2%	0.14	7%	0.25
Non-Western immigrant 2nd gen	0%	0.06	1%	0.08	1%	0.08	0%	0.04
Married	89%	0.31	88%	0.33	87%	0.34	84%	0.37
Widowed	1%	0.10	1%	0.08	0%	0.00	0%	0.04
Divorced	11%	0.31	12%	0.33	4%	0.19	4%	0.19
Partner is WE with pension	61%	0.49	54%	0.50	37%	0.48	32%	0.47
Partner is WE without pension	6%	0.24	9%	0.29	6%	0.24	4%	0.21
Partner is SE with pension	1%	0.10	1%	0.10	21%	0.41	6%	0.24
Partner is SE without pension	3%	0.17	4%	0.20	7%	0.25	29%	0.45
Partner age	45.2	6.60	44.3	6.47	46.2	5.99	44.6	6.66
Partner Western immigrant 1st gen	4%	0.19	5%	0.22	3%	0.17	4%	0.20
Partner Western immigrant 2nd gen	5%	0.21	5%	0.22	5%	0.21	5%	0.21
Partner Non-Western immigrant 1st gen	6%	0.24	8%	0.27	1%	0.11	7%	0.25
Partner Non-Western immigrant 2nd gen	0.4%	0.06	1%	0.08	0.4%	0.07	0.4%	0.06
Agriculture	1%	0.10	1%	0.08	0%	0	13%	0.3
Industry	18%	0.38	18%	0.38	0%	0	6%	0.2
Public sector and Education	21%	0.41	2%	0.13	0%	0	3%	0.2
Construction	10%	0.30	1%	0.08	38%	0.49	18%	0.4
Wholesale and Retail	13%	0.34	17%	0.38	0.30%	0.05	22%	0.4
Transportation and Storage	8%	0.27	5%	0.22	0%	0	4%	0.2
Accommodation and food services	1%	0.12	0%	0.04	0%	0	6%	0.2
Information and communication	3%	0.18	10%	0.30	0%	0	2%	0.2
Finance related	4%	0.19	19%	0.39	0%	0	2%	0.1
Business services	10%	0.30	26%	0.44	10%	0.29	15%	0.4
Health care	5%	0.21	0%	0.02	52%	0.50	2%	0.1
Culture and sport	1%	0.10	2%	0.13	0%	0	3%	0.2
Other sectors	5%	0.22	1%	0.10	0%	0	5%	0.2
N	80,885		8992		705		8821	
N couples (Wage employed)	75,121							
N Singles (Wage employed)	14,756							
N Couples (Self-employed)	9,526							

Note: SE = self-employed, WE = wage employed, gen = generation. The 3rd pillar stands for private pension savings. Source: CBS Microdata, own computations.

pension wealth is missing or zero (see van Santen, 2019). Here instead we do.

At the same time, a proportion of self-employed workers, who are often mentioned for their lack of affiliation to the occupational pension system, do actually participate in a mandatory professional or industry pension fund (self-employed with compulsory pension) and should be included in a study of the displacement effect for pension funds participants. For instance medical specialists, general practitioners, physiotherapists, notaries and a group of painters and carpenters (see Section "The pension system in the Netherlands" for more details). We identify the self-employed with compulsory pension by using the code on the industry in which the self-employed is active (the SBI-code). Participation in the industry pension fund for painters, carpenters and glaziers is explicitly obliged for those self-employed workers active in a specific sector. For the other groups of self-employed workers with compulsory pension their profession is precisely enough defined for us to be sufficiently confident that the professional pension fund obligation applies to them.

Table 3 compares the means of selected variables for the whole sample over the years 2007–2010, separately for wage employed and self-employed, taking into account their pension scheme participation status as elicited in the ad hoc CBS data mentioned above. It is based on the selection in Table 1 where all variables in the analysis, including pension fund size, are available, thus corresponding to the estimating sample later on.

When we focus on the wage employed, the statistics show that those without active pension build up have accumulated more household wealth than those with, primarily in the form of household financial

Table 4
Estimates of the displacement effect for wage employed (OLS), 2007–2010.

	Couples	Singles
Whole sample	−0.0325***	−0.172**
With Gale's Q	−0.0381***	−0.236**
Income below median	−0.0556***	−0.0762
Income above median	−0.0634***	−0.182**
Wealth below median	0.0132***	0.0226
Wealth above median	−0.0711***	−0.251***
Elementary/no education	−0.0418***	−0.122
Higher education (all)	−0.00680	0.0345
Urban area	0.0107	−0.0311
Rural area	−0.0752***	−0.165
Pre-crisis period (2007)	−0.0504***	−0.232*
Post-crisis period (2008–2010)	−0.0290**	−0.170***
Financial sector	−0.0177	0.159
Non-financial sectors	−0.0359***	−0.197***
Age below 45	−0.0410**	−0.223**
Age 45–55	−0.0700***	−0.181
Age above 55	−0.0392*	−0.0424
N	75,121	14,756

Note: Coefficients have been estimated with clustered standard errors by household. Gale's Q adjusts compulsory savings by a discount factor that allows one to compare compulsory savings across generations that are far from retirement with those of the elderly. The estimation by subgroup are without Gale's Q. Urban and rural areas defined on the basis of a 5 point scale urbanization classification of CBS. The distribution of the subgroups in the population of couples is as follows: Higher education = 32%, Urban area = 62%, Pre-crisis period = 49%, Financial sector = 5%, Age below 45 = 40%. Asterisks represent statistical significance at conventional levels: ***= 1%, **= 5%, * = 10%. Source: CBS microdata, own computations.

wealth, and also have built up slightly more third pillar pension wealth. As we would have expected, wage employed with active pension accrual have a higher net present value of occupational (second pillar) pension wealth. Still, wage employed without active pension accrual have an average household occupational pension wealth of almost half the amount relative to active participants. This partly represents the dynamics in pension participation status over time. Not all inactive pension participants have always been without pension accrual, and not all active ones have always been accruing pensions before. Another important explanation is that we look at pension wealth at the household level. The occupational choice and pension scheme participation status of the partner are only mildly correlated with those of the household head. Over half of the household heads with inactive pension status have a partner who does participate in an occupational pension scheme. Pension accruing wage-employed households earn a lower (gross and net) income, but when we look at total compensation, which includes an approximation for pension accrual, they earn almost the same on average.[6] There are several significant, but mostly small, differences in personal and household characteristics between pension-active and inactive households. The latter are relatively concentrated in sectors such as information and communication and in finance and they are almost absent in public service and education and in health care.

When we focus on the self-employed, we find that those with a pension fund affiliation have more household wealth. They also earn a substantially higher net household income on average, even more so when we look at total compensation, including pension accrual. Corresponding to the professional pensions funds for self-employed workers we discussed before, they are mostly found in construction, business services and health care. When the household head is self-employed, the partner more often is self-employed too, and there is also a strong positive correlation between their pension participation status. A comparison between wage employed and self-employed workers shows that on average the self-employed are substantially wealthier, but only those with a pension fund stand out with a relatively very high household income. They are also the oldest group on average, but these differences are much smaller.

All in all, the descriptive statistics indicate that especially self-employed people with and without active pension affiliation are two quite heterogeneous, non-random groups. This means that it is unlikely that we can fully control for possible selection effects in the

[6] We approximate total compensation, including pension accrual, by multiplying personal income above the first pillar pension (AOW) exemption by 1.25, because total (employer + employee) pension premiums typically amount to around 20% of this part of income. We also differentiate between an exemption for full-time (13,000 euro) and for part-time (10,000 euro) workers.

Table 5
First stage IV regression results of wage-employed couples, 2007–2010.

	coeff	*s.e.*
Instruments		
Log of active fund members	23.03***	*0.755*
Log company size	5.373***	*0.225*
HH average total compensation	1.855***	*0.0516*
HH variance total compensation	−0.00133***	*0.000223*
Pension fund performance uncertainty	1,508***	*50.39*
Pension fund performance uncertainty unknown (d)	−1.969	*1.646*
Age	−99.16***	*21.68*
Age^2	2.103***	*0.447*
Age^3	−0.0142***	*0.00304*
Non-temporary contract (d)	26.94***	*2.805*
Full-time contract (d)	−14.40***	*1.321*
Stock ownership (d)	3.942***	*1.297*
3rd pillar pension wealth ownership (d)	1.746	*1.157*
Home ownership (d)	22.01***	*1.424*
Year 2007 (d)	19.56***	*0.542*
Year 2008 (d)	13.57***	*0.441*
Year 2009 (d)	6.192***	*0.334*
Male (d)	−14.81*	*8.352*
Household size	−0.268	*0.598*
High urbanization (d)	2.741	*1.901*
Western immigrant, 1st generation (d)	−8.394**	*3.610*
Western immigrant, 2nd generation (d)	2.155	*2.799*
Non-Western immigrant, 1st generation (d)	−6.544**	*3.168*
Non-Western immigrant, 2nd generation (d)	−11.28	*7.257*
Married (d)	−6.789***	*1.978*
Widowed (d)	−8.320	*18.65*
Divorced (d)	−5.243	*3.601*
Province 2 (d)	0.796	*3.706*
Province 3 (d)	4.972	*4.119*
Province 4 (d)	1.786	*3.396*
Province 5 (d)	7.951*	*4.495*
Province 6 (d)	2.855	*3.182*
Province 7 (d)	2.079	*3.517*
Province 8 (d)	9.165***	*3.229*
Province 9 (d)	3.684	*3.119*
Province 10 (d)	−3.335	*4.460*
Province 11 (d)	−1.879	*3.135*
Province 12 (d)	10.15***	*3.569*
Partner is WE with pension (d)	15.12***	*1.274*
Partner is WE without pension (d)	–22.64***	*1.929*
Partner is SE with pension (d)	−7.541	*5.292*
Partner is SE without pension (d)	–22.43***	*3.331*
Partner age	2.105***	*0.143*
Partner is Male (d)	−14.98*	*7.680*
Partner Western immigrant, 1st generation (d)	−12.45***	*3.169*
Partner Western immigrant, 2nd generation (d)	−2.459	*2.841*
Partner Non-Western immigrant, 1st generation (d)	−5.160*	*3.102*
Partner Non-Western immigrant, 2nd generation (d)	−0.120	*6.501*
Constant	1,023***	*347.7*
Overidentification test of all instruments	49.3	
Observations	75,121	

Note: The instruments in the IV regressions are the number of participants in the pension fund and company size. The instrumented variable is household occupational pension wealth (1000 €). Dummy variables are indicated by (d). Coefficients have been estimated with clustered standard errors by household. Asterisks represent statistical significance at conventional levels: ***= 1%, **= 5%, * = 10%. Source: CBS microdata, own computations.

Table 6
Estimates of the displacement effect for wage employed (IV), 2007–2010.

	Couples	Singles
Whole sample (Random Effect IV)	−0.271***	−0.386**
with within-unit means	−0.330***	−0.434***
Whole sample (pooled IV)	−0.333***	−0.429***
with Gale's Q	−0.365***	−0.619***
Income below median	−0.357***	−0.507***
Income above median	−0.411***	−0.347**
Wealth below median	−0.0513***	0.0191
Wealth above median	−0.264***	−0.621***
Elementary / no education	−0.291***	−0.251
Higher education (all)	−0.332***	−0.257*
Urban area	−0.240***	−0.226*
Rural area	−0.329***	−0.308
Pre-crisis period (2007)	−0.322***	−0.238
Post-crisis period	−0.343***	−0.484***
Financial sector	−0.0750	0.259
Non-financial sectors	−0.340***	−0.484***
Age below 45	−0.563***	−0.803***
Age 45–55	−0.278***	−0.332
Age above 55	−0.134**	−0.148
N	75,121	14,756

Note: The instruments in the IV regressions are the log of number of participants in the pension fund and the log of company size. The random effect IV also includes within unit means of the time-varying regressors. We cannot not reject the null hypothesis of these means being jointly equal to zero. Coefficients have been estimated with clustered standard errors by household. Gale's Q adjusts compulsory savings by a discount factor that allows one to compare compulsory savings across generations that are far from retirement with those of the elderly. The estimation by subgroup are without Gale's Q. Urban and rural areas are defined on the basis of a 5 point scale urbanization classification of CBS. The distribution of the subgroups in the population of couples is as follows: Higher education = 32%, Urban area = 62%, Pre-crisis period = 49%, Financial sector = 5%, Age below 45 = 40%. Asterisks represent statistical significance at conventional levels: ***= 1%, **= 5%, * = 10%. Source: CBS microdata, own computations.

displacement effects with the available covariates. That is why we will also specifically analyze the self-employed active in the construction sector, where compulsory pension accumulation is arguably more random and the two groups are more comparable.[7]

Empirical implementation

To determine the displacement effects of the different subgroups that we identified in our dataset above, we estimate the following equation:

$$HW_{i,t} = \beta_0 + \beta_1 PW_{i,t} + \boldsymbol{X}'_{i,t}\boldsymbol{\beta}_x + \boldsymbol{Y}'_{i}\boldsymbol{\beta}_y + \boldsymbol{V}'_{i}\boldsymbol{\beta}_v + \varepsilon_i \quad (1)$$

Here, $HW_{i,t}$ is total household wealth (excluding the occupational pension wealth) of household i at time t, PW is total occupational pension wealth at the household level and $\boldsymbol{X}'$ is a list of time and household varying control variables, including an approximation of

[7] Descriptive statistics for the construction sector (not shown here but available on request) confirm this as these show that differences in household wealth measures between these two groups are relatively small and none is significant. The levels are close to those of all self-employed workers without compulsory pension, which means that with this selection we basically exclude a few exceptional (very wealthy) groups of households among the self-employed people with compulsory pension (think for instance of directors-shareholders of firms in companies with pension funds). The other variables show that the self-employed with compulsory pension in the construction sector have substantially more occupational pension wealth and also a somewhat higher average income than the corresponding self-employed without compulsory pension.

Table 7
Full results IV regressions wage employed couples, 2007–2010.

	IV (random effect)		IV (pooled)
	(a) coeff	(b) coeff	(c) coeff
HH occupation pension wealth (PW) (in 1,000 euro)	−0.271***	−0.330***	−0.333***
HH average total compensation	2.955***	−0.804	3.042***
HH variance total compensation	−0.0019***	−0.0375*	−0.002***
Pension fund performance uncertainty	184.5***	57.21	513.2***
Pension fund performance uncertainty unknown (d)	−1.942	1.843	−13.03***
Age	27.53	21.29	85.62**
Age^2	−0.467	−0.343	−1.523**
Age^3	0.0032	0.0026	0.0095*
Non-temporary contract (d)	1.793	0.377	7.220
Full-time contract (d)	−3.709***	−0.736	−20.32***
Stock ownership (d)	29.32***	10.05***	65.85***
3rd pillar pension wealth ownership (d)	18.85***	10.72**	15.99***
Home ownership (d)	103.8***	64.37***	130.5***
Year 2007	55.42***	44.33***	56.07***
Year 2008	38.69***	31.02***	39.26***
Year 2009	16.02***	12.40***	15.63***
Male (d)	0.117	5.286	2.479
Household size	9.399***	5.311***	11.37***
High urbanization (d)	−2.993	2.242	−5.946*
Western immigrant, 1st generation (d)	−48.47***	−40.76***	−40.69***
Western immigrant, 2nd generation (d)	−26.08***	–22.95***	−25.32***
Non Western immigrant, 1st generation (d)	−25.18***	−13.60**	−20.27***
Non Western immigrant, 2nd generation (d)	−51.26***	−40.35**	−39.07***
Married (d)	−9.167***	0.724	−14.77***
Widowed (d)	3.178	36.25	−2.417
Divorced (d)	−16.24***	8.564	−36.17***
Province 2	16.90**	12.83	20.30***
Province 3	12.75*	−0.263	13.92*
Province 4	38.58***	41.24	38.89***
Province 5	−11.16	104.4***	–22.74***
Province 6	47.86***	58.66***	50.83***
Province 7	37.92***	29.74	43.98***
Province 8	32.59***	65.91***	35.19***
Province 9	18.20***	70.69***	22.03***
Province 10	32.80***	197.2***	25.75***
Province 11	66.60***	83.00***	67.97***
Province 12	31.02***	133.4***	33.58***
Partner is WE with pension (d)	−5.751***	−1.027	−20.33***
Partner is WE without pension (d)	−6.479***	−1.923	−25.07***
Partner is SE with pension (d)	−1.116	5.283	−30.67***
Partner is SE without pension (d)	16.18***	17.07***	2.815
Partner age	3.884***	−1.44	4.016***
Partner is Male	−2.455	0.499	1.517
Partner Western immigrant, 1st generation (d)	−29.95***	−28.49***	−30.73***
Partner Western immigrant, 2nd generation (d)	−24.59***	–23.31•••	−24.92***
Partner Non Western immigrant, 1st generation (d)	−30.66***	−29.14***	−28.27***
Partner Non Western immigrant, 2nd generation (d)	−2.882	0.893	−3.780
Constant	−898.2***	−2,697***	−1,970***
Within-unit means	NO	YES	NO
R-squared			0.286
N	75,121		

Note: The instruments in the IV regressions are the log of the number of participants in the pension fund and the log of company size. Dummy variables are indicated by (d). OLS coefficients have been estimated with clustered standard errors by household. Model (b) includes within unit means of the time-varying regressors. We cannot reject the null hypothesis of these means being jointly equal to zero. Asterisks represent statistical significance at conventional levels: ***= 1%, **= 5%, * = 10%. Source: CBS microdata, own computations.

Table 8
estimates of the displacement effect for self-employed workers, 2007–2010.

Displacement effect	Couples 2007–2010	N
All income levels (OLS)	−0.437***	9,526
with Gale's Q	−0.608***	
Income below median	−0.236	1,852
Income above median	−0.264*	1,881
All income levels (Construction sector only)	−0.512***	1,844
with Gale's Q	−0.768***	

Note: Gale's Q adjusts compulsory savings by a discount factor that allows one to compare compulsory savings across generations that are far from retirement with those of the elderly. Coefficients have been estimated with clustered standard errors by household. Asterisks represent statistical significance at conventional levels: ***= 1%, **= 5%, * = 10%. Source: CBS microdata, own computations.

Table A1
Composition of household wealth.

Assets (+)	
Financial assets	
	- Checking and savings account
	- Bonds
	- Shares
Real estate	
	- Primary residence
	- Other real estate
	Business equity
	Other assets
	Third pillar pension wealth
Debts (-)	
	Mortgage debt of primary residence
	Other debt

permanent income and its variance and of pension fund performance uncertainty,[8] and dummies for the ownership of risky assets that are meant to proxy for someone's risk attitude. We also include year dummies $\boldsymbol{Y}$ and time invariant characteristics, such as immigration status, in $\boldsymbol{V}$.

Estimating the displacement effect using an equation like Equation (1) is standard practice in the literature (see e.g. Alessie et al., 2013). The thus found displacement effect can be less than the individual would have preferred, due to e.g. liquidity constraints. There are also several reasons why the true displacement effect is (substantially) underestimated in many empirical studies. Alessie et al. (1997), following an earlier draft of Gale (1998), discuss important sources of bias that plague the analysis of the relationship between pension wealth and assets in such a regression model. Almost all of these biases drive β_1 towards zero or even to be positive. They can be divided into two main categories.

The first important source for bias are omitted variables. We are interested in the effect of occupational pension wealth on private household savings, but the accumulation of occupational pension wealth is not random. For example, those with a relatively high preference for saving might build up a large amount of private household wealth, but also choose a job with a relatively generous pension scheme. We do not observe such preferences. Also, those with a relatively high life expectancy or with plans to retire early might combine relatively high household wealth with high pension wealth. This way pension wealth and assets seem to be less negatively correlated than is actually the case, or even seem to be positively correlated. Though such preferences are unobserved, these could be correlated to the interaction between occupational choices and participation in compulsory pension schemes, so accounting for them could alleviate this problem. As explained, due to institutional differences, self-employed workers in the Netherlands are substantially less likely to participate in a pension scheme. Comparing participants and non-participants into occupational pensions would therefore be uninformative of the displacement effect itself. We would largely be comparing wage employed with self-employed workers, who also differ, for instance, in terms of risk attitude. Indeed, the self-employed are found to be less risk-averse on average than wage employed (Hartog et al., 2002). Also, there is reason to believe that the wage employed – especially those who currently do not participate in an occupational pension scheme – might not be fully aware of their (lack of) pension accrual, while the self-employed will probably be aware that they do not accrue any pension entitlements if they do not act on it themselves. And those self-employed workers who do participate in a pension scheme will probably have a clearer image of how much they contribute, because there is no employer who makes the payments for them or adds an employer contribution. Card and Ransom (2011) study the displacement effects among a group of college professors and find that their supplemental savings are substantially less sensitive to employer pension contributions than to employee contributions, with displacement effects of employee contributions ranging from about 60 to 80 percent and displacement effects of employer contributions about half of that. Also, Bottazzi et al. (2006) find that the offset between private wealth and perceived pension wealth is particularly substantial for workers that are better informed about their pension wealth.

Performing separate analyses on the displacement effect of self-employed workers and wage employed should partly address the problem of omitted variables, in a way that survey data never could in previous studies. The fact that not all wage employed accumulate pension wealth and not all self-employed workers do not, ensures sufficient variability within the groups to perform such separate analyses. The second important source for bias arises from imperfect measurement. Narrow measures of non-pension wealth (e.g. excluding housing wealth) tend to lead to lower displacement estimates. Pension wealth itself is notoriously difficult to measure and, furthermore, should be measured net of taxes. And because an occupational pension is essentially deferred income, those with pension accrual actually make more money in total than those without pension accrual but a comparable net pay-check. So, controlling for income should be based on total compensation (including a correction for pension accrual) and not on current earnings only. Overall, these measurement errors tend to lead to an underestimation of the displacement effect. Here, our available administrative data on pension wealth – though still not perfect – arguably outperform the survey data that are normally used. Also, we do correct for taxes and for pension accrual in our income data.

For determining the displacement effect for the wage employed we start with a simple OLS estimation of Equation (1), where we use the panel as a repeated cross section and only cluster the standard errors by household. Table 4 presents the results. For wage employed couples, we find a small but significant displacement effect of 3.3%, which slightly increases to 3.8 % when we make an age-related adjustment known as "Gale's Q" (Gale, 1998).[9]

A breakdown shows a slight increase in the displacement effect with income, possibly due to less liquidity constraints or differences in the

[8] We proxy pension fund performance uncertainty by looking at the variance in the difference between the actual and the required funding ratio of pension funds over the period 1994–2010, based on the pension fund participation in 2010. When an individual is not affiliated or could not be linked to a pension fund in 2010, the funding ratio information is missing, so we multiply this coefficient by a specific dummy indicating the availability of this information.

[9] Gale (1998) adjusted compulsory savings by a discount factor (Gale's Q) in his theoretical model. This allows one to compare compulsory savings across generations that are far from retirement with those of the elderly. We also account for this in our analysis. For the computation of Gale's Q, we assume a discount rate (δ) equal to the interest rate (r) (in accordance with Alessie et al. (2013)), which equals 0.015. Furthermore, we find that within reasonable ranges away from these parameter values our estimate of the displacement effect does not change significantly.

Table A2
T-test for the mean of regressors, by company size and fund participants, above or below median (WE).

	Active participants				Company size			
	Below median fund	Above median fund	diff of means	t	Below median company	Above median company	diff of means	t
HH occupation pension wealth	67 109	125 975	−58 866	−86.2	69 285	123 760	−54 475	−79.3
HH average total compensation (monthly)	3 930	5 637	−1 707	−20.8	3 783	5 770	−1 987	−24.2
Pension fund performance uncertainty	0.011	0.019	−0.007	−61.9	0.013	0.017	−0.004	−34.4
Pension fund performance uncertainty not known	49.5%	35.9%	13.7%	41.8	44.4%	40.8%	3.6%	10.9
Age	47.6	48.2	−0.6	−15.5	47.5	48.3	−0.8	–22.5
Non-temporary contract	99%	96%	3%	28.0	98%	97%	1%	13.7
Full-time contract	85%	74%	11%	41.0	82%	76%	5%	19.8
Stock ownership	30%	29%	1%	4.9	27%	31%	−4%	−13.3
3rd pillar pension wealth ownership	44%	44%	0%	−0.5	45%	43%	2%	5.6
Home ownership	82%	78%	4%	13.5	79%	80%	−1%	−4.0
Male	94%	85%	9%	44.8	93%	87%	6%	29.5
Household size	3.4	3.3	0.1	15.8	3.4	3.3	0.1	16.9
High urbanization	12%	17%	−5%	–23.0	12%	17%	−5%	−20.5
Western immigrant, 1st generation	3%	3%	0%	−4.2	3%	3%	0%	−0.8
Western immigrant, 2nd generation	5%	5%	−1%	−5.3	5%	6%	−1%	−7.1
Non-Western immigrant, 1st generation	5%	7%	−2%	−11.1	6%	6%	0%	−2.3
Non-Western immigrant, 2nd generation	0%	0%	0%	−2.0	0%	0%	0%	−3.7
Married	90%	88%	2%	7.2	89%	89%	0%	2.2
Widowed	1%	1%	0%	−3.0	1%	1%	0%	−3.8
Divorced	9%	13%	−4%	−20.5	9%	12%	−3%	−14.9
Province 2	4%	4%	0%	−1.2	4%	4%	1%	5.6
Province 3	3%	3%	0%	−0.9	3%	3%	0%	−1.5
Province 4	7%	7%	0%	2.5	7%	6%	1%	6.9
Province 5	2%	3%	0%	−3.6	2%	3%	−1%	−6.2
Province 6	13%	13%	0%	0.9	14%	12%	1%	6.4
Province 7	8%	8%	0%	−0.4	7%	8%	0%	−2.5
Province 8	14%	16%	−2%	−8.0	14%	17%	−3%	−12.1
Province 9	20%	22%	−2%	−8.4	20%	21%	−1%	−4.8
Province 10	3%	2%	0%	4.4	2%	2%	0%	2.5
Province 11	17%	14%	3%	13.5	16%	14%	2%	8.7
Province 12	7%	6%	1%	6.2	7%	7%	0%	2.6
Partner is WE with pension	57%	62%	−5%	−13.6	58%	62%	−4%	−10.8
Partner is WE without pension	7%	6%	1%	6.3	7%	6%	1%	6.1
Partner is SE with pension	1%	1%	0%	−6.9	1%	1%	0%	−2.2
Partner is SE without pension	3%	3%	0%	−0.2	3%	3%	0%	−0.3
Partner age	44.9	45.3	−0.5	−9.7	44.6	45.6	−1.0	−21.5
N	89,877							

Note: SE = self-employed, WE = wage employed, gen = generation. The 3rd pillar stands for private pension savings. Source: CBS Microdata, own computations.

propensity to consume across the income distribution. The displacement effect also appears to be somewhat higher for those with wealth levels above the median, with only elementary or no education, living in more rural areas of the country, not working in the financial sector and middle-aged. Also, the displacement effect seems to be slightly lower in the post-financial crisis period (2008–2010), compared to the year prior to the crisis. For singles, we find in the simple OLS regressions a displacement effect of 17%. The breakdown in subgroups for singles shows a qualitative very similar pattern to the one for couples, albeit at a different level, and with some estimates lacking significance, possibly because of the smaller sample size. The full results for the OLS regression for couples on all income levels can be found in Table A3 in the Appendix.

Due to the endogeneity discussed above, OLS estimates are biased as $E(\varepsilon_{i,t}|PW_{i,t}) \neq 0, t = 1, \cdots, T$. We tackle this using an instrumental variable approach. We include in $Z_{i,t}$ the log of company size and the log of the number of active participants of the pension fund, where $Cov(PW_{i,t}, Z_{i,t}) \neq 0$. The usual assumptions apply, so that $E(\varepsilon_{i,t}|Z_{i,t}) = 0$, $\forall i$ and $E(\varepsilon_i|Z_i) = 0$, which we will explain below. Instrumenting pension wealth using company size and pension fund participants is legitimate because both measures can be seen as an indicator of ex-ante profitability. This is the case because financial investments can benefit of economies of scale. A larger fund has access to investments of larger size (think for instance of purchasing a large size RMBS pool), that are not accessible by smaller funds. This increases the investment opportunities and can also reduce investment costs (for instance in terms of management and administration). In addition, larger investments could also possibly deliver higher returns, or better fit the liability structure of a pension fund, because these might have a longer time horizon. A similar argument could be made for company size, as some funds are company-based and larger companies can also exploit more profitable economies of scale, to the advantage of the fund members. For company size, we use the log of the number of employees in the company where the wage employed works. For pension fund participants we use the log of the number of active participants of the pension fund the employee is linked to. We present in Table A2 in the Appendix summary statistics and *t*-test analysis for values of the instruments below and above their median.

The first stage regression results, as shown in Table 5, confirm that the instruments are strongly correlated with occupational pension wealth. Our instruments should also be uncorrelated with the error in the second stage of the regression model and the Sargan test for over-identifying testifies of this. Employees could sort into differently sized companies with different sized pension funds, partly based on (or correlated with) risk and saving preferences. We have no evidence of this in the literature, but should this be an issue, it is likely to affect workers close to retirement more than those in our age selection.

Table 6 shows the results for the IV analyses for couples in different subgroups. The displacement effect ranges between −27% and –33% when we estimate a random effect IV model – without and with within

Table A3
Full results OLS regressions wage employed couples, 2007–2010.

Household wealth (HW) in 1,000 euro	**Pooled OLS**	
	coeff	**s.e.**
HH occupation pension wealth (PW) (in 1,000 euro)	−0.0325***	0.0064
HH average total compensation	2.454***	0.0368
HH variance total compensation	−0.00163***	0.000121
Pension fund performance uncertainty	−114.5**	48.32
Pension fund performance uncertainty unknown (d)	−16.21***	1.682
Age	119.8***	25.10
Age^2	−2.253***	0.511
Age^3	0.0145***	0.00344
Non-temporary contract (d)	3.924	4.323
Full-time contract (d)	−14.96***	1.575
Stock ownership (d)	64.61***	1.291
3rd pillar pension wealth ownership (d)	15.35***	1.153
Home ownership (d)	123.3***	1.743
Year 2007 (d)	49.41***	1.628
Year 2008 (d)	34.76***	1.590
Year 2009 (d)	13.65***	1.567
Male (d)	11.19	7.163
Household size	11.34***	0.624
High urbanization (d)	−8.153***	1.892
Western immigrant, 1st generation (d)	−38.94***	3.734
Western immigrant, 2nd generation (d)	−27.02***	2.646
Non Western immigrant, 1st generation (d)	−19.19***	3.704
Non Western immigrant, 2nd generation (d)	−36.72***	10.12
Married (d)	−12.26***	2.147
Widowed (d)	3.114	15.52
Divorced (d)	–33.85***	3.921
Province 2 (d)	20.99***	4.292
Province 3 (d)	12.38***	4.523
Province 4 (d)	39.23***	3.840
Province 5 (d)	−25.97***	4.792
Province 6 (d)	50.51***	3.567
Province 7 (d)	43.93***	3.804
Province 8 (d)	33.16***	3.531
Province 9 (d)	21.80***	3.447
Province 10 (d)	27.52***	4.893
Province 11 (d)	69.95***	3.506
Province 12 (d)	31.27***	3.857
Partner is WE with pension (d)	−25.83***	1.332
Partner is WE without pension (d)	−18.37***	2.448
Partner is SE with pension (d)	−30.40***	5.928
Partner is SE without pension (d)	9.384***	3.405
Partner age	3.340***	0.148
Partner is Male (d)	5.061	7.285
Partner Western immigrant, 1st generation (d)	−27.40***	3.043
Partner Western immigrant, 2nd generation (d)	−24.48***	2.691
Partner Non Western immigrant, 1st generation (d)	−27.04***	3.479
Partner Non Western immigrant, 2nd generation (d)	−3.182	8.744
Constant	−2,439***	407.6
R-squared	0.306	
N	75,121	

Note: Coefficients have been estimated with clustered standard errors by household. Dummy variables are indicated by (d). Asterisks represent statistical significance at conventional levels: ***= 1%, **= 5%, * = 10%. Source: CBS microdata, own computations.

units means as in Mundlak (1978) – and is –33.3% when we use pooled IV clustering by household, so these estimation methods do not diverge much. When we take Gale's Q into account, it increases to about −37%.

The results for the subgroup analyses reveal a somewhat different pattern relative to the OLS-estimations we carried out before.[10] Couples with lower incomes have somewhat lower displacement effects, but lower-income singles have a somewhat higher displacement. Further, we observe larger displacement effects among those with an above median level of wealth and higher education. We also look separately at individuals living in areas that are 'Very highly' to 'Moderately' urbanized versus the more rural areas. These latter areas are typically, but not always, inhabited by somewhat older adults. The differences in displacement effects are not large, but show a small positive differential in rural areas. This could be due to differences in life expectancy, but also to the more solid financial position of older households in these areas. When we split the observation period into one year before and three years after the financial crisis, we find a slightly higher displacement effect in the latter case. Finally, we find a lower displacement effect among the wage employed below 45. Of course these bivariate distinctions hide interactions that are more complex, among all the characteristics being listed, which makes it difficult to fully place them within a single narrative. This heterogeneity analysis is important to show that large variations in displacement can occur across households.

The full results of the IV regression for wage employed couples are shown in Table 7. Our measure for the pension fund performance uncertainty is significant and positive, consistent with our original expectations, but not when we also include its' within unit average (that is though significant but not reported in the table). There are further no qualitatively different results in the main variables when pooled IV or random effect IV is used, though the magnitude of the effects of the time-varying regressors is of course somewhat affected when we add the within unit averages in model (b). We prefer however to use the pooled regression and treat the data as appended cross section. This because the variables of interest are at the household level, and the IPO data is a panel also when one follows a key person in the household (usually the oldest male at birth). So changes to wealth could be determined by changes in household members that is difficult to control for. The usual suspects, such as age, household size and wealth ownership, are positively related to net wealth, as expected, in both specifications.

Table 8 reports the displacement effect for the self-employed. Because the number of observations is considerably lower than for the wage employed, we only show the estimates for couples. The standard OLS results for couples show a significant and also relatively strong displacement effect of about −44%. When we take Gale's Q into account, it increases to about −61%. The full results for the OLS regression for SE couples can be found in Table A4 in the Appendix. For the self-employed, a breakdown in income levels shows non-significant results for lower incomes, and a slightly significant displacement effect of 26% for higher incomes.

Earlier, we described how the self-employed are a highly heterogeneous group. Especially, those self-employed workers currently participating in a compulsory pension scheme differ substantially from those who do not participate. The instruments we could use for wage employed (company size and pension fund participants) are not applicable or available for the self-employed. But as argued, the pension scheme participation of self-employed workers within the construction sector can be considered to be relatively random. If we restrict our OLS analysis to the construction sector only, the resulting displacement effect amounts to about −51%, or −77% with Gale's Q. This again suggests the displacement effect is somewhat stronger for the self-employed than for the wage employed. The full regression results can be found in Table A4 in the Appendix.

Conclusion

We look at the displacement effect from mandatory occupational pension saving on household wealth in the Netherlands, taking institutional differences among occupations into account. Where most wage employed in the Netherlands participate in a mandatory occupational pension scheme, a substantial minority does not participate. Conversely, while most self-employed are fully responsible for their own pension accrual (on top of the state pension), some groups of self-employed workers (less than 10% in total) are obliged to participate in a professional or industry pension fund. This requires to separately measure the displacement effects within these groups, thus controlling for

[10] A comparison of tables 4 and 6 suggests that the size of the bias in the OLS estimates varies across groups, most notably between couples and singles. However, due to the imprecision of some of the OLS estimates, it is difficult to assess a clear direction of the impact of this bias.

Table A4
Full results OLS regression SE couples, overall and in Construction sector, 2007–2010.

Household wealth (HW) in 1,000 euro	OLS		OLS (Gale's Q)		OLS Construction		OLS Construction (Gale's Q)	
	coeff	se	coeff	se	coeff	se	coeff	se
HH occupation pension wealth (PW) (in 1,000 euro)	−0.437***	0.0619	−0.608***	0.0909	−0.512***	0.137	−0.768***	0.203
HH average total compensation	3.350***	0.113	3.331***	0.113	5.527***	0.326	5.524***	0.325
HH variance total compensation	1.04e-05***	1.54e-06	1.04e-05***	1.54e-06	3.29e-05***	5.39e-06	3.29e-05***	5.39e-06
Age	158,893	137,015	157,129	137,055	42,252	252,444	38,933	252,477
Age^2	−3,032	2,790	−2,999	2,791	−514.6	5,169	−448.4	5,169
Age^3	20.57	18.80	20.38	18.81	2.156	35.01	1.746	35.01
Year 2007 (d)	64,044***	8,895	63,795***	8,896	72,800***	15,608	72,604***	15,605
Year 2008 (d)	48,661***	8,684	48,554***	8,686	60,770***	15,038	60,687***	15,036
Year 2009 (d)	16,812**	8,556	16,811**	8,558	20,497	14,633	20,505	14,632
Male (d)	40,787	61,395	39,185	61,414				
Household size	26,071***	3,235	26,103***	3,236	17,203***	5,629	17,209***	5,628
High urbanization (d)	−24,236**	10,398	−24,652**	10,399	−7,924	19,606	−7,831	19,605
Western immigrant, 1st generation (d)	−112,683***	19,121	−112,684***	19,126	−135,007***	39,796	−134,648***	39,790
Western immigrant, 2nd generation (d)	−62,547***	15,520	−62,859***	15,524	−68,452**	28,261	−68,046**	28,259
Non-Western immigrant, 1st generation (d)	−67,495***	20,561	−67,602***	20,567	−72,732	50,854	−72,180	50,848
Non-Western immigrant, 2nd generation (d)	−95,743	76,212	−94,793	76,231				
Stock ownership (d)	120,415***	6,863	120,137***	6,864	79,222***	12,676	79,144***	12,674
3rd pillar pension wealth ownership (d)	13,688**	6,578	13,666**	6,580	14,669	11,943	14,650	11,941
Home ownership (d)	141,622***	9,323	141,258***	9,325	206,731***	16,943	206,787***	16,941
Married (d)	−3,340	10,176	−3,335	10,179	24,168	18,092	24,088	18,089
Widowed (d)	−190,927**	78,930	−193,350**	78,946	7,775	232,629	6,952	232,609
Divorced (d)	−54,826***	18,458	−54,847***	18,463	−16,776	29,856	−16,155	29,860
Province 2 (d)	20,785	21,526	20,927	21,532	–23,792	35,230	–23,434	35,228
Province 3 (d)	22,167	24,124	22,184	24,131	−91,270**	45,173	−90,304**	45,173
Province 4 (d)	40,560*	20,723	40,353*	20,728	−9,474	36,382	−8,965	36,379
Province 5 (d)	−44,674*	25,088	−44,311*	25,094	−136,825***	43,884	−136,146***	43,879
Province 6 (d)	−14,750	19,017	−14,697	19,022	2,993	32,704	3,529	32,705
Province 7 (d)	−11,917	19,828	−12,047	19,833	−86,181**	39,092	−85,360**	39,097
Province 8 (d)	−1,402	18,085	−1,152	18,090	31,233	31,329	31,672	31,329
Province 9 (d)	–22,532	18,146	–22,353	18,151	–33,334	31,779	–33,013	31,776
Province 10 (d)	36,358	25,106	36,783	25,112	−6,162	52,616	−5,579	52,612
Province 11 (d)	29,060	18,095	29,153	18,100	31,966	31,490	32,781	31,498
Province 12 (d)	1,227	20,617	1,427	20,623	24,630	38,399	25,060	38,397
Partner is WE with pension (d)	−41,565***	8,358	−43,102***	8,333	−8,830	13,022	−9,277	12,989
Partner is WE without pension (d)	−69,545***	15,845	−69,298***	15,849	−50,450**	23,137	−50,288**	23,133
Partner is SE with pension (d)	8,541	13,395	7,596	13,392	−19,634	27,402	−20,435	27,402
Partner is SE without pension (d)	91,676***	8,556	92,226***	8,556	44,187**	21,005	44,171**	21,002
Partner age	3,780***	770.4	3,810***	771.4	7,451***	1,462	7,542***	1,465
Partner is Male (d)	−74,722	48,938	−75,698	48,952				
Partner Western immigrant, 1st generation (d)	–23,709	16,505	–22,861	16,506	42,834	37,589	42,779	37,586
Partner Western immigrant, 2nd generation (d)	−57,302***	15,131	−57,163***	15,135	−130,998***	29,972	−130,329***	29,965
Partner Non-Western immigrant, 1st generation (d)	−42,405**	20,580	−41,587**	20,582	−12,152	40,500	−11,722	40,493
Partner Non-Western immigrant, 2nd generation (d)	−25,598	49,785	−25,153	49,798	92,605	92,534	90,441	92,506
Constant/1000	−3216	2225	−3187	2226	−1662	4078	−1615	4079
R-squared	0.314	0.31	0.383	0.38				
N	9526	1844						

Note: Coefficients have been estimated with clustered standard errors by household. Dummy variables are indicated by (d). Asterisks represent statistical significance at conventional levels: ***= 1%, **= 5%, * = 10%. Source: CBS microdata, own computations.

unobserved characteristics that correlate with the occupational choice between working as wage employed or self-employed.

In order to correct for several possible biases in the OLS estimation of the displacement effect, we estimate it separately for different occupations and we use an instrumental variables approach. Our IV analyses, where we use the log of company size and the log of the number of pension fund participants as instruments, suggests a displacement effect of –37% for the wage employed; an effect that rises with income, wealth and education and is slightly higher in more rural areas and in the years directly following the financial crisis (2009–2010). For the self-employed, where our instruments are not available, we find a stronger displacement effect of greater than −61% using OLS, or −77% when we focus only on the construction sector. In that sector the existing compulsory pension scheme ensures that pension participation by the self-employed within this sector is arguably less endogenous than in other sectors.

As the financial position of households is positively related to the displacement effect, we could speculate that any underestimation of the financial situation could imply an underestimation of the displacement effect. This is important to consider, because we only have a partial representation of one's portfolio, as we for instance proxy private (third pillar) pensions and do not observe saving deposits accrued to the mortgage.

Overall, our results suggest a larger displacement effect for self-employed workers than for wage employed. A possible explanation lies in the fact that self-employed workers can on average be expected to be much more aware of the pension entitlements they do or do not accrue than wage employed. Such a higher awareness would lead to an on average higher displacement effect among self-employed workers than among wage employed (Card and Ransom, 2011; Bottazzi et al., 2006).

CRediT authorship contribution statement

Mauro Mastrogiacomo: Conceptualization, Methodology, Visualization, Investigation, Writing – review & editing. **Rik Dillingh:** Data curation, Writing – original draft, Writing – review & editing, Supervision. **Yue Li:** Data curation, Writing – original draft.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A

Table A2 shows significant but mostly minimal differences for most variables that we related to household wealth. Notable exception is of course pension wealth, but this is expected, as the instruments are supposed to be significantly related to the instruments.

If we look at the other estimation results, we find that the variance of total compensation has a negative effect on household wealth. Possibly, this is due to the fact that the observation period primarily showed negative shocks in income, for example through the loss of employment. This would lead to a negative correlation between the variance of income and household wealth. We also find a significant negative effect of our proxy for pension fund performance uncertainty. This would suggest that those with a pension fund with relatively high variability in its performance save relatively less.

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