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Quid pro quo

the institutional environment and the allocation of household wealth

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Quid pro quo: the institutional environment and the allocation of household wealth

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Abstract

What can account for the allocation of household wealth? In this article I analyse the evolution of the French and Dutch household portfolio between 1963 and today. I employ a Financial Almost Ideal Demand System after Blake (2004) to estimate wealth and interest rate elasticities for five wealth classes: M1, Savings, Equity, Life-insurance and pension assets and housing. The main contribution of the paper is that I highlight the importance of the institutional environment for the allocation of household wealth. The liberalization wave of French finance in the 1980s is reflected in the estimated elasticities, which increase in size for those assets that became more widely available. Institutional change in the Netherlands was much more limited, which is reflected in the relative stability of the estimated interest and wealth coefficients.

Keywords: household wealth, portfolio choice, model

JEL classification: C51, E21, D14, G11

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1 Introduction

What can account for cross-country differences in the allocation of household wealth? Although some tentative answers are formulated which highlight culture, the regulatory setting or historical experiences (e.g. Badarinza et al., 2016; Arrondel et al., 2016), our understanding of cross-country differences in the allocation of household wealth remains limited. This is surprising given the economic weight of the household sector in the real economy and the relation between household financial decisions and economic crises (e.g. Jordà et al., 2016; Mian and Sufi, 2009; DNB, 2015).

This article takes a portfolio perspective and employs a Financial Almost Ideal Demand System (FAIDS) after Blake (2004) to study the allocation of French and Dutch household wealth from 1963 until today. A FAIDS is an extension of the seminal AIDS model of Deaton and Muellbauer (1980) and allows for the estimation of wealth and interest rate elasticities for (financial) assets. This article highlights the importance of the institutional environment for the estimated elasticities.

The French and the Dutch case are particularly well-suited to study the relevance of the institutional environment for their radically different financial past. The French financial setting was one of extensive state control over the operations of the financial system until the 1980s: large parts of the banking system were nationalized and the mortgage and savings market heavily regulated (Butzbach, 2015; Heugas-Darraspen, 1994). This would change with a liberalization wave in the mid-1980s that introduced a variety of financial markets and increasingly allowed market forces to do their work (see Bertrand et al., 2007; Cerny, 1989). In the Dutch setting, on the other hand, the role of the state was already relatively retracted at an early stage: banking supervision was limited to prudential oversight (Barendregt and Visser, 1997), while market conduct was largely left at the financial sector's discretion (e.g. Slot, 2004; van Gerwen, 1998). Unlike France, one cannot speak of a liberalization wave in Dutch retail finance.

In this paper I exploit this radically different financial past by allowing for a structural break in the estimated elasticities within the FAIDS model. For the French case the results point at considerable dynamics in the estimated elasticities; rising wealth and own-rate elasticities on equity, life-insurance and housing wealth are interpreted as a sign that these assets (and mortgage debt) became increasingly available to consumers, depressing transactions costs and making households – in turn – more sensitive to changes in returns and wealth. Dutch elasticities, on the other hand, show remarkable stability, which is consistent with the limited degree of institutional change and the already wider availability of equity, life-insurance and mortgage debt at an earlier stage.

The fact that the institutional environment matters for holdings of specific types of assets in itself is now new. A variety of explanations for relative holdings of individual assets has been put forward, including studies with a focus on equity (Guiso et al., 2008; La Porta et al., 1997, 1998; Stulz and Williamson, 2003; Degryse et al., 2018), investment funds (Rydqvist et al., 2014), pension assets (Perotti and Schwienbacher, 2009; Cutler and Johnson, 2004; Aggarwal and Goodell, 2013), tenure choice (Norris, 2016; Kofner, 2014) and mortgages (Stephens, 2011; Hilber and Turner, 2013; Scanlon et al., 2008; Bover et al., 2016; Breuer et al., 2015).

The innovation of this article is that it takes a portfolio perspective which explicitly allows for substitution effects between the various types of assets. Substitution effects are expected particularly important for pension wealth, which is often found to displace non-pension wealth (Alessie et al., 2013; Feldstein, 1974; Gale, 1998). Similarly, Arrondel et al. (2016) finds a negative relationship between equity ownership and pension system replacement rates, where Christelis et al. (2013) finds that home owners are less likely to own equity.(also see Heaton and Lucas, 2000; Yamashita, 2003). The different setup of the French and Dutch pension system is also of interest in this regard. France relies on relatively limited PAYG provisions, whereas the Dutch pension systems is characterized by a an extensive semi-mandatory capital funded component in addition to PAYG provision.[1] French households are therefore required to build up wealth in alternative asset classes in order to smooth life-time consumption.

A number of authors employed a FAIDS to study the allocation of household wealth. Blake (2004) was the first to apply a FAIDS to the household sector and studied the portfolio allocation of UK households between 1984 and 1994. Blake finds that, in addition to wealth and returns, demographics, the economic cycle, and government finances play a role in the adjustment process of the household balance sheet over time. Avouyi-Dovi et al. (2014) estimate a FAIDS on the French and German household portfolio between 1978-2009 and 1959-2009, respectively. Demographic factors appear to play an important role for both nations, although the effects are not always consistent: German ageing appears to result in greater equity holdings and smaller holdings of savings accounts, whereas a rising working population contributes to greater equity holdings and less household savings in France. More recently, Avouyi-Dovi et al. (2019) estimate a FAIDS on French household data between 1999 and 2016 to estimate the long-run effects of a new French tax regime on the composition of the household portfolio.

Ochmann (2013) and Ricciarelli (2011) instead exploit household level variation to estimate a FAIDS. Ricciarelli (2011) finds substitution effects between bank deposits on the one hand, and bonds and equity investment on the other hand. Bonds and equity investment act as substitutes, which points at the use of capital gains to finance alternative forms of investment according to the author. Ochmann (2013) concludes that own-rate elasticities play a dominant role in the allocation of household wealth as opposed to the household decision to save or consume.

The remainder of this article is structured as follows. Section 2 provides a description of the main main dataset. Section 3 proceeds with an introduction of the FAIDS, which is subsequentially estimated in section 4. Section 5 introduces a variant to the baseline results of section 4 and allows for a structural break in the estimated elasticities. Finally, section 6 concludes.

[1] The latest figures from OECD (2017) indicate a net replacement rate of 74.5 in France, and 100.6 percent in the Netherlands after a full career. A similar picture emerges from historical figures (Aldrich, 1982).

2 Data

Eurostat data following the ESA 2010 standard forms the basis for the Dutch and French household balance sheet data.[2] Earlier data on the composition of the household balance sheet for France comes from the Banque de France (1977-), where Dutch data comes from the Netherlands Bureau for Economic Policy Analysis (1970-).[3] Because bond holdings are limited in both nations these were merged with life-insurance assets and pension assets.[4]

Figures 1a and 1b display the historical evolution of the French and Dutch household portfolio. All figures are displayed as a fraction of total assets, except for Net Worth (NW), which is a fraction of GDP (on the right axis).

The French household portfolio is dominated by housing wealth, although life-insurance assets became more important after the liberalization wave of the 1980s. Equity holdings are falling up until the 1980s, to show impressive growth from the 1980s onwards. The Dutch household portfolio is instead characterized by a sizeable stock of pension assets throughout the entire period.[5] Equity assets display a similar pattern up until the 1980s as in France, but today only make a relatively limited share of the total households portfolio. M1 (currency and deposits) and savings fall over time in both nations. The figures on Net Worth indicate that Dutch households are somewhat wealthier throughout the period under consideration.

The nominal returns on the various asset classes were derived from a variety of sources including the Banque de France, Jordà et al. (2019) and De Nederlandsche Bank. The return on M1 (currency and deposits) is calculated as the fitted values of a regression of the return on M1 (overnight deposits) over the period of 2003-2018 on the money market rate (which is available for a longer time-period), similar to Avouyi-Dovi et al. (2014): $r_{M1} = \beta_0 + \beta_1 * MM$. The return on savings in France is equal to the weighted return on the main savings accounts.[6] In the Netherlands, the return on savings is set equal to a 2 year term account.

For equity and bonds I make use of a total return index for which dividends and coupons are reinvested. The return on life-insurance holdings in France is set to the return on bonds, as the majority of investments by life-insurers is directed towards the bond market (see Avouyi-Dovi et al., 2014). For Dutch life-insurers and pension funds, the weighted return of the asset side of their respective balance sheet is employed.[7] The return on housing assets is comprised of the sum of housing price changes and owner's equivalent rent. The mortgage rate in France is defined as the rate on outstanding loans, as this was most consistent with historical sources. The Dutch mortgage rate is on new loans instead due to the availability of sources.

[2]For a full list of sources see the appendix.

[3]For both the earlier French and Dutch data a transformation from the ESA 1995 to the ESA 2010 standard was made (see Banque de France, 2009, 2014; Eurostat, 2013). French data for 1963-1976 was extracted from a variety of archival sources. Life-insurance holdings are life-insurers' technical reserves from Statistics Netherlands.

[4]Returns on these assets are highly similar; see the discussion on returns below.

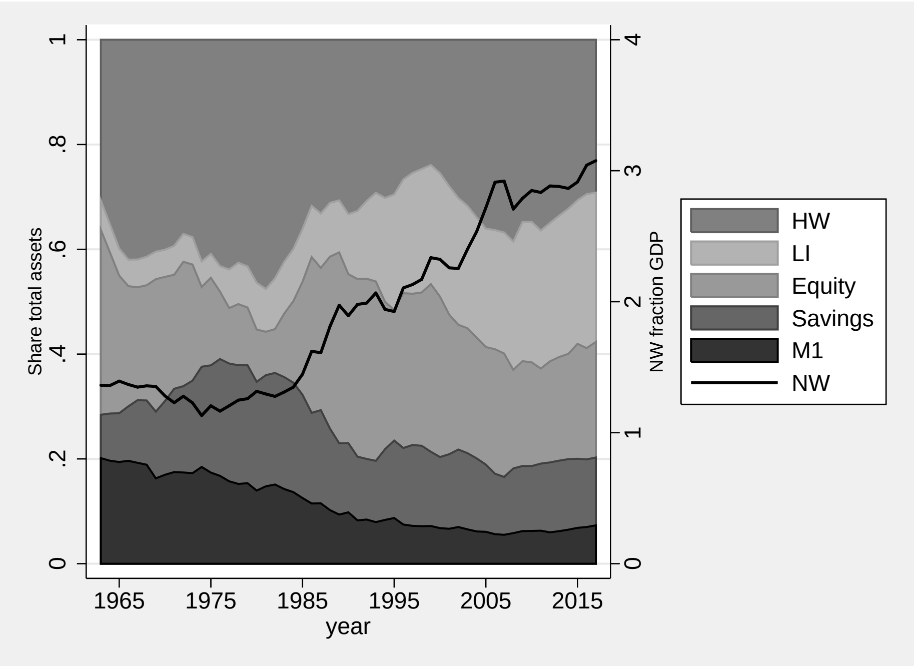
[5]The recent rise in pension assets for the Netherlands is largely due to falling interest rates which inflate the net present value of these household claims.

[6]These include the Livret A, the Compte d'Epargne Logement, the Livret Bancaire (or regular savings account), the Livret d'Epargne Populaire, the compte de développement durable and the Plan d'Epargne Logement.

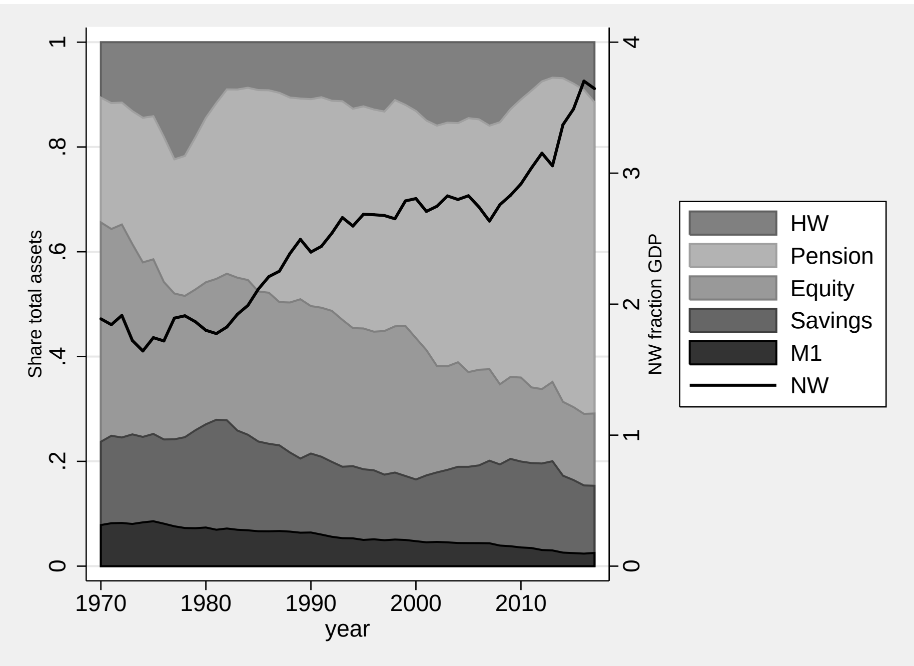
[7]See figures 2 and 3 in the appendix.

Figure 1: The allocation of household wealth

(a) France



(b) the Netherlands



Note: These figures display the evolution of asset shares for France and the Netherlands. Net worth (NW) is expressed as a fraction of GDP (right axis).

Summary statistics on all variables employed are reported in tables 1 and 2.[8] The nominal figures on the (total) return are transformed into real figures by deducting the rate of inflation.[9] Moreover, the returns are transformed into $ln(1 + r)$, which is consistent with the later econometric specification.

Table 1: Summary statistics France

	mean	sd	min	max
Asset shares				
M1	0.11	0.05	0.06	0.20
Savings	0.15	0.04	0.10	0.23
LI	0.16	0.09	0.05	0.29
Equity	0.22	0.07	0.08	0.36
HW	0.35	0.06	0.24	0.48
Returns (transformed)				
rWealth	0.03	0.07	-0.11	0.20
rM1	-0.04	0.04	-0.14	0.00
rSavings	-0.00	0.03	-0.08	0.02
rEquity	0.03	0.23	-0.52	0.42
rLI	0.03	0.12	-0.18	0.28
rHW	0.03	0.06	-0.09	0.18
Control variables				
Unemployment	7.25	2.89	1.44	10.72
sdCAC	6.41	2.11	3.54	13.22
Dependency	0.92	0.07	0.85	1.07

Note: The transformation of the real return r is $ln(1 + r)$.

Considering returns, the large degree of volatility stands out for equity re-

[8] Correlation figures can be found in tables 17 and 18.

[9] The return on pension assets in the Netherlands is constructed as the weighted return on life-insurance and pension assets on the balance sheet of insurers and pension funds, respectively.

Table 2: Summary statistics the Netherlands

	mean	sd	min	max
Asset shares				
M1	0.06	0.02	0.02	0.09
Savings	0.16	0.02	0.12	0.21
Equity	0.25	0.07	0.14	0.42
Pension	0.41	0.11	0.23	0.62
HW	0.12	0.03	0.07	0.22
Returns (transformed)				
rWealth	0.06	0.09	-0.15	0.22
rM1	-0.03	0.03	-0.10	0.02
rSavings	0.02	0.02	-0.04	0.05
rEquity	0.07	0.23	-0.73	0.46
rPension	0.05	0.08	-0.14	0.21
rHW	0.10	0.18	-0.37	0.42
Control variables				
Unemployment	5.41	1.71	1.60	9.00
sdAEX	5.82	1.58	2.82	9.60
Dependency	0.68	0.08	0.60	0.85

Note: The transformation of the real return r is $ln(1+r)$.

turns in both nations. Moreover, returns on housing wealth appear much more volatile in the Netherlands. Average returns on total household wealth are positive in both nations, although higher in the Netherlands. This comes at the cost of greater volatility, however.

I employ three additional variables that likely contributed to the observed shifts in the composition of the household portfolio over time: the unemployment rate, stock market volatility and the dependency rate. The unemployment rate accounts for business cycle variations. A large literature finds that a business cycle downturn (and a heightened probability of becoming unemployed) is associated with greater precautionary savings and a boost in net worth (e.g. Carroll, 1997; Carroll et al., 2003; Engen and Gruber, 2001) Considering tables 1 and 2, the average of the French unemployment rate appears to lie considerably higher as compared to the Netherlands, and furthermore is characterized by a higher volatility.

A measure of stock market volatility is meant to capture uncertainty about stock market returns. Such uncertainty may increase risk aversion and hence negatively affect risky investment (e.g. Guiso et al., 2018). sdCAC and sdAEX capture the absolute value of the unexplained variation of a regression of the main stock market index on its lag.[10] Following the summary statistics, stock market volatility lies at a somewhat higher level in France, although the differences – also in their volatility – appear minor.

Finally, I include demographic patterns in my analysis. An ageing society may display different saving patterns to ensure sufficient income after retirement. Moreover, the latter effect may be particularly large if the pension system is organised on a PAYG basis whereby the working population finances the pensions of the retired population. Where ageing may incite households to build up additional savings in long-term assets, the overall effect is not immediately evident. Demographic patterns are measured by means of the dependency rate, which is defined as the ratio of the dependent population (aged over 60 and below 20 years) over the working population (aged 20-59). Summary statistics show that the dependency rate in France lies substantially higher as compared to the Netherlands, consistent with a greater share of people over 60 in France both now, and historically.

3 Theoretical model

This section presents the derivation of the FAIDS model after Blake (2004). The objective function of the representative agent is equal to:

$$\text{Max } \bar{U}(\theta_{i,t+1}W_{t+1}, ..., \theta_{N,t+1}W_{t+1}), \tag{1}$$

where $U(.)$ is a utility function and $\theta_{i,t+1}$ is the share of total real wealth W_{t+1} invested in asset i out of a total of N assets. The wealth constraint is:

$$\sum_{i=1}^{N} \theta_{it} W_t (1 + \bar{r}_{it}) = W_{t+1}, \tag{2}$$

where, r_{it} is the real return between period t and t+1, which is equal to the expected nominal return between period and t+1, minus the expected rate of inflation between period t and t+1, while a bar denotes an expectation.

Following Deaton and Muellbauer (1980), an associated cost function is minimized by using a PIGLOG utility function[11], which results in the following (long-run) optimal portfolio weights:

[10] This regression was run on monthly data. The series reported here are the yearly averages of the resultant monthly series.

[11] See Barr and Cuthbertson (1991) for a derivation.

$$\theta_{it}^* = a_i^* + b_i^* ln(W_t(1+\bar{r}_{W_t})) + \sum_{j=1}^{N} c_{ij}^* ln(1+\bar{r}_{jt}) + \sum_{j=1}^{M} h_{ij}^* Z_{jt}. \quad (3)$$

Here, r_{Wt} denotes the real return on the total portfolio under a number of assumptions (see Blake, 2004). The model thus suggests that the optimal portfolio weight on asset i at time t is a function of real wealth and the real return on the total household portfolio, the asset itself and the other assets in the household portfolio. Z_{jt} allows for M additional control variables in the model.

Demand theory implies the following restrictions on the model:

$$\sum_{i=1}^{N} a_i^* = 1, \qquad \sum_{i=1}^{N} c_{ij}^* = 0, \qquad \sum_{i=1}^{N} b_i^* = 0, \qquad \sum_{i=1}^{N} h_{ij}^* = 0, \quad (4)$$

which are implemented by dropping one asset class from the estimation and deriving its coefficients from the above restrictions. Moreover, homogeneity and symmetry requires the following to hold:

$$\sum_{j=1}^{N} c_{ij}^* = 0, \qquad c_{ij}^* = c_{ji}^*. \quad (5)$$

Allowing for dynamic adjustment[12] and applying the Bewley (1979) transformation allows for the direct estimation of the long-run coefficients of equation 3:

$$\begin{aligned} \theta_{it} = {} & a_i^* + b_i^* ln(W_t(1+r_{Wt})) + \sum_{j=1}^{N-1} c_{ij}^* ln(1+r_{jt}) + \sum_{j=1}^{M} h_{ij}^* Z_{jt} \\ & + \sum_{j=1}^{N-1} \lambda_j^* \Delta\theta_{jt-1} + \sum_{s=0}^{K} b_{is}^* \Delta ln(W_t(1+r_{Wt-s})) \\ & + \sum_{s=0}^{K} \sum_{j=1}^{N-1} c_{ijs}^* \Delta ln(1+r_{j,t-s}) + \sum_{s=0}^{K} \sum_{j=1}^{M} h_{ijs}^* \Delta Z_{j,t-s} + u_{it}^*. \end{aligned} \quad (7)$$

The first line represents the long-run optimal portfolio weights of equation 3, where the last two lines denote the adjustment process. Note that the expected real returns are replaced with realized real returns, which is based on the assumption of rational expectations.[13] The various assets are summed over

[12]To allow for dynamic adjustments of the optimal portfolio weights, Blake (2004) defines a quadratic cost function through which the household chooses the actual portfolio weights:

$$\min_{\theta_t} \frac{1}{2} \left[(\theta_t - \theta_{t-1})' \Psi (\theta_t - \theta_{t-1}) + (\theta_t - \theta_{t^*})' \Omega (\theta_t - \theta_{t^*}) \right]. \quad (6)$$

The first part of this quadratic cost function takes into account the cost of making a change to the portfolio share, where the latter part accounts for the costs associated with diverging from the optimal portfolio share.

[13]Prediction errors of nominal returns and inflation end up in the residual and are assumed to be orthogonal to actual returns and inflation.

N-1 assets, reflecting that one of the asset categories is left out to allow for the introduction of the restrictions of equation 4.

The coefficients of the above equation are then employed to calculate the related elasticities. Note that these wealth elasticities express the response in the quantity of assets held in response to a wealth or price change. Wealth elasticities are calculated using $\bar{P}_{i,t+1}Q_{i,t+1} = (1+\bar{r}_{it})\theta_{it}W_t$, where $\bar{P}_{i,t+1}$ and $Q_{i,t+1}$ are the expected price and units held of asset i at time t+1, respectively:

$$\eta_{iWt} = \frac{b_i^*}{\theta_{it}} + 1. \tag{8}$$

Interest rate elasticities are calculated as:

$$e_{ijt} = \frac{c_{ij}^*}{\theta_{it}} + \delta_{ij}, \tag{9}$$

where δ_{ij} is the Kronecker delta, which equals 1 in case of the own-rate elasticity. Finally, elasticities for the level and log control variables are calculated as:

$$\xi_{ijt} = \frac{h_{ij}^*}{\theta_{it}} z_{jt}, \qquad \xi_{ijt} = \frac{h_{ij}^*}{\theta_{it}}. \tag{10}$$

All elasticities are calculated at the average of the relevant asset share in the relevant time-period.

4 Baseline estimation

We now turn to the estimation of the long run equation 7.[14] As the error terms of the N-1 assets are expected to be correlated, I estimate the model using seemingly unrelated regression analysis which allows for the simultaneous estimation of the equations. As indicated in the previous section, elasticities are calculated on the basis of equations 8 through 10. For both the French and the Dutch case, asset N is chosen to be the Savings. As a consequence, no standard errors can be reported for the coefficients in the equation of Savings and the return on Savings in the other equations.[15]

The estimated elasticities can be interpreted in the following way. With regards to wealth elasticities, $\eta_{iWt} = 1$ implies that asset holdings grow at par with the growth in wealth, whereas for $\eta_{iWt} > 1$ asset holdings increase by a greater percentage than the increase in wealth. Conversely, $\eta_{iWt} < 1$ implies asset holdings grow at a slower rate than the increase in wealth.

Own-rate elasticities ($e_{ijt}|_{i=j}$) can be expected to be positive as an increase in returns should, ceteris paribus, make the asset more attractive. A cross rate elasticity of $e_{ijt}|_{i\neq j} > 0$ would imply that two asset classes are complements, whereas $e_{ijt}|_{i\neq j} < 0$ implies the two asset classes are substitutes. Negative interest rate elasticities are expected for those assets that perform a similar

[14] Two lags are included in the model as K is set to 1. No further lags were included due to the limited amount of observations.

[15] The choice for Savings as a reference category is informed by the high correlation between the return on savings accounts and other return variables which may result in multicollinearity problems (see tables 17 and 18 for correlation figures). Like in Blake (2004), most of the variables are plagued by unit root which is in conflict with the modelling assumptions (see tables 15 and 16). Unfortunately, no remedy is available within the confines of the model.

function from the household's perspective: a higher rate of return on a substitute asset can be expected to result in lower asset holdings of the asset itself. The elasticities of the additional control variables are interpreted in the usual fashion.

Section 4.1 now presents the results of the baseline model, after which section 4.2 presents a discussion.

4.1 Results

The results on the French and Dutch household portfolio are reported in tables 3 and 4, respectively. The figures below the coefficients indicate p-values; all coefficients that are significant at the ten percent level are marked in bold.

Table 3: Long-run elasticities France (1963-2017)

	M1	Equity	LI	HW	Savings
Wealth	**0.758**	0.911	**1.761**	0.996	0.557
	0.043	0.538	0.000	0.937	.
rM1	**-0.905**	0.254	0.820	**-2.961**	3.792
	0.044	0.356	0.132	0.001	.
rEquity	0.126	0.809	**0.324**	**0.264**	-0.523
	0.356	0.640	0.018	0.092	.
rLI	0.610	**0.487**	**0.276**	**-1.629**	1.256
	0.132	0.018	0.093	0.000	.
rHW	**-0.949**	**0.171**	**-0.703**	1.574	0.907
	0.001	0.092	0.000	0.278	.
rSavings	2.853	-0.795	1.272	2.128	-4.457
	.	.	.	.	.
Unemployment	**-0.333**	0.061	**0.335**	**-0.268**	0.448
	0.095	0.816	0.021	0.001	.
sdCAC	-0.025	0.110	**-0.409**	0.037	0.180
	0.836	0.526	0.000	0.406	.
Dependency	**1.415**	-1.460	-0.027	-0.080	1.372
	0.021	0.102	0.954	0.721	.

Note: this table reports the elasticities calculated on the basis of equation 3. P-values are immediately below the elasticities. All bold figures are significant at a ten percent level.

Considering the French results in table 3, all wealth elasticities are positive as expected, but not always significant. M1 and savings have a wealth elasticity below 1 which is perhaps unsurprising given the low-risk nature of these assets and the transaction motive of M1. The wealth elasticity on equity and housing wealth are close to unity but insignificant; the wealth elasticity of life-insurance is positive and significantly larger than one indicating that life-insurance holdings expand faster than an increase in wealth.

Own-rate elasticities are positive for life-insurance, equity and housing wealth, although insignificant for the latter two. Insignificance can potentially be accounted for by variations over time in the elasticities which will be taken into account in section 5 below. Own-rate elasticities are negative for M1 and Savings, which is in conflict with expectations although similar to the findings of Avouyi-Dovi et al. (2014) for France.

Considering cross-asset elasticities, equity and housing wealth appear to function as complements. Considering the negative correlation between housing and equity returns (see table 17), this might not come as a surprise. Housing wealth and life-insurance assets instead act as substitutes, which is consistent with a similar life-time consumption smoothing function for both asset classes from the household perspective. Finally, equity and life-insurance appear to function as complements, which is more difficult to interpret.

Turning to the additional control variables, the unemployment elasticity is negative on M1 and housing wealth, while positive on life-insurance assets and savings. This observation is consistent with a move towards safe assets as uncertainty about (future) job prospects is low (although the coefficient on M1 is counter-intuitive). The elasticity on stock market volatility is negative on life-insurance holdings, and positive on savings, where the latter is line with greater precautionary savings in times of uncertainty. The insignificant effect on equity is against expectations as a negative effect was expected. The dependency elasticity is insignificant across most asset classes.

Turning to the Dutch results in table 4, all wealth elasticities are positive and significant as expected. Pension assets and housing wealth stand out with wealth elasticities above one, indicating that these assets holdings grow at a faster rate than household wealth.

Own-rate elasticities are all positive – although the elasticity on pension assets is insignificant. The latter can potentially be accounted for by the fact that Dutch households semi-automatically build up pension savings and have only limited say in increasing pension savings.

Cross-asset elasticities show that housing wealth and pension assets act as substitutes, which is consistent with their similar function in the household portfolio of smoothing life-time consumption. Housing wealth and equity instead act as complements which is consistent with uncorrelated returns (see table 18). Equity and pension assets appear to function as substitutes which seems consistent with a large share of the pension balance sheet invested in equity, particularly from the 1990s onwards (see figure 2) and the generally high correlation of their returns.

Turning to the additional control variables, the unemployment elasticity appears to be negative for equity and housing asset holdings. These observations appear consistent with a move out of risky assets (equity) and reduced access to housing loans in times of higher unemployment. For stock market volatility a small positive elasticity is found on equity, which is against expectations. The negative elasticity on housing wealth is consistent with reduced housing credit

Table 4: Long-run elasticities the Netherlands (1970-2017)

	M1	Equity	Pension	HW	Savings
Wealth	**0.301**	**0.110**	**1.549**	**1.359**	0.948
	0.000	0.000	0.000	0.007	.
rM1	**3.224**	**0.355**	-0.006	0.078	-2.651
	0.003	0.069	0.989	0.446	.
rEquity	**0.079**	**1.743**	**-0.813**	**0.314**	-0.323
	0.069	0.000	0.000	0.001	.
rPension	-0.001	**-0.496**	1.253	**-0.139**	0.382
	0.989	0.000	0.194	0.005	.
rHW	0.035	**0.639**	**-0.464**	**1.756**	-0.967
	0.446	0.001	0.005	0.000	.
rSavings	-0.955	-0.524	1.016	-0.770	2.233
	.	.	.	.	.
Unemployment	**-0.267**	**-0.110**	**0.283**	**-0.661**	0.048
	0.000	0.087	0.000	0.000	.
sdAEX	-0.008	**0.145**	**0.038**	**-0.414**	-0.003
	0.860	0.009	0.091	0.000	.
Dependency	**-0.410**	**-1.186**	**0.788**	-0.373	0.272
	0.011	0.000	0.000	0.231	.

Note: this table reports the elasticities calculated on the basis of equation 3. P-values are immediately below the elasticities. All bold figures are significant at a ten percent level.

supply in times of uncertainty. The elasticity on the dependency rate appears positive on pension assets, consistent with the view that a larger dependent (and older) share of the population opts for greater pension savings. The dependency elasticity on equity and housing wealth is negative, on the other hand.

4.2 Discussion

Comparing the French and the Dutch results, the following patterns can be discerned. Wealth elasticities are mostly positive and significant in line with expectations. Where the own-rate elasticities are positive and significant for the Dutch case, this does not always appear to hold in France. It is possible that the French estimates are less precise due to the overhaul of the French financial system in the mid-1980s which may have affected the elasticities there (see below).

In both nations, housing wealth and life-insurance or pension assets act as substitutes, whereas housing wealth and equity act as complements. The former is consistent with a similar function of life-time consumption smoothing for both assets, whereas the latter is consistent with a negative correlation of returns which gives rise to a potential hedging motive. Cross-elasticities for equity and life-insurance (pension) assets are of a different sign for the French and Dutch case, however.

Turning to the additional control variables, the elasticities on unemployment show similar patterns across both nations, with the exception of the equity equation for which the elasticity is insignificant in France. Larger differences exist for the stock market volatility elasticities, which display a negative effect on equity holdings in France and a positive effect in the Netherlands. Furthermore, the elasticity of stock market volatility in the housing wealth equation is negative for the Netherlands, and insignificant for France. Finally, the dependency rate appears largely insignificant across the various asset classes in France, whereas the elasticity is negative for the Dutch equity equation, and positive for the Dutch pension equation.

As was noted above, the estimated elasticities are derived from a period in which considerable institutional change took place – particularly in France. The following section takes a closer look at the dynamics.

5 Structural break

In this section I explicitly allow for the presence of a structural break in the estimated elasticities. A number of historical developments in the French and Dutch setting are of interest in this regard. In France, the mid-1980s were characterized by a large scale liberalization of the French financial system. The availability of mortgage credit and investment products grew as a result. Moreover, the 1990s were characterized by a crisis of the welfare state in France which resulted in growing demand for financial products that could smooth life-time consumption for French households.

Developments in the Dutch setting were more limited in nature. Mortgage credit and equity products were already more widely available to the general public and limitations imposed by Dutch government were relatively limited. Furthermore, and in contrast to the French case, there were little doubts about the capacity of the Dutch pension system to effectively provide retirement income.

A relationship between the long-run wealth and interest rate elasticities and institutional change can be motivated in the following two ways. First, the growing availability of some asset decreases transactions costs that may otherwise impede purchase. Falling transaction costs may, in turn, result in a relatively greater sensitivity in the holdings of this asset to changes in return or wealth. Given the historical account above, rising wealth and interest rate elasticities are particularly expected for the French case with the rising availability of mortgage credit, and equity and life-insurance assets. In the Netherlands, on the other hand, such products were already more widely available at an earlier stage.

A second way in which elasticities may change over time relates to the potential of portfolio rebalancing in response to a worsening outlook over the capacity of the existing pension system to effectively smooth life-time consumption. Given a worsening outlook, households may seek to hold a relatively larger share of their wealth in assets that allow for consumption smoothing. The wealth elasticity on life-insurance assets in particular may be expected to show a rise relative to other assets in such a case. Here, the largest dynamics are again expected for the French case given its crisis of the welfare state in the 1990s and the limitations introduced to the PAYG pension system thereafter.

The remainder of this section is structured as follows. Section 5.1 first explains how the introduction of a set of interaction terms allows for a structural break in the estimated elasticities. Next, section 5.2 proceeds with the estimation of the model, after which section 5.3 provides a brief discussion.

5.1 Specification

In order to consider the possibility of a structural break in the estimated coefficients, I add two interaction terms and a dummy to equation 7

$$k_i^* d1990_i + g_i^* d1990_i ln(W_t(1+r_{W_t})) + \sum_{j=1}^{N-1} m_{ij}^* d1990_i ln(1+r_{jt}) \qquad (11)$$

where $d1990_i$ is a dummy that takes the value of 1 if the year is greater or equal to 1990, and g_i^* and m_{ij}^* capture potential changes in wealth and interest rate elasticities after 1990, respectively. The year of 1990 is chosen because many of the liberalization policies that were implemented from the mid-1980s onwards likely took some time to have their effect on local market practices.[16]

The largest changes are expected for the French setting, where the most significant institutional changes took place. For the Netherlands, relative stability of the coefficients can be expected given the more limited changes to the institutional setting.

To implement the estimation, the following restrictions are added to those of equation 4 and 5:

$$\sum_{i=1}^{N} k_i^* = 0, \qquad \sum_{i=1}^{N} g_{ij}^* = 0, \qquad \sum_{i=1}^{N} m_{ij}^* = 0 \qquad (12)$$

which are again implemented by leaving the savings estimation out from the estimation and calculating the coefficients on the basis of these restrictions. Moreover, homogeneity and symmetry requires the following to hold:

$$\sum_{j=1}^{N} m_{ij}^* = 0, \qquad m_{ij}^* = m_{ji}^*. \qquad (13)$$

[16] A series of Bai-Perron breakpoint tests on individual asset shares in table 19 and 20 in the appendix corroborate this choice (see Bai and Perron, 1998, 2003). French breakpoints largely group together in the early 1980s and the early 1990s and thereby correspond to the deep economic crisis of the early 1980s and the aforementioned deregulatory wave, respectively. Note that these results are similar to those of Avouyi-Dovi et al. (2019). The Dutch results mainly match the 1977 Second Oil Crisis, the 2001 Dot-Com bubble and the 2008 Great Financial Crisis.

The elasticities are calculated as in equation 9 at the average portfolio share. Changes in the elasticities thereby exclusively capture changes in the coefficient and disregard any potential changes in portfolio shares that would otherwise affect the estimated elasticities.[17]

5.2 Results

Tables 5 and 6 display the French and Dutch results, respectively. The top six rows display the wealth and interest rate elasticities for the period up to the 1990s. The bottom six rows instead display the change in the wealth and interest rate elasticities between the period before and after 1990. The sum of the top and bottom rows therefore denote the elasticities for the post-1990 period. Note that I do not report the elasticities of the additional control variables here, although these are included in the regression.

Considering the French results in table 5 for the period up to the 1990s, the wealth elasticities for equity and housing wealth now turn positive and significant as compared to the baseline results from table 3, which is consistent with expectations. The wealth elasticity on life insurance now is insignificant compared to the positive and significant effect found in te baseline results.

Turning to the period after 1990, the interaction terms with the wealth elasticities are consistent with a structural break in the estimated elasticities. The wealth elasticity on equity falls below 1 (but remains positive) after 1990, whereas an opposite effect can be discerned for wealth elasticities on housing wealth and life-insurance from the 1990s onwards. The latter may reflect the crisis of the welfare state in the 1990s which led many households to allocate a growing share of their wealth towards life-insurance assets.

Where the own-rate elasticities were mostly insignificant in the baseline results of table 3, they are now significant for both equity and life-insurance for the period up to 1990. Contrary to expectations, the own-rate elasticity on life-insurance is negative, however. The interaction terms show considerable dynamics after 1990, with rising and positive own-rate elasticities for equity, life-insurance and housing wealth after 1990. This is consistent with the growing availability of these assets following the French liberalization wave.

The cross-asset elasticities for the period up to 1990 are relatively stable as compared to the baseline results, although the cross-asset elasticity on equity and life-insurance assets turns insignificant. The substitution relationship between housing wealth and life-insurance appears stable after the 1990. This is not the case for the cross-asset elasticity between housing wealth and equity, and life-insurance and equity, however: both cross-asset elasticities turn negative after 1990.

Considering the Dutch results in table 6 for the period up to 1990, the wealth elasticities change somewhat as compared to the baseline results in table 4. The wealth elasticity on equity turns slightly negative, whereas the wealth elasticity on housing wealth rises as compared to the baseline model. The wealth elasticity on pension assets remains stable, however, and is comparable to earlier results. Changes in wealth elasticities after 1990 appear modest: a slight drop can be discerned for the wealth elasticity on housing wealth.

[17]This comes at the cost of measurement error in the estimated elasticities. Indeed, household portfolio shares display considerable dynamics over time (see figures 1a and 1b).

Table 5: Long-run elasticities the France with interactions (1970-2017)

	M1	Equity	LI	HW	Savings
Wealth	0.828	**1.931**	0.941	**0.672**	0.543
	0.412	0.000	0.674	0.000	.
rM1	-0.469	0.005	0.442	-0.978	2.000
	0.108	0.980	0.357	0.180	.
rEquity	0.003	**1.538**	0.106	**0.290**	-0.936
	0.980	0.007	0.314	0.032	.
rLI	0.328	0.159	**-0.401**	**-1.523**	2.436
	0.357	0.314	0.000	0.000	.
rHW	-0.313	**0.188**	**-0.657**	**2.279**	-0.497
	0.180	0.032	0.000	0.000	.
rSavings	1.505	-1.424	2.466	-1.165	-0.381
	.	.	.	.	.
d1990Wealth	0.812	**-1.459**	**1.962**	**1.585**	2.537
	0.516	0.000	0.000	0.000	.
d1990rM1	0.040	0.136	-0.119	0.796	0.147
	0.756	0.369	0.746	0.170	.
d1990rEquity	0.067	**1.554**	**-0.397**	**-0.568**	0.343
	0.369	0.000	0.000	0.000	.
d1990rLI	-0.088	**-0.596**	**2.027**	0.191	-0.533
	0.746	0.000	0.000	0.446	.
d1990rHW	0.255	**-0.368**	0.082	**0.676**	0.354
	0.170	0.000	0.446	0.085	.
d1990rSavings	0.111	0.522	-0.540	0.831	0.076
	.	.	.	.	.

Note: this table reports the elasticities calculated on the basis of equation 3 with the addition of the interaction terms of equation 11. P-values are immediately below the elasticities. All bold figures are significant at a ten percent level. Control variables are not reported here but included in the regression.

Table 6: Long-run elasticities the Netherlands with interactions (1970-2017)

	M1	Equity	Pension	HW	Savings
Wealth	**0.406**	**-0.112**	**1.432**	**2.767**	0.460
	0.054	0.000	0.000	0.000	.
rM1	**3.850**	**0.954**	0.078	**-17.220**	13.338
	0.081	0.027	0.912	0.000	.
rEquity	**0.212**	**1.813**	**-1.063**	**0.243**	-0.206
	0.027	0.000	0.000	0.052	.
rPension	0.011	**-0.648**	1.296	**-0.329**	0.670
	0.912	0.000	0.191	0.000	.
rHW	**0.289**	**0.496**	**-1.098**	**2.180**	-0.867
	0.010	0.052	0.000	0.000	.
rSavings	-1.629	-0.335	1.782	5.745	-4.563
	.	.	.	.	.
d1990Wealth	0.875	1.215	1.107	**-0.276**	1.429
	0.696	0.334	0.305	0.000	.
d1990rM1	4.124	**-0.421**	-0.339	**-0.311**	-2.053
	0.220	0.099	0.583	0.043	.
d1990rEquity	**-0.094**	1.007	0.100	0.079	-0.093
	0.099	0.954	0.423	0.335	.
d1990rPension	-0.046	0.061	1.122	**0.106**	-0.244
	0.583	0.423	0.515	0.023	.
d1990rHW	**-0.141**	0.161	**0.355**	**0.666**	-0.041
	0.043	0.335	0.023	0.025	.
d1990rSavings	-0.740	-0.151	-0.649	-0.033	2.572
	.	.	.	.	.

Note: this table reports the elasticities calculated on the basis of equation 3 with the addition of the interaction terms of equation 11. P-values are immediately below the elasticities. All bold figures are significant at a ten percent level. Control variables are not reported here but included in the regression.

The own-rate elasticities for the period up to 1990 appear relatively stable as compared to the baseline of table 4 as well. The only notable change is the own-rate elasticity on savings which turns negative. Changes after 1990 are modest as well, with generally insignificant interaction terms on the own-rate elasticities. The only exception is the own-rate elasticity on housing wealth, which displays a slight increase after 1990.

Cross-asset elasticities for the period before 1990 are similar to those of the baseline specification of table 4, and the changes over time are limited. The only real change is the negative cross-elasticity between housing wealth and pension assets, which is somewhat more negative in the period prior to 1990, to fall afterwards in absolute terms. Overall, the Dutch results appear consistent with a relatively stable institutional environment.

5.3 Discussion

Comparing the French and the Dutch results, a first observation is that the French case is characterized by a structural break in the long-run coefficients, whereas the coefficients for the Dutch case appear relatively stable. Both wealth and own-rate elasticities display considerable change over time in France. One way to interpret this greater degree of change in the French elasticities is to regard them as the outcome of 1) a general overhaul of the French financial system from the mid-1980s onwards and 2) a crisis of the welfare state in the early 1990s. These factors altered incentives and opportunities for French households which are reflected in changing wealth and interest rate elasticities.

A second observation is that the precision of the estimation improved considerably as compared to the baseline estimation in table 3. Overall significance of the wealth and interest elasticities improves and the elasticities are more in line with theory – especially for the French case. It therefore appears that the estimation of a FAIDS with historical data should consider the incorporation of breaks in the estimated elasticities to improve precision.

6 Conclusion

In this article I estimate a Financial Almost Ideal Demand System (FAIDS) on the French and Dutch household portfolio for the period 1963-2018 and 1970-2018, respectively. In line with expectations I find generally positive wealth and own-rate elasticities in the baseline estimation, although the results for France are plagued by greater standard errors. I hypothesize that this uncertainty around the French estimates revolves around 1) the general overhaul of the French financial system in the mid-1980s and 2) a crisis of the welfare state in the 1990s. Both factors likely altered household incentives and opportunities in their financial decisions and consequentially increased standard errors.

To incorporate these institutional dynamics in the analysis, a second specification explicitly allows for structural breaks in the long-run wealth and interest elasticities. Where the Dutch estimates appear relatively stable, this is not the case for the French case. In particular, I find a structural break in the long-run wealth and own-rate elasticities after 1990. Moreover, the precision of the estimates improve considerably.

Cross-rate elasticities appear relatively stable, both across space and time. Housing wealth acts as a substitute for life-insurance or pension assets in both nations which likely reflects the role played by both asset types in smoothing out consumption over time. Instead, housing wealth and equity appear complements in both the French and Dutch household portfolio, which is consistent with a hedging function: housing and equity returns are negatively correlated in both nations. Furthermore, these cross-rate elasticities appear relatively stable over time as well.

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A Data sources

A.1 France

Table 7: Data sources household assets and mortgage debt France

Variable	Source
Currency	1960-1976: Annuaire statistique de la France; 1977-1994: BdF; 1995-2017: Eurostat.
Deposits	1963-1976: Annuaire statistique de la France; 1977-1994: BdF; 1995-2017: Eurostat.
Savings	Sum of the Livret A, Livret Bancaire, CEL, PEL, LEP, CODEVI/LDD, livret jeune and PEL.
Livret A	1963-1968: Annuaire Statistique de la France; 1969-1992: Rapport Annuel du Conseil National du Crédit; 1993-2018: BdF.
Livret Bancaire	1963-1968: Annuaire Statistique de la France; 1969-1992: Rapport Annuel du Conseil National du Crédit; 1993-2018: BdF.
CEL	1965-1968: Annuaire Statistique de la France; 1969-1992: Rapport Annuel du Conseil National du Crédit; 1993-2018: BdF.
PEL	1969-1992: Rapport Annuel du Conseil National du Crédit; 1993-2018: BdF.
LEP	1982-1992: Rapport Annuel du Conseil National du Crédit; 1993-2018: BdF.
CODEVI/LDD	1983-1992: Rapport Annuel du Conseil National du Crédit; 1993-2018: BdF.
Bonds	1963-1976: Annuaire Statistique de la France. The growth rate between 1976 and 1977 was derived from the growth rate of the French bond market (Bozio, 2002); 1977-1994: BdF; 1995-2017: Eurostat.

Continued on next page

Variable	Source
Equity	1963-1976: growth rates of stock market capitalization from Bozio (2002); 1977-1994: BdF; 1995-2017: Eurostat.
Life Insurance	Sum of life-insurance holdings and the Plan d'épargne Populaire. Life insurance holdings: No information prior to 1977; 1977-1994: BdF; 1995-2018: Eurostat.
PEP	1990-1992: Rapport Annuel du Conseil National du Crédit; 1993-2018: BdF.
Housing wealth	See section A.3.
Mortgage debt	1960-1992: Jordà et al. (2016); 1993-2018: Banque de France.

Table 8: Data sources returns and costs of assets and liabilities France

Variable	Source
Money market	1945-1999: Levy-Garboua and Éric Monnet (2016); 2000-2018: DNB (3-month Euribor).
M1	Fitted values of a regression of the return on M1 (overnight deposits) over the period of 2003-2018 on the money market rate: $r_{M1} = \beta_0 + \beta_1 * MM$.
Overnight deposits	2003-2018: ECB.
Livret A	1962-2018: Banque de France.
Livret Bancaire	1962-1986: Rapport annuel Conseil National du Crédit; 1987-2006: Annuaire statistique de la France; 2007-2018: Banque de France.
CEL	1962-2018: Banque de France.
PEL	1962-2018: Banque de France.
LEP	1962-2018: Banque de France.
CODEVI/LDD	Rate livret A.
Bonds	Total return index. 1960-2015: Jordà et al. (2019); 2016-2018: fitted values of a regression of the total return index of Jordà et al. (2019) on a total return index of bonds from Datastream (1986-2018): $r_{Bonds-Jorda} = \beta_0 + \beta_1 * r_{Bonds-Datastream}$. R-squared 88 percent.
Capital market	1945-2015: Levy-Garboua and Éric Monnet (2016); 2016-2018: Banque de France.

Continued on next page

Variable	Source
Equity	Total return index. 1960-2015: Jordà et al. (2019); 2016-2018: fitted values of a regression of the total return index of Jordà et al. (2019) on a total return index of equity from Datastream (1970-2018): $r_{Equity-Jorda} = \beta_0 + \beta_1 * r_{Equity-Datastream}$. R-squared 96 percent.
Life-insurance	Bonds.
PEP	Bond return.
Housing wealth	Weighted return (cost) of housing assets and mortgages.
Housing assets	Sum of owner's equivalent rent and housing price increases.
Owners equivalent rent	Ratio of a rent and price index multiplied by 2.8 after Jordà et al. (2017) and MSCI (2016).
Rent index	1970-2015: CGPC (2018); 2016-2018: INSEE
Mortgage rate	1960-1967: fitted values of a regression of the mortgage rate on the capital market rate between 1968 and 2018 $rMortgage = \beta_0 + \beta_1 * rCapitalMarketRate$; 1968-1988: Annuaire statistique de la France, average of lower and upper bound mortgage rate; 1989-1990: Rapport annuel Conseil National du Crédit; 1991-1993: Bulletin Trimestriel Annuaire statistique de la France; 2004-2018: ECB, mortgage rate outstanding loans.
Inflation	1956-2017: OECD.

Table 9: Data sources control variables France

Variable	Source
sdCAC40	The absolute value of the unexplained variation of a regression of CAC40 index changes on its lag. Regression run on monthly data, where sdCAC40 is the yearly average. CAC40 index from BdF.
Unemployment	1969-1974: Annuaire statistique de la France; 1975-2017: INSEE.
Dependency ratio	1946-2017: INSEE.

A.2 The Netherlands

Table 10: Data sources household assets and mortgage debt the Netherlands

Variable	Source
Currency	1970-1994: CPB, macroeconomische verkenning 2013; 1995-2017: Eurostat.
Transferable deposits	1970-1994: CPB, macroeconomische verkenning 2013; 1995-2017: Eurostat.
Savings accounts	1970-1994: CPB, macroeconomische verkenning 2013; 1995-2017: Eurostat.
Equity	1970-1994: CPB, macroeconomische verkenning 2013; 1995-2017: Eurostat.
Pension	1970-1994: CPB, macroeconomische verkenning 2013; 1995-2017: Eurostat.
Life-insurance	1970-1994: CBS, technical reserves life-insurers; 1995-2017: Eurostat.
Bonds	1970-1994: CPB, macroeconomische verkenning 2013; 1995-2017: Eurostat.
Housing wealth	See section A.3.
Mortgage debt	1960-2003: Jordà et al. (2016); 2003-2018: DNB.

Table 11: Data sources returns and costs of assets and liabilities the Netherlands

Variable	Source
Money market	1960-1976: CBS; 1977-2018: DNB.
M1	Fitted values of a regression of the return on M1 (overnight deposits) over the period of 2003-2018 on the money market rate: $r_{M1} = \beta_0 + \beta_1 * MM$.
Overnight deposits	2003-2018: ECB.
Savings account	1969-1998: CBS Maandstatistiek van het financiewezen (various years), 2 year term account; 1998-2002: DNB statistical bulletin (various years), 2 year term account; 2003-2017: DNB, term accounts smaller or equal to 2 years.

Continued on next page

Variable	Source
Equity	Total return index. 1960-2015: Jordà et al. (2019); 2016-2018: fitted values of a regression of the total return index of Jordà et al. (2019) on a total return index of equity from Datastream (1988-2018): $r_{Equity-Jorda} = \beta_0 + \beta_1 * r_{Equity-Datastream}$. R-squared 85 percent.
Pension assets	Weighted return of the components of the balance sheet of Dutch pension funds. 1960-1986: De Nederlandsche Bank (1987); 1987-2015: CBS. For 2016-2018, 2015 figures are used due to breaks in the data. Components of pension fund balance sheet reported in figure 2.
Life-insurance	Weighted return of the components of the balance sheet of Dutch life-insurers. Weights are from CBS. For 2016-2018, 2015 figures are used due to breaks in the data. The same holds for 1970-1974, where the 1975 values are used. Components of Life-insurance balance sheet reported in figure 3.
Bonds	Total return index. 1960-2015: Jordà et al. (2019); 2016-2018: Datastream.
Housing wealth	Weighted return (cost) on housing assets and mortgages.
Housing assets	Sum of owner's equivalent rent and housing price increases.
Owner's equivalent rent	Ratio of rent and price index multiplied by 4.4 after Jordà et al. (2017) and MSCI (2016).
Rent index	Product of owner-equivalent rent and index of rent increases. 1970-2017: CBS.
Mortgages	2003-2018: DNB, new loans; 1945-2002: CBS Statline, new loans.
Inflation	1956-2017: OECD.

Table 12: Data sources control variables

Variable	Source
Unemployment	1969-2018: CBS Statline.
Life expectancy at birth	1970-2016: CBS Statline.
Fraction of high savers	1970-2016: CBS Statline; fraction of people aged between 40 and 65.

Continued on next page

Variable	Source
sdAEX	The absolute value of the unexplained variation of a regression of AEX index changes on its lag. Regression run on monthly data, where sdAEX is the yearly average. AEX data from CBS.

A.3 Housing assets

Housing assets are calculated using the following

$$HW_t = P_t * HS_t * DS_t, \tag{14}$$

where P_t is the housing price, HS_t is housing stock, and DS_t is the fraction of houses owned by households.

To approximate the housing price I make use use of a methodology inspired on Slacalek (2009) and make use of a housing price index which is published for both France and the Netherlands by the BIS. Specifically, I calculate an average house price for 2011 (because this is the last year for which we have figures for both countries), and make use of the price index to calculate the development of the price over time. The average housing price over time is therefore equal to:

$$P_t = PI_t * \left(\frac{HW_{2011}}{HS_{2011}} * \frac{1}{DS_{2011}} \right), \tag{15}$$

where PI_t is a price index and HS_{2011} is the number of houses in 2011. The figure in brackets is the average housing price in 2011 and, consequently, PI_{2011} is equal to 1.

Table 13: Data sources housing wealth France

Variable	Source
Price index	1945-2012: Knoll et al. (2017); 2013-2017: BIS.
Housing wealth 2011	OECD.
Housing stock	1962-1981: Annuaire statistique de la France (various editions), several years linearly interpolated. 1982-2018: INSEE.
Tenure	1953-1983: Annuaire Statistique de la France; 1984-2018: INSEE.

Table 14: Data sources housing wealth The Netherlands

Variable	Source
Price index	1945-2012: Knoll et al. (2017); 2013-2017: BIS.
Housing wealth 2011	OECD.
Housing stock	CBS.
Tenure	1947-2006: Haffner et al. (2009); 2007-2018: CBS.

A.4 Figures

Figure 2: Balance sheet Dutch pension funds

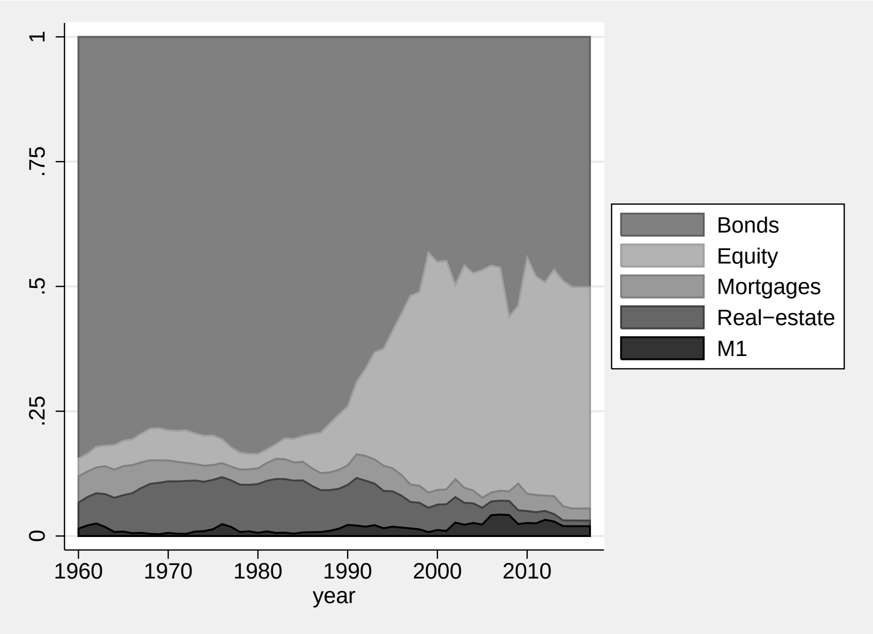
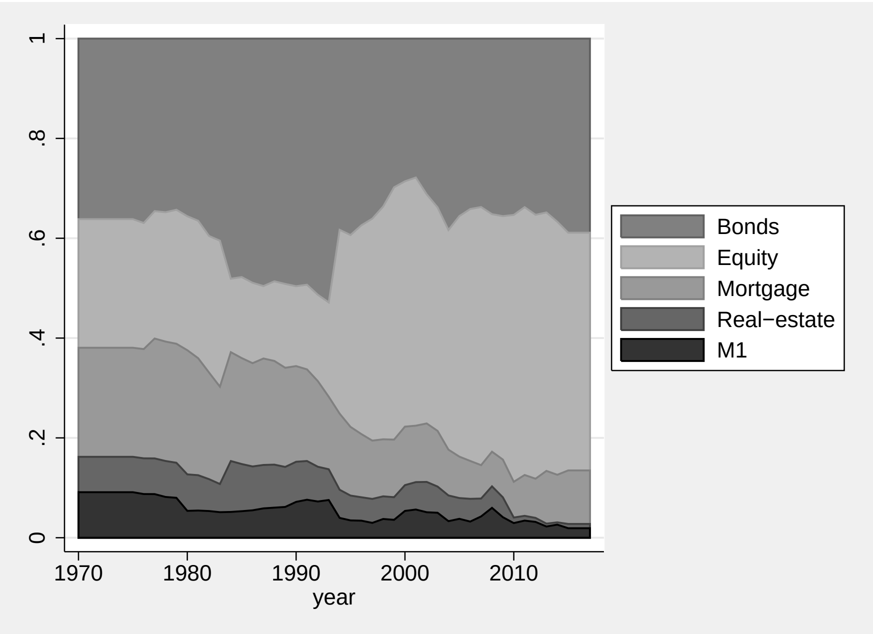


Figure 3: Balance sheet Dutch Life-insurers



A.5 Tables

Table 15: Unit Root tests France

(a) Asset shares

	Wealth	M1	Savings	LI	Equity	HW
Dfuller	0.72	0.98	0.35	0.54	0.53	0.42
PPerron	0.67	0.99	0.39	0.42	0.40	0.27

(b) Returns

	rWealth	rM1	rSavings	rEquity	rLI	rHW	rHW
Dfuller	0.00	0.00	0.65	0.51	0.00	0.00	0.11
PPerron	0.00	0.00	0.57	0.41	0.00	0.00	0.10

(c) Control variables

	Unemployment	dependency_NL	sdCBS
Dfuller	0.95	1.00	0.00
PPerron	0.89	1.00	0.00

Note: Unit root tests on regression variables. Figures are p-values where H0 is unit root. Both the Dickey-Fuller and Phillips-Perron test include a trend.

Table 16: Unit Root tests the Netherlands

(a) Asset shares

	Wealth	M1	Savings	Equity	Pension	HW
Dfuller	0.83	0.01	0.82	0.48	0.57	0.67
PPerron	0.87	0.01	0.64	0.38	0.46	0.35

(b) Returns

	rM1	rSavings	rEquity	rPension	rHW
Dfuller	0.32	0.53	0.00	0.00	0.31
PPerron	0.19	0.37	0.00	0.00	0.19

(c) Control variables

	Unemployment	Dependency	sdAEX
Dfuller	0.55	1.00	0.02
PPerron	0.40	1.00	0.02

Note: Unit root tests on regression variables. Figures are p-values where H0 is unit root. Both the Dickey-Fuller and Phillips-Perron test include a trend.

Table 17: Correlation table France

	rWealth	rM1	rSavings	rEquity	rLI	rHW	Unemp.	Dep.	sdCAC
rWealth	1.000								
rM1	0.514	1.000							
rSavings	0.515	0.899	1.000						
rEquity	0.785	0.252	0.338	1.000					
rLI	0.574	0.359	0.468	0.380	1.000				
rHW	0.292	0.244	-0.018	-0.114	-0.130	1.000			
Unemp.	0.444	0.502	0.675	0.386	0.456	-0.220	1.000		
Dep.	-0.367	-0.309	-0.537	-0.254	-0.367	0.037	-0.828	1.000	
sdCAC	0.327	-0.072	0.080	0.303	0.143	0.089	0.253	-0.346	1.000

Table 18: Correlation table the Netherlands

	rM1	rSavings	rEquity	rPension	rHW	Unemp.	sdAEX	Dep.
rM1	1.000							
rSavings	0.767	1.000						
rEquity	0.200	0.160	1.000					
rPension	0.317	0.248	0.730	1.000				
rHW	0.075	-0.141	-0.025	0.029	1.000			
Unemp.	0.506	0.494	0.478	0.428	-0.204	1.000		
sdAEX	0.233	0.339	0.108	0.069	-0.117	0.289	1.000	
Dep.	-0.773	-0.501	-0.158	-0.274	-0.043	-0.445	-0.231	1.000

Table 19: Breakpoints France

	BP1	BP2	BP3	BP4
2.5%	1982	1991	2001	
M1	1983	1992	2002	
97.5%	1985	1993	2005	
2.5%	1976	1993		
Savings	1977	1994		
97.5%	1978	1996		
2.5%	1979	1990	2007	
Equity	1980	1991	2008	
97.5%	1982	1992	2011	
2.5%	1982	1985	1999	2014
LI	1983	1992	2000	2015
97.5%	1984	1993	2001	2016
2.5%	1977	1990	1999	2007
HW	1980	1991	2001	2009
97.5%	1986	1992	2003	2010

Note: This table displays breakpoints of the five assets shares following Bai and Perron (1998, 2003). The figures include a point estimate and confidence intervals at 2.5% and 97.5%.

Table 20: Breakpoints the Netherlands

	BP1	BP2	BP3	BP4	BP5
2.5%	1975	1981	1990	1998	2009
M1	1976	1983	1991	2000	2010
97.5%	1977	1985	1992	2001	2011
2.5%	1975	1984	1991	1998	
Savings	1978	1985	1992	2003	
97.5%	1979	1987	1994	2004	
2.5%	1975	1999	2006		
Equity	1976	2000	2007		
97.5%	1979	2001	2009		
2.5%	1979	1989	1999	2009	
Pension	1980	1990	2001	2010	
97.5%	1981	1993	2002	2011	
2.5%	1979	1998	2008		
HW	1980	1999	2009		
97.5%	1989	2001	2010		

Note: This table displays breakpoints of the five assets shares following Bai and Perron (1998, 2003). The figures include a point estimate and confidence intervals at 2.5% and 97.5%.

Table 21: Long-run elasticities France with breakpoint 1985

	M1	Equity	LI	HW	Savings
Wealth	1.081	-1.783	1.319	1.910	2.713
	0.835	0.000	0.364	0.000	.
rM1	-1.368	0.245	-0.206	0.008	2.322
	0.017	0.172	0.625	0.991	.
rEquity	0.121	1.255	0.504	0.281	-1.161
	0.172	0.299	0.000	0.043	.
rLI	-0.153	0.757	-1.362	-2.203	3.961
	0.625	0.000	0.000	0.000	.
rHW	0.003	0.182	-0.950	1.774	-0.008
	0.991	0.043	0.000	0.065	.
rSavings	1.747	-1.766	4.010	-0.019	-2.972
	.	.	.	.	.
d1985Wealth	0.261	3.795	1.463	-0.066	-0.665
	0.135	0.000	0.284	0.000	.
d1985rM1	5.462	0.061	-0.143	1.294	-5.673
	0.024	0.680	0.627	0.014	.
d1985rEquity	0.030	0.773	-0.460	-0.163	0.821
	0.680	0.268	0.000	0.136	.
d1985rLI	-0.106	-0.692	2.884	0.318	-1.404
	0.627	0.000	0.000	0.339	.
d1985rHW	0.415	-0.106	0.137	1.187	-0.633
	0.014	0.136	0.339	0.463	.
d1985rSavings	-4.268	1.249	-1.421	-1.486	6.926
	.	.	.	.	.

Note: this table reports the elasticities calculated on the basis of equation 3 with the addition of the interaction terms of equation 11. P-values are immediately below the elasticities. All bold figures are significant at a ten percent level. Control variables are not reported here but included in the regression.

Table 22: Long-run elasticities France with breakpoint 1995

	M1	Equity	LI	HW	Savings
Wealth	0.429	2.548	1.568	0.422	-0.144
	0.006	0.000	0.000	0.000	.
rM1	-0.630	-0.014	0.606	0.036	1.002
	0.122	0.944	0.124	0.959	.
rEquity	-0.007	1.794	0.271	0.107	-1.164
	0.944	0.000	0.008	0.388	.
rLI	0.450	0.407	0.135	-1.249	1.258
	0.124	0.008	0.013	0.000	.
rHW	0.011	0.069	-0.539	2.092	-0.634
	0.959	0.388	0.000	0.002	.
rSavings	0.754	-1.772	1.273	-1.487	2.231
	.	.	.	.	.
d1995Wealth	1.324	-2.196	0.882	2.092	3.176
	0.407	0.000	0.546	0.000	.
d1995rM1	2.955	0.019	-0.447	-0.280	-1.247
	0.556	0.874	0.176	0.602	.
d1995rEquity	0.009	1.587	-0.234	-0.510	0.147
	0.874	0.000	0.000	0.000	.
d1995rLI	-0.332	-0.351	1.257	-0.029	0.455
	0.176	0.000	0.277	0.901	.
d1995rHW	-0.090	-0.331	-0.012	0.091	1.342
	0.602	0.000	0.901	0.000	.
d1995rSavings	-0.938	0.224	0.460	3.150	-1.897
	.	.	.	.	.

Note: this table reports the elasticities calculated on the basis of equation 3 with the addition of the interaction terms of equation 11. P-values are immediately below the elasticities. All bold figures are significant at a ten percent level. Control variables are not reported here but included in the regression.

Table 23: Long-run elasticities the Netherlands with breakpoint 1985

	M1	Equity	Pension	HW	Savings
Wealth	-0.444	-0.667	1.529	2.434	1.676
	0.002	0.000	0.000	0.000	.
rM1	3.212	1.815	-1.286	-2.357	-0.383
	0.225	0.000	0.062	0.410	.
rEquity	0.403	2.334	-1.031	0.131	-0.838
	0.000	0.000	0.000	0.283	.
rPension	-0.174	-0.629	1.300	-0.283	0.786
	0.062	0.000	0.160	0.000	.
rHW	0.304	0.267	-0.946	2.361	-0.987
	0.001	0.283	0.000	0.000	.
rSavings	-1.230	-1.359	2.090	0.306	1.193
	.	.	.	.	.
d1985Wealth	1.832	1.859	1.017	-0.141	0.169
	0.092	0.004	0.898	0.011	.
d1985rM1	4.922	-0.647	-0.518	-0.478	-2.278
	0.049	0.021	0.227	0.001	.
d1985rEquity	-0.144	0.516	0.141	0.171	0.316
	0.021	0.004	0.289	0.038	.
d1985rPension	-0.070	0.086	1.047	0.085	-0.148
	0.227	0.289	0.683	0.028	.
d1985rHW	-0.216	0.347	0.284	0.502	0.083
	0.001	0.038	0.028	0.005	.
d1985rSavings	-0.821	0.513	-0.393	0.066	1.635
	.	.	.	.	.

Note: this table reports the elasticities calculated on the basis of equation 3 with the addition of the interaction terms of equation 11. P-values are immediately below the elasticities. All bold figures are significant at a ten percent level. Control variables are not reported here but included in the regression.

Table 24: Long-run elasticities the Netherlands with breakpoint 1995

	M1	Equity	Pension	HW	Savings
Wealth	0.341	-0.099	1.736	1.954	0.302
	0.029	0.000	0.000	0.030	.
rM1	2.475	0.351	0.176	0.097	-2.098
	0.172	0.197	0.713	0.975	.
rEquity	0.078	1.615	-0.221	0.061	-0.533
	0.197	0.000	0.247	0.588	.
rPension	0.024	-0.135	0.622	-0.200	0.689
	0.713	0.247	0.087	0.001	.
rHW	0.094	0.125	-0.667	2.232	-0.784
	0.131	0.588	0.001	0.000	.
rSavings	-0.796	-0.865	1.832	-0.584	1.413
	.	.	.	.	.
d1995Wealth	0.890	1.317	0.689	0.193	1.996
	0.805	0.410	0.087	0.215	.
d1995rM1	3.888	0.240	-0.920	-0.108	-2.101
	0.064	0.194	0.012	0.292	.
d1995rEquity	0.053	1.015	-0.230	0.201	-0.040
	0.194	0.918	0.144	0.019	.
d1995rPension	-0.125	-0.140	1.125	0.095	0.044
	0.012	0.144	0.517	0.042	.
d1995rHW	-0.049	0.410	0.318	0.556	-0.235
	0.292	0.019	0.042	0.003	.
d1995rSavings	-0.757	-0.065	0.118	-0.187	1.891
	.	.	.	.	.

Note: this table reports the elasticities calculated on the basis of equation 3 with the addition of the interaction terms of equation 11. P-values are immediately below the elasticities. All bold figures are significant at a ten percent level. Control variables are not reported here but included in the regression.