Inflation Expectations and Choices of Households: Evidence from Linked Survey and Administrative Data*

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Abstract

How do households form inflation expectations? Do their inflation expectations affect their choices? To address the first question, we study panel data on household inflation expectations for the period 1993-2016. We find that a standard model for the average inflation expectation (across households) also matches fairly well household-level data on inflation expectations. Turning to the second question, we link – at the household level – the survey data on inflation expectations to administrative data on income and wealth. Estimating panel data models, where change in or level of net worth is the dependent variable, we obtain a negative relationship between inflation expectations and savings, consistent with the common idea in academic and policy circles that an increase in inflation expectations stimulates spending.

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1 Introduction

How do individuals form inflation expectations? The answer to this question is of central importance for policy makers. Inflation expectations are viewed as a key determinant of inflation (Bernanke, 2007, Yellen, 2015), and in the United States, in Europe, and in Japan, policies that raise inflation expectations have been proposed as policies to stimulate spending when the effective lower bound on interest rates is binding. Hence, theoretical and empirical research on how decision-makers *form* inflation expectations has been an important input into policy-making.[1]

A question that seems equally important is: Do agents' inflation expectations affect their choices? According to theories that have had a large impact on policy-making in practice, there is a very tight link between inflation expectations and choices (e.g., the consumption Euler equation and the New Keynesian Phillips curve in New Keynesian models), but empirically it is still an open question whether there exists such a tight link between inflation expectations and choices, and only if inflation expectations do affect choices, we care about how inflation expectations are formed in the first place.

The key innovation of this paper is to link survey data on inflation expectations and administrative data on income and wealth at the household level. The survey data on inflation expectations are already interesting, because one can track individual households over several years. We use the Dutch Household Survey. The survey aims to be representative for the Dutch population. Every year households are asked to forecast prices for the next year. Households participate for several years. Since one can track individual households over time, one can study how individual households update inflation expectations over time. Most papers studying how individuals update inflation expectations over time use either a survey of professional forecasters or the panel component of the Michigan Survey of Consumers, but professional forecasters do not appear prominently in Macroeconomic models and households are surveyed at most twice in the Michigan Survey of Consumers. We therefore begin the paper by investigating how households update inflation expectations over time. We find that a standard model of the dynamics of the *average* inflation expectation also matches fairly well the dynamics of *individual-level* inflation expectations after some small modifications.

[1] For example, the rational expectations revolution has had a large impact on institutional design such as central bank independence. Learning models have affected how central banks think about disinflations.

In the second part, we turn to the key question of the paper: Do agents' inflation expectations affect their choices? We exploit the fact that one can link the survey data on inflation expectations and administrative data on income, assets, and liabilities at the household level. Estimating panel data models, where change in or level of net worth is the dependent variable, we obtain a negative relationship between inflation expectations and savings, consistent with the common idea in academic and policy circles that an increase in inflation expectations stimulates spending. It turns out that the negative relationship between inflation expectations and net worth mainly comes from assets not liabilities.

There exist only a few papers that study the relationship between inflation expectations and choices by households using microdata. Most papers in this literature examine the relationship between quantitative inflation expectations and answers to qualitative questions on "readiness to spend" (Bachmann et al., 2015, D'Acunto et al., 2016, Andrade et al., 2016, Arioli et al., 2017). These papers use the Michigan Survey of Consumers (MSC) or similar surveys for other countries. Another group of papers exploit recent innovations in the Federal Reserve Bank of New York Survey of Consumer Expectations (SCE): Crump et al. (2015) estimate the elasticity of intertemporal substitution, exploiting the fact that the SCE elicits quantitative measures of both inflation and spending growth expectations; Armantier et al. (2015) find that inflation expectations co-move in a meaningful way with investment choices in a financially incentivized field experiment. Finally, Malmendier and Nagel (2016) investigate the relationship between their model-implied inflation expectations and financial decisions reported in the Survey of Consumer Finances (SCF) at the cohort level. We take a different and complementary approach to the existing papers in this literature. We link microdata on inflation expectations for the period 1993-2016 to administrative data on income, assets, and liabilities at the household level.

The rest of the paper is organized as follows. Section 2 presents the survey data on inflation expectations and the core results on how individual households update inflation expectations over time. Section 3 introduces the administrative data on income and wealth and investigates whether households' inflation expectations affect their choices. Section 4 concludes.

2 Inflation Expectations of Households

In this section, we investigate how households update inflation expectations over time. The micro data on expectations are from the DNB Household Survey. This data set has two novel features: (i) one can track an individual household's inflation expectation over several years, and (ii) one can link the survey data on inflation expectations and administrative data on income and wealth at the household level. We are not aware of any existing paper that has studied a data set with feature (i) *or* (ii). The main goal of this section is to present the survey data on inflation expectations and to make the point that a standard model of the dynamics of the *average* inflation expectation also matches fairly well the dynamics of *individual-level* inflation expectations.

2.1 Data

The inflation expectations microdata is from the DNB Household Survey, conducted annually since 1993 and administered by CentERdata at Tilburg University. The survey aims to be representative for the Dutch population. Households participate for several years. Since one can track individual households over time, one can study how individual households update inflation expectations over time.

The purpose of the DNB Household Survey is to study the economic and psychological determinants of the saving behavior of households. The data are collected through the Internetpanel of CentERdata. Households without a computer and/or access to the Internet are provided a basic computer and an Internet connection.

The DNB Household Survey consists of six questionnaires. The questionnaire "Health and Income" includes several questions about inflation expectations. Beginning with the 2008 wave, the main quantitative question on inflation expectations is:

> "What is the most likely (consumer) prices increase over the next twelve months, do you think?"

Possible answers are:

> 1%, 2%, 3%, . . . , 10%

Respondents are then asked four questions regarding their subjective CDF:

> "Of course it is difficult to predict on forehand how much (consumer) prices will increase. Therefore we would like to ask you how sure you are about your prediction."[2]
>
> "How likely do you think that it is that the increase (in percent) in prices in the next twelve months will be less than [Y1]%?"
>
> "How likely do you think that it is that the increase (in percent) in prices in the next twelve months will be less than [Y2]%?"
>
> "How likely do you think that it is that the increase (in percent) in prices in the next twelve months will be more than [Y3]%?"
>
> "How likely do you think that it is that the increase (in percent) in prices in the next twelve months will be more than [Y4]%?"

In the years 1993-2002, households were only asked for a point prediction. The questions read:

> "Do you expect prices in general to rise, to remain the same, or to go down, in the next 12 months?"
>
> "If the answer is rise: By what percentage do you expect prices in general to rise in the next 12 months?"

In the years 2003-2007, households were only asked for their subjective CDF:

> "We now would like to learn what you expect will happen to the prices in the next twelve months. What will be the minimum percentage prices could increase over the next twelve months, do you think? If you think prices will decrease, you can fill in a negative percentage by using a minus in front of the number."
>
> "What is the maximum percentage prices will increase over the next twelve months, do you think?"

Calling the answers MIN and MAX, the respondents were asked 4 questions, with $i \in \{2, 4, 6, 8\}$:

> "How likely do you think that it is that the increase in prices in the next twelve months will be less than $\frac{i(MAX-MIN)}{10} + MIN$?"

[2] The values of Y1, Y2, Y3, and Y4 in the following four questions depend on the answers given to the first question.

For the years 2003-2007, where households were only asked for their subjective CDF, we estimate the mean of the subjective CDF using a piece-wise linear interpolation over the probability density function.

Figure 1 shows the cross-sectional distribution of point predictions made in the year 2012. Recall that households were asked: "What is the most likely (consumer) prices increase over the next twelve months, do you think?" Possible answers were: 1%, 2%,..., 10%. As one can see, there is large cross-sectional heterogeneity in the answers. Some households answered 1%, while other households picked 10%. Close to one fifth of households chose a number of 5% or larger, although annual CPI inflation in the Netherlands had been below 4.7% since 1983. However, the large majority of respondents made a very good forecast that year: two thirds of households answered 2% or 3% in 2012, and CPI inflation turned out to be 2.5% in 2013.

Figure 2 illustrates the evolution of the cross-sectional distribution of inflation expectations over time. The cross-sectional distribution of inflation expectations for year t is described by the 10th percentile (dots), the mean (large dashes), and the 90th percentile (small dashes). We also plot the time series for realized CPI inflation (solid line). To facilitate comparison between expectations and realizations, the four numbers reported for year t refer to the distribution of forecasts made in year t-1 for year t and the realization in year t. The vertical lines mark changes in the survey questions. The cross-sectional heterogeneity in inflation expectations is large in all years. The cross-sectional mean of inflation expectations has properties which are familiar from the literature on predictability of average forecast errors (Coibion and Gorodnichenko, 2012 and 2015). In the case of a difference between realized inflation in year t and the average inflation expectation reported in year t-1 (i.e., in the case of a non-zero average forecast error in year t), the average inflation expectation moves in the direction of realized inflation but the average forecast error is highly persistent! Furthermore, a persistent average forecast error can appear because inflation changes and inflation expectations adjust sluggishly (see the period since November 2013, where the main policy rate of the European Central Bank has been 25 basis points or less) and a persistent average forecast error can also appear because inflation expectations and realized inflation move in opposite directions (see forecasts for inflation and realized inflation for the year 2002, where euro coins and banknotes were introduced). Finally, the changes in the survey questions did not coincide with unusual changes in the cross-sectional mean of reported inflation expectations, but they may have coincided with small changes in the cross-sectional heterogeneity in reported inflation expectations.

The panel component of the survey data allows us to track individual households over several years. We can investigate how *individual* households *update* their inflation expectations over time. Several thousand households participated in the survey. It is difficult to visualize several thousand paths for the reported inflation expectation. We therefore present transition matrices.

In Table 1, we study the answers of all households with an observation in the year after the first observation. The entries are conditional probabilities. The first row contains the relative frequency of answers in year two given that the answer in year one was 1%, the second row contains the relative frequency of answers in year two given that the answer in year one was 2%, and so on. The diagonal entries are 0.47, 0.42, 0.33, 0.36, and 0.30. Roughly 1/3 of households gave the same answer in year two as in year one, and the fraction is higher for initially low answers and lower for initially high answers.

Table 2 repeats the exercise for all households with observations in both years after the first observation. The first panel reports transition probabilities comparing answers in years one and two. The second panel shows transition probabilities comparing answers in years two and three. The third panel reports transition probabilities comparing *directly* answers in year one and year three. The two one-year transition matrices in Table 2 are similar to the one-year transition matrix in Table 1, suggesting that there is nothing special about the first year of being in the survey. A striking feature of the expectations data can be seen in the last panel of Table 2 – the (1,1) entry of panel three ("1 to 3") is much larger than the product of row one of panel one ("1 to 2") and column one of panel two ("2 to 3"). Answers do not follow a Markov process with common transition probabilities. A household has a higher probability of going from an answer of 2% in year two to an answer of 1% in year three *if the household already said 1% in year one*. The same observation applies to the other diagonal entries of the last panel. Households seem to return to individual-specific attractors for the inflation expectation.

Table 3 confirms this finding. In Table 3, we repeat the exercise for all households with at least four consecutive answers; more precisely, we repeat the exercise for all households with three observations in the three years after the first observation. The different panels in the table are the three one-year transition matrices and the transition matrix comparing directly the answers in years one and four. The diagonal entries of the last transition matrix ("1 to 4") are again much larger than the probabilities implied by a Markov process with common transition probabilities and the one-year transition matrices reported in the first three panels. Households tend to return to individual-specific attractors after they have moved away. To identify this feature of the data, one needs three or more observations per household.

Another striking feature of the panel data is that extreme answers come to a large extent from households who *temporarily* report a very high inflation expectation. The first row of any one-year transition matrix shows that households who say 1% in a given year have a 3-4 percent probability of saying 6% or more in the next year, and the fifth row of any one-year transition matrix shows that households who say 6% or more in a given year have a high probability of providing a non-extreme answer in the subsequent year.

In sum, cross-sectional dispersion in reported inflation expectations is large, the average forecast error is highly persistent, a persistent average forecast error can be caused by movements in inflation and a sluggish adjustment of inflation expectations or by movements in inflation expectations that are unwarranted, individual inflation expectations seem to have individual-specific attractors, and extreme answers come to a large extent from households who gave fairly normal answers in the past and temporarily report a very high inflation expectation.

2.2 Model

In the model, households receive noisy signals on inflation. The noise has an idiosyncratic component and an aggregate component. The idiosyncratic component of noise is interpreted as coming from limited attention. The aggregate component of noise is interpreted as coming from noisy media reports. Noisy signal models of belief formation, where the noise is interpreted as coming from limited attention (Sims, 2003, Woodford, 2003, Maćkowiak and Wiederholt, 2009), have recently gained popularity in the empirical literature on expectation formation (Patton and Timmermann, 2010, Coibion and Gorodnichenko, 2012 and 2015), because the noise in the signal alone generates three features of survey data on expectations: cross-sectional heterogeneity in expectations due to the idiosyncratic component of noise, unwarranted movements in the average expectation due to the aggregate component of noise, and slow adjustment of the average expectation to inflation innovations because of down-weighting of noisy signals. We slightly modify a standard noisy signal model by introducing a feature generating individual-specific intercepts in the equation for household inflation expectations. The presence of those intercepts will be important for the model's ability to match individual-level expectations data. The precise origin of those intercepts will be less important.

Households' perceived law of motion for inflation is

$$\pi_t = (1-\rho)\,c + \rho\pi_{t-1} + u_t, \tag{1}$$

where π_t is the inflation rate in year t, $\rho \in (-1,1]$ is the autocorrelation coefficient, $c \in \mathbb{R}$ is a constant, and $u_t \sim i.i.d.N\left(0,\sigma_u^2\right)$ is the inflation innovation in year t. In every year, each household i receives a noisy signal on inflation

$$s_{it} = \pi_t + \varepsilon_{it}, \tag{2}$$

where $\varepsilon_{it} \sim i.i.d.N\left(\mu_i,\sigma_\varepsilon^2\right)$ is the noise in the signal. The noise has an aggregate component and an idiosyncratic component, $\varepsilon_{it} = \bar{\varepsilon}_t + \hat{\varepsilon}_{it}$, where the aggregate component $\bar{\varepsilon}_t$ is interpreted as coming from noisy inflation statistics or noisy media reports on inflation and the idiosyncratic component $\hat{\varepsilon}_{it}$ is interpreted as coming from limited attention. The subjective mean of the noise term, denoted $\mu_i \in \mathbb{R}$, may be non-zero, which captures the idea that the household may believe that inflation statistics or media reports on inflation are biased. Households remember all signals received in the past and use the steady-state Kalman filter to compute conditional expectations of future inflation.

The standard Kalman filter equations imply that the nowcast for inflation is given by

$$E[\pi_t|\mathcal{I}_{i,t}] = E[\pi_t|\mathcal{I}_{i,t-1}] + K\left(s_{it} - \mu_i - E[\pi_t|\mathcal{I}_{i,t-1}]\right).$$

The nowcast for inflation of household i, $E[\pi_t|\mathcal{I}_{i,t}]$, is a linear combination of the household's prior mean, $E[\pi_t|\mathcal{I}_{i,t-1}]$, and the product of the Kalman gain K and the difference between the signal realization and the expected signal realization, after the household has deducted the perceived bias μ_i from the signal to transform the signal into an unbiased signal on current inflation. The perceived law of motion for inflation implies that the forecast for inflation is

$$E[\pi_{t+1}|\mathcal{I}_{i,t}] = (1-\rho)\,c + \rho E[\pi_t|\mathcal{I}_{i,t}].$$

Combining the last two equations yields

$$E[\pi_{t+1}|\mathcal{I}_{i,t}] = (1-\rho)\,c - \rho K\mu_i + \rho\,(1-K)\,E[\pi_t|\mathcal{I}_{i,t-1}] + \rho K s_{it}.$$

If the signal s_{it} is indeed a linear combination of the current inflation rate and noise, $s_{it} = \pi_t + \varepsilon_{it}$, we arrive at

$$E[\pi_{t+1}|\mathcal{I}_{i,t}] = (1-\rho)\,c - \rho K \mu_i + \rho\,(1-K)\,E[\pi_t|\mathcal{I}_{i,t-1}] + \rho K \pi_t + \rho K \varepsilon_{it}, \tag{3}$$

or equivalently

$$\pi_{t+1|t,i} = \beta_i + \beta_1 \pi_{t|t-1,i} + \beta_2 \pi_t + \nu_{it}, \tag{4}$$

where $\pi_{t+1|t,i} \equiv E[\pi_{t+1}|\mathcal{I}_{i,t}]$, $\pi_{t|t-1,i} \equiv E[\pi_t|\mathcal{I}_{i,t-1}]$, and $\nu_{it} \equiv \rho K \varepsilon_{it}$. Here $\beta_i = (1-\rho)\,c - \rho K \mu_i$, $\beta_1 = \rho\,(1-K)$, and $\beta_2 = \rho K$. Note that $\beta_1 + \beta_2 = \rho$ and $\beta_2/\beta_1 = K/\,(1-K) > 0$. Finally, from the last equation for a household's inflation expectation one can derive an equation for the average inflation expectation. Summing across i on both sides of equation (4) and dividing by the number of households yields

$$\bar{\pi}_{t+1|t} = \bar{\beta} + \beta_1 \bar{\pi}_{t|t-1} + \beta_2 \pi_t + \bar{\nu}_t, \tag{5}$$

where $\bar{\beta}$ denotes the average intercept and $\bar{\nu}_t$ denotes the average noise term. The last two equations show how noisy signal models generate three features of survey data on expectations: (i) underreaction of the average inflation expectation to inflation innovations since $\beta_2 < \rho$, (ii) cross-sectional heterogeneity in inflation expectations due to the idiosyncratic component of noise, and (iii) unwarranted movements in the average inflation expectation due to the aggregate component of noise. The new feature of the model is that heterogeneity in the perceived biases μ_i generates individual-specific intercepts in the equation for household-level inflation expectations.

The individual-specific intercepts in household-level inflation expectations may have a different reason. For example, households may shrink a data-based forecast towards some other individual-specific view. Patton and Timmermann (2010) propose a model in which professional forecasters shrink a data-based forecast towards some other individual-specific view. According to their model, the forecast of agent i in year t is a weighted average of the conditional expectation, $E[\pi_{t+1}|\mathcal{I}_{i,t}]$, and some other individual-specific view, ξ_i,

$$\pi_{t+1|t,i} = \omega \xi_i + (1-\omega)\,E[\pi_{t+1}|\mathcal{I}_{i,t}].$$

If the conditional expectation is given by equation (3), then the forecast is given by equation (4).[3] Alternatively, households may misunderstand the survey question on inflation expectations

[3] In this case, $\beta_i = \omega\,[1-\rho\,(1-K)]\,\xi_i + (1-\omega)\,[(1-\rho)\,c - \rho K \mu_i]$, $\beta_1 = \rho\,(1-K)$, $\beta_2 = (1-\omega)\,\rho K$, and $\nu_{it} = (1-\omega)\,\rho K \varepsilon_{it}$.

and submit forecasts for inflation rates at the household level.[4] If the perceived law of motion for household inflation is aggregate inflation plus a constant, $\pi_{it} = \pi_t + \delta_i$, the perceived law of motion for aggregate inflation is given by equation (1), and households pay limited attention to current household inflation to forecast future household inflation, $s_{it} = \pi_{it} + \varepsilon_{it}$, then the conditional expectation of future household inflation is given by

$$E\left[\pi_{i,t+1}|\mathcal{I}_{i,t}\right] = (1-\rho)\left(c+\delta_i\right) + \rho\left(1-K\right)E[\pi_{it}|\mathcal{I}_{i,t-1}] + \rho K s_{it}.$$

In addition, if the actual law of motion for household inflation has the form $\pi_{it} = \pi_t + \zeta_{it}$, where ζ_{it} may or may not coincide with δ_i, then the forecast of household i in year t is given by equation (4) with $\beta_i = (1-\rho)\left(c+\delta_i\right)$, $\beta_1 = \rho\left(1-K\right)$, $\beta_2 = \rho K$, and $\nu_{it} = \rho K\left(\zeta_{it} + \varepsilon_{it}\right)$. In the following, the presence – not the origin – of the individual-specific intercepts will matter.

2.3 Comparison of model and data

The noisy signal model presented in the previous subsection (without the individual-specific intercepts) has been frequently used to match *average* inflation expectations in the literature building on Coibion and Gorodnichenko (2012, 2015). We now ask whether this model also matches the empirical transition matrices for individual-level inflation expectations reported in Section 2.1.

To be as transparent as possible, we proceed in three steps. First, we estimate equation (5) for the average inflation expectation with the time series for the cross-sectional average of inflation expectations and the time series for inflation. These time series are plotted in Figure 2. This yields estimates of $\bar{\beta}$, β_1, β_2, and $\sigma_{\bar{\nu}}^2$. Second, we estimate the actual law of motion for inflation using the same series for inflation. Third, we make an assumption about the shape of the cross-sectional distribution of β_i, and we make an assumption about the variance of the idiosyncratic component of ν_{it}: (i) β_i has a log-normal distribution, and (ii) the variance of $\hat{\nu}_{it} \equiv \nu_{it} - \bar{\nu}_t$ equals twice the variance of $\bar{\nu}_t$. We choose the parameters of the log-normal distribution to match the cross-sectional variance of inflation expectations in the year 2012. This cross-sectional variance is reported in Figure 1. This completes our choice of parameters.

With these parameters, we simulate data for individual-level inflation expectations using equation (4) as well as the actual law of motion for inflation, and we compute transition matrices for

[4] Kaplan and Schulhofer-Wohl (2016) use scanner data to estimate inflation rates at the household level.

individual-level inflation expectations from the simulated data.[5]

Table 4 shows the results for estimation of equation (5) with the time series for the cross-sectional average of inflation expectations and the time series for inflation.[6] The estimates of β_1 and β_2 approximately sum to one. According to the model presented in Section 2.2, this means households' perceived law of motion for inflation is a random walk because $\beta_1 + \beta_2 = \rho$. Dividing the estimate of β_1 by the estimate of β_2 yields a value around 1.5. According to the model presented in Section 2.2, this means the Kalman gain is 0.4 because $\beta_1/\beta_2 = (1 - K)/K$.

Table 5 shows the results for estimation of an AR(1) for inflation using data for the period 1984-2016.[7] The point estimate of the coefficient on lagged inflation is 0.59 and the point estimate of the constant is 0.72. The estimated variance of the innovation equals 0.76. Hence, according to the model and these estimates, households believe inflation is more persistent than it actually is (the perceived autocorrelation coefficient for inflation is close to 1 not 0.6) and households believe media reports on inflation are noisy and/or households pay limited attention to current inflation to forecast future inflation (the estimated Kalman gain is 0.4 not 1).

Next, we turn to the cross-sectional distribution of inflation expectations. We set the parameters of the log-normal distribution for β_i to obtain a cross-sectional mean of β_i of 0.40 and a cross-sectional variance of β_i of 0.33. For these values, the cross-sectional mean of β_i equals the estimated value of $\bar{\beta}$ obtained in the first step (see the first column of Table 4), and the cross-sectional standard deviation of inflation expectations equals (on average across time and simulations) the value reported in Figure 1. This completes our choice of parameters. With these model parameters, we simulate time series for individual-level inflation expectations.

Tables 6-8 show the transition matrices computed from the simulated data. The model-implied transition matrices for individual inflation expectations are not far away from the empirical transition matrices for individual inflation expectations, but there are three features of the data that the model clearly misses. First, direct transitions from a very low inflation expectation to a very

[5]In the simulations, we assume that households with inflation expectations below 1.5% say 1%, households with inflation expectations in the interval $[1.5\%, 2.5\%)$ say 2%, and so on.

[6]The first column uses inflation expectations as reported by households, where the survey question is asked in three different ways as reported in Section 2.1. The second column adjusts inflation expectations to the same format of the most recent question. Results are similar. In both columns, the inflation data are the official annual inflation data published by Statistics Netherlands.

[7]The inflation data are again the official annual inflation data published by Statistics Netherlands.

high inflation expectation are rare in the model (see the (1,5) entry and the (2,5) entry of Table 6), as one would expect from a model with Bayesian agents tracking an inflation process with a small variance of the innovation, but such transitions are not rare in the data (see the (1,5) entry and the (2,5) entry of any one-year transition matrix in Tables 1-3). The same point applies to transitions in the opposite direction. Direct transitions from a very high inflation expectation to a very low inflation expectation are rare in the model (see the (5,1) entry and the (5,2) entry of Table 6), but such transitions are frequent in the data (see the (5,1) entry and the (5,2) entry of any one-year transition matrix in Tables 1-3). Second, the diagonal elements for high inflation expectations ("4-5%" and "6% or more") are too *high* in the model (Tables 6-8) compared to the data (Tables 1-3). Third, the diagonal elements for the 2% inflation expectation are too *low* in the model (Tables 6-8) compared to the data (Tables 1-3).

For these three reasons, we introduce two small modifications of the model. We assume that in any given period any given household reports the household's true inflation expectation with a 97 percent probability and provides an answer of 10% (instead of reporting the household's true inflation expectation) with a 3 percent probability. We interpret this assumption as a specific form of measurement error. In addition, we assume that 3 percent of households are non-updaters who always report an inflation expectation of 2%, perhaps because they believe that the central bank will tend to achieve price stability defined as an inflation rate below but close to 2%. We calibrate the model with these two assumptions by following the same procedure as before. See the beginning of this subsection. The new model-implied transition matrices are given in Tables 9-11. The model-implied transition matrices are close to the empirical transition matrices. In sum, after small modifications, a standard model for the average inflation expectation also matches fairly well household-level data on inflation expectations.

3 Choices of households

In this section, we report novel results on the relationship between inflation expectations and financial decisions of households.

3.1 Data

We exploit the fact that the same survey with household inflation expectations (the DNB Household Survey) can be linked to administrative data with measures of household income and wealth. The administrative data are provided by Statistics Netherlands, who also provide a working environment, where we could merge the microdata from the DNB Household Survey with the administrative data at the household level.[8] This allows us, for example, to link the self-reported inflation expectation of household i in year t to the wealth in checking and savings accounts that banks reported for household i for year t. Households were asked in 2011 to 2014 whether they agreed to be matched. 88% of the households appearing in our DHS sample agreed to be matched. For those households, we looked at all observations going back to the year 2006, since that is the first year for which we have administrative data on household wealth. The following two paragraphs provide more information on the income and wealth measures based on administrative data.

We use disposable household income, which is the sum of labor income, business income, and interest income (including use of the own home), plus transfers and alimony, minus taxes and health insurance premiums for all members in the household. Not measured (or imputed) are income transfers between households, income transfers abroad, black market income, and alimony to children.

Wealth is measured from several administrative sources, coming from the tax authorities and banks. The Netherlands has a tax on interest income, which is calculated as a fixed rate on the average holdings of cash, checking and savings accounts, stocks and bonds, real estate not being the primary residence, minus debt (including study loans, excluding mortgages for the primary residence). Since there is a threshold of 20,000 euro of wealth for the interest income tax (double the amount for couples), from tax records alone only higher wealth levels would be observed. For households not reporting interest income tax, Statistics Netherlands imputes wealth holdings based on dividend and interest income. Furthermore, for all households banks report wealth held in checking and savings accounts. The value of stocks and bonds is the market value at the beginning of January of a year. Other asset variables include housing value (based for tax purposes, which is correlated with but not necessarily equal to market value), stock ownership in substantial holdings, and business equity. On the liability side the mortgage value of the own home and the sum of other

[8]Statistics Netherlands checks all output to guarantee anonymity of households.

loans (including study loans) are reported, but not consumer loans or credit line facilities. As our main dependent variable we use net worth–the difference between the sum of all assets and the sum of all liabilities. Since the administrative data on household wealth is available as of the beginning of 2006, we cover the ten years 2006-2015 for the wealth positions and 2007-2015 for the flows.

We estimate empirical models of the following form

$$Y_{i,t} = \beta_0 + \beta_1 \pi_{t|t-1,i} + \mathbf{x}'_{i,t}\delta + \nu_{i,t}. \tag{6}$$

The dependent variable $Y_{i,t}$ is either the change in net worth or the level of net worth of household i in year t. We will also consider sub-categories of net worth, by looking at total assets, total liabilities and savings balances–the total of checking and savings accounts for the household. The main variable of interest is $\pi_{t|t-1,i}$, which is taken from the survey. In terms of timing, inflation expectations are measured at the beginning of year t and the dependent variable at the end. We control for relevant background characteristics $x_{i,t}$ and a time trend. Standard errors ($\nu_{i,t}$) are clustered at the level of the household. In some specifications we exploit the panel dimension and estimate models with household fixed effects in order to capture unobserved heterogeneity. We calculate the flows as the first difference. Since first differences of wealth can result in large swings, we trim the upper and lower ten percent of the distribution. For the regressions in levels we construct the coefficient of variation for each household, and trim the upper and lower five percent. Regressions with household fixed effects are sensitive to large changes of an outcome variable within a household, and this procedure takes care of that. Trimming of the distribution is done separately for each regression, therefore the number of observations may differ between outcomes. To be consistent with sample selections in Section 2.3, all observations are dropped for households who chose the answer 10% at least once in 2008-2015 (in these years respondents choose one number out of $[1, 2, ..., 10]$, see Section 2.1).

Table 12 shows the summary statistics for the regression sample. Expected inflation is measured in brackets $[1, 2, ..., 10]$, see Section 2.1 for the wording of the question. For the years 2006 and 2007 we construct expected inflation based on the subjective CDF, and we convert the measures to the same brackets. Net worth averages 120,000 euro, with on average 181,000 euro in assets and 61,000 euro in liabilities. Most of household assets is house value, and most of the liabilities is the mortgage. Home-ownership rates in the sample are slightly higher than in the population (73% in the sample and around 67% in the population). Households hold on average 28,800 euro in savings balances (including checking accounts). After-tax household income is around 23,000 euro. Older households are overrepresented in our sample, which has the advantage that household portfolios are more mature. Overall we have 9,605 household-year observations for 1,642 unique households, with an average panel dimension of close to six years.

3.2 Results

Table 13 studies the relationship between inflation expectations and net worth, assets, liabilities and savings balances. In the first two columns, we regress the value of net worth of the household at the end of year t on the inflation expectation of the household at the beginning of year t.[9] We control for income, education, a number of other household characteristics, regional characteristics and a time-trend. In the columns (3)-(4), we regress the value of all assets of the household on the inflation expectation of the household, and in columns (5)-(6) we regress the value of total liabilities of the household on the inflation expectation of the household. The last column-pair has savings balances as outcome. The even columns have the same specification as the ones in the odd columns, but include household fixed effects.

We obtain three novel findings. Households with higher inflation expectations have lower net worth, less assets, and less liabilities. To start with net worth, in column (1) of Table 13 a one percentage point increase in inflation expectations is associated with 3,200 euro lower net worth. Comparing columns (3) and (5) most of this effect comes from less assets (minus 5,000 euro), than from less liabilities (minus 1,800 euro). Note that the liabilities observed in the administrative data are mainly mortgages and student loans, but not consumer credit. Controlling for unobserved heterogeneity reduces the size of the coefficients, but all signs on inflation expectations are negative. At the bottom of the table F-tests are reported for the null hypothesis that all household fixed effects are jointly zero, which is rejected in all cases. Also for savings balances signs are negative, but the standard errors are large and the coefficients cannot be distinguished from zero.

In Table 14 we study changes in asset holdings, as a measure of savings behavior. In addition to the same controls as in Table 13, we add net worth, transformed using the inverse hyperbolic

[9] Whenever possible we use the inflation expectation of the household head. In the case of a missing value, we use the inflation expectation of the spouse. The variables “female”, “retired”, “college education”, and “age” all refer to the person providing the inflation expectations. “Children in the house” is a dummy variable.

sine.[10] Looking at the change in net worth in column (1), we find that a one percentage point increase in expected inflation is associated with a decrease in net worth of around 530 euro on average. This is a large effect compared to the unconditional mean of the flow of net worth, which is a decrease of around 510 euro. Almost all of the effect of inflation expectations on the decrease in net worth is due to the decrease in assets, see columns (3)-(4). Though the signs on inflation expectations in the regressions on liabilities are negative, the size is quite small (and only significant when including household fixed effects, see column (6)). Including household fixed effects in the regressions on flow of net worth and flow of assets increases the magnitude of the effect–an even more negative association in columns (2) respectively (4). One potential issue is that the flows of net worth and assets reflect a combination of active and passive saving, that is decisions to save/invest and price changes of assets. We therefore look at a subcategory of assets for which passive savings is relatively small: changes in savings balances. Changes in the sum of checking and savings accounts are most likely active savings. In column (7) a one percentage point increase in inflation expectations is associated with a decrease of 55 euro on average. The unconditional flow of savings balances increased with 570 euro on average, so that the magnitude of the effect is a little less than ten percent. Including household fixed effects in column (8) reduces the coefficient towards zero, but the F-statistic on the joint significance of household fixed effects denotes that the null cannot be rejected at conventional levels of statistical significance (p-value of 0.325). Taken together, we find that households with higher inflation expectations have smaller flows of net worth as well as smaller flows of savings balances. Where the first is a combination of active and passive savings, the latter is predominantly an active choice on behalf of the household.

One potential concern is that inflation expectations are correlated with some general optimism or pessimism. To the extent that optimism is a fixed trait, this would be captured by the household fixed effects. To the extent that this is time-varying, this might be correlated with other household expectations on macroeconomic variables. We exploit the fact that the DNB Household survey has a questionnaire with two macroeconomic expectations, a point forecast on house prices in general and a point forecast on mortgage interest rate expectations. Both questions are asked to both renters and home-owners, and the questionnaire is a different module than inflation expectations (asked a few months apart). A consequence of the questions being in separate modules is that

[10] The inverse hyperbolic sine transformation is similar to the log, but allows negative and zero values.

respondents can miss a survey: the number of observations with expectations on inflation, house prices and mortgage interest rate drops by half, and the number of households by a third. Table 15 shows the results of the same specification as in Tables 13 and 14, but with house price expectations and mortgage interest rate expectations included. Panel A corresponds to Table 13 and shows the levels. Panel B corresponds to Table 14 and shows the flows. Focusing on inflation expectations and net worth, the results remain virtually the same: coefficients are negative and statistically significant, except in column (1) of Panel A where the sign on inflation expectations is still the same as in Table 13 but not statistically significant. Moving from column (1) to column (2) coefficients on inflation expectations actually *increase*, which was not the case in Tables 13 and 14. Comparing columns (3)-(6) to columns (1)-(2) reveals once again that the negative relationship between inflation expectations and net worth seems to come mainly from assets. Turning to the last columns, in Table 13 inflation expectations did not have a statistically significant relation with the level of savings balances, nor do they after controlling for other economic expectations. Overall we find the same negative relationship between inflation expectations and net worth and assets after controlling for other economic expectations in both levels and flows.

To sum up: households with higher inflation expectations have smaller change in and level of net worth and assets.

4 Conclusions

To understand how households form inflation expectations, we study panel data on inflation expectations for the period 1993-2016. The data set allows us to track individual households over several years. We find that a standard model of the dynamics of the *average* inflation expectation also matches fairly well the dynamics of *individual-level* inflation expectations after some small modifications.

Survey data on household inflation expectations is sometimes criticized by arguing that it is probably unrelated to anything that households actually do. This criticism was feasible, because relatively little was known about the empirical relationship between reported inflation expectations and choices of households. To address this criticism, we study the empirical relationship between reported inflation expectations and a range of financial decisions of households. We exploit the fact that one can link the microdata from the DNB Household Survey with administrative data on income and wealth at the household level. Estimating panel data models, where change in net worth or level of net worth is the dependent variable, we obtain a negative relationship between inflation expectations and savings. This finding is consistent with the common idea in academic and policy circles that an increase in inflation expectations stimulates spending.

References

[1] Andrade, Philippe, Gaetano Gaballo, Eric Mengus, and Benoit Mojon (2016). "Forward Guidance and Heterogeneous Beliefs." Discussion Paper, Banque de France and HEC Paris.

[2] Armantier, Olivier, Waendi Bruine de Bruin, Giorgio Topa, Wilbert van der Klaauw, and Basit Zafar (2015). "Inflation Expectations and Behavior: Do Survey Respondents Act on Their Beliefs?" *International Economic Review*, 56(2): 505-536.

[3] Arioli, Rodolfo, Colm Bates, Heinz Dieden, Ioana Duca, Roberta Friz, Christian Gayer, Geoff Kenny, Aidan Meyler, and Iskra Pavlova (2017): "EU consumers' quantitative inflation perceptions and expectations: an evaluation." *European Central Bank Occasional Paper Series*, No 186.

[4] Bachmann, Ruediger, Tim Berg, and Eric Sims (2015). "Inflation Expectations and Readiness to Spend: Cross-Sectional Evidence." *American Economic Journal: Economic Policy*, 7(1): 1-35.

[5] Bernanke, Ben S. (2007). "Inflation Expectations and Inflation Forecasting." Speech at NBER Monetary Economics Workshop, 2007, available at http://www.federalreserve.gov/newsevents/speech/Bernanke20070710a.htm.

[6] Coibion, Olivier and Yuriy Gorodnichenko (2012). "What Can Survey Forecasts Tell Us about Information Rigidities?" *Journal of Political Economy*, 120(1): 116-159.

[7] Coibion, Olivier, and Yuriy Gorodnichenko (2015). "Information Rigidity and the Expectations Formation Process: A Simple Framework and New Facts." *American Economic Review*, 105(8): 2644-2678.

[8] Crump, Richard, Stefano Eusepi, Andrea Tambalotti, and Giorgio Topa (2015). "Subjective Intertemporal Substitution." *Federal Reserve Bank of New York Staff Reports*, No 734.

[9] D'Acunto, Francesco, Daniel Hoang, and Michael Weber (2016). "The Effect of Unconventional Fiscal Policy on Consumption Expenditure." Discussion Paper, University of California at Berkeley, Karlsruhe Institute of Technology, and University of Chicago.

[10] Kaplan, Greg, and Sam Schulhofer-Wohl (2016). "Inflation at the Household Level." Discussion Paper, University of Chicago and Federal Reserve Bank of Chicago.

[11] Maćkowiak, Bartosz, and Mirko Wiederholt (2009). "Optimal Sticky Prices under Rational Inattention." *American Economic Review*, 99(3): 769-803.

[12] Malmendier, Ulrike, and Stefan Nagel (2016). "Learning from Inflation Experiences." *The Quarterly Journal of Economics*, 131(1): 53-87.

[13] Patton, Andrew J., and Allan Timmermann (2010). "Why Do Forecasters Disagree? Lessons from the Term Structure of Cross-sectional Dispersion." *Journal of Monetary Economics*, 57(7): 803-820.

[14] Sims, Christopher A. (2003). "Implications of Rational Inattention." *Journal of Monetary Economics*, 50(3): 665-690.

[15] Wiederholt, Mirko (2015). "Empirical Properties of Inflation Expectations and the Zero Lower Bound." Discussion Paper, Goethe University Frankfurt.

[16] Woodford, Michael (2003). "Imperfect Common Knowledge and the Effects of Monetary Policy." In Knowledge, Information, and Expectations in Modern Macroeconomics: In Honor of Edmund Phelps, edited by Philippe Aghion et al. Princeton, NJ: Princeton University Press.

[17] Yellen, Janet L. (2015). "Inflation Dynamics and Monetary Policy." Speech at the Philip Gamble Memorial Lecture, University of Massachusetts, Amherst, available at http://www.federalreserve.gov/newsevents/speech/yellen20150924a.htm.

Figure 1: Distribution of Point Predictions in 2012

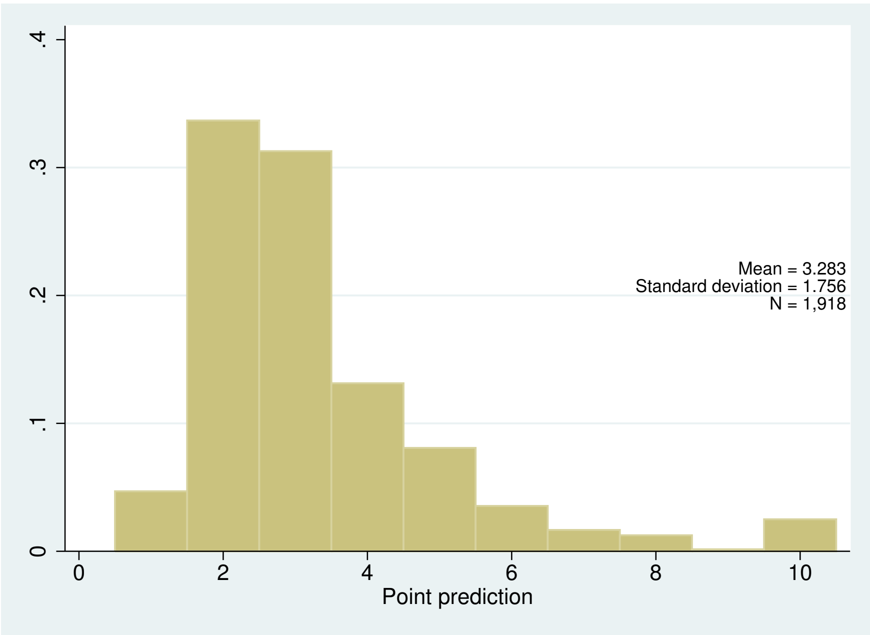

Figure 2: Cross-Sectional Distribution of Inflation Expectations, 1994-2016

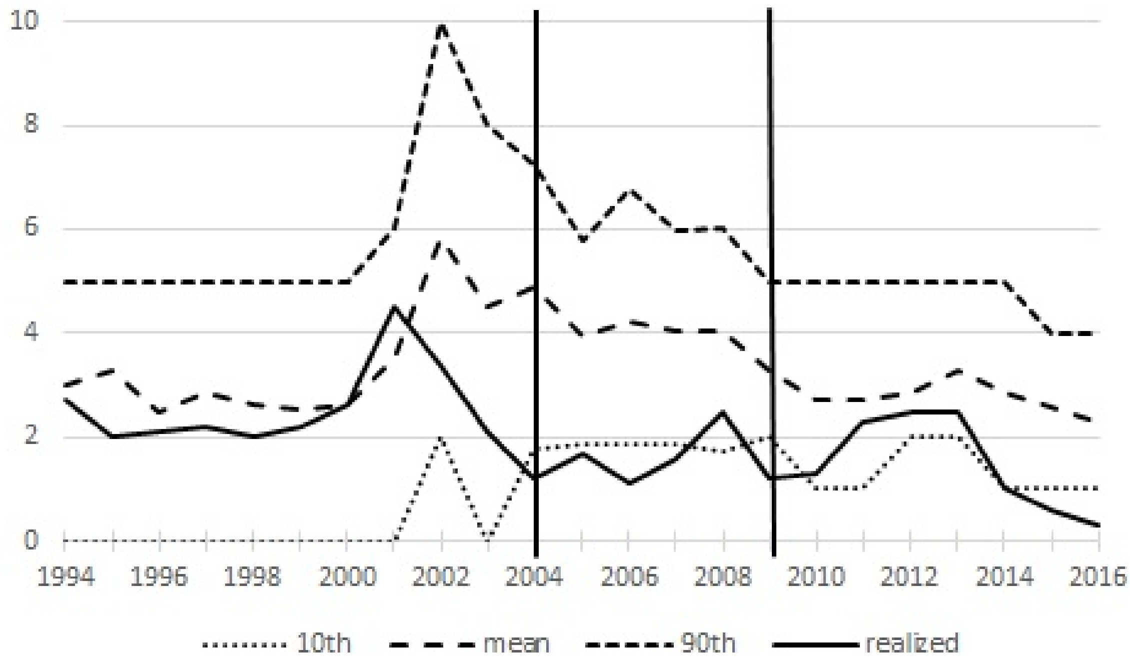

Table 1: Transition matrix, all households with at least 2 adjacent obesrvations

1 to 2	1% or less	2%	3%	4-5%	6% or more
1% or less	46.7	22.2	15.6	11.3	4.2
2%	20.4	42.0	23.7	10.6	3.3
3%	14.8	27.5	33.1	19.9	4.7
4-5%	13.5	16.7	22.8	35.8	11.2
6% or more	13.2	11.0	14.3	31.9	29.7
N = 8,051					

Table 2: Transition matrices, all households with at least 3 adjacent obesrvations

1 to 2	1% or less	2%	3%	4-5%	6% or more
1% or less	44.3	22.8	17.4	11.4	4.1
2%	18.8	40.0	27.7	10.4	3.6
3%	13.5	26.9	34.3	20.4	4.9
4-5%	12.2	17.6	23.4	35.6	11.2
6% or more	12.2	12.2	12.2	31.7	31.7

2 to 3	1% or less	2%	3%	4-5%	6% or more
1% or less	50.9	22.6	10.8	12.3	3.3
2%	24.1	43.3	20.7	9.6	2.3
3%	17.3	31.0	31.9	16.1	3.6
4-5%	13.4	17.4	24.9	34.8	9.5
6% or more	13.0	11.7	16.9	32.5	26.0

1 to 3	1% or less	2%	3%	4-5%	6% or more
1% or less	47.2	22.0	15.1	12.4	3.2
2%	24.1	39.4	22.5	12.0	2.0
3%	17.1	32.7	28.2	18.0	4.1
4-5%	17.1	22.0	22.4	29.3	9.3
6% or more	13.3	14.5	18.1	30.1	24.1
N = 4,793					

Table 3: Transition matrices, all households with at least 4 adjacent obesrvations

1 to 2	1% or less	2%	3%	4-5%	6% or more
1% or less	46.3	22.9	19.2	8.9	2.8
2%	17.4	41.7	29.6	8.1	3.2
3%	13.3	28.5	34.4	19.1	4.7
4-5%	11.6	16.6	25.1	36.2	10.6
6% or more	10.6	11.8	14.1	31.8	31.8

2 to 3	1% or less	2%	3%	4-5%	6% or more
1% or less	49.5	23.6	10.6	13.5	2.9
2%	22.4	41.0	23.5	10.8	2.2
3%	17.8	29.2	33.3	16.7	3.0
4-5%	12.2	19.1	26.6	33.5	8.5
6% or more	9.6	11.0	20.5	31.5	27.4

3 to 4	1% or less	2%	3%	4-5%	6% or more
1% or less	51.3	21.7	15.4	9.6	2.1
2%	21.3	47.2	21.6	8.2	1.8
3%	13.1	30.0	36.3	17.7	3.0
4-5%	14.0	17.2	27.4	32.3	9.1
6% or more	9.1	14.5	18.2	25.5	32.7

1 to 4	1% or less	2%	3%	4-5%	6% or more
1% or less	43.7	25.8	14.6	13.1	2.8
2%	24.4	40.7	22.8	10.6	1.6
3%	17.6	32.4	30.9	14.8	4.3
4-5%	17.6	21.1	29.1	24.6	7.5
6% or more	12.0	19.3	22.9	26.5	19.3
N = 3,084					

Table 4: Estimation of Equation (5), 1994-2016

	Unadjusted	Adjusted
Expected inflation year t	0.609***	0.570***
	(0.165)	(0.160)
Realized inflation year t	0.440*	0.378**
	(0.212)	(0.160)
Constant	0.398	0.588
	(0.586)	(0.481)
$\hat{\rho}$	1.049***	0.948***
	(0.255)	(0.193)
$\hat{\kappa}$	0.419***	0.398***
	(0.140)	(0.136)
$\hat{\mu}$	−1.122*	−1.289**
	(0.570)	(0.539)
Adjusted R^2	0.619	0.698
Mean expected inflation t+1	3.309	3.157
N observations	23	23

Both columns are estimated with OLS (heteroskedasticity robust standard errors reported in parentheses). The first column uses inflation expectations as reported by households, where the survey question is asked in three different ways as reported in the text. The second column adjusts inflation expectations to the same format of the most recent question. The standard errors of the structural parameters are estimated with the Delta method. Average realized inflation in this period is 1.95%.
*/**/*** correspond to 10%/5%/1%.

Table 5: Estimation of an AR(1) process for inflation, 1984-2016

Inflation year t-1	0.592***
	(0.119)
Constant	0.716***
	(0.266)
N observations	32

Coefficients are estimated with OLS (heteroskedasticity robust standard errors reported in parentheses).
*/**/*** correspond to 10%/5%/1%.

Table 6: Transition matrix, model, 1 to 2

	1% or less	2%	3%	4-5%	6% or more
1% or less	50.7	30.1	14.9	4.3	0.0
2%	24.9	33.7	27.8	13.4	0.2
3%	10.0	24.8	34.0	29.8	1.3
4-5%	1.9	9.1	23.5	53.7	11.8
6% or more	0.0	0.2	1.9	23.9	73.9

Table 7: Transition matrix, model, 1 to 3

	1% or less	2%	3%	4-5%	6% or more
1% or less	40.9	27.9	19.9	10.9	0.4
2%	26.0	27.9	25.8	19.1	1.3
3%	15.6	23.5	28.1	29.5	3.3
4-5%	5.9	13.4	23.4	43.7	13.5
6% or more	0.3	1.4	4.8	26.5	67.0

Table 8: Transition matrix, model, 1 to 4

	1% or less	2%	3%	4-5%	6% or more
1% or less	35.2	25.9	21.6	16.1	1.2
2%	25.6	24.8	24.4	22.8	2.3
3%	18.0	21.8	25.3	30.0	4.8
4-5%	8.8	14.5	21.8	39.8	15.1
6% or more	1.0	2.8	6.4	25.6	64.3

Table 9: Transition matrix, model, 1 to 2

	1% or less	2%	3%	4-5%	6% or more
1% or less	47.3	30.2	15.4	4.1	3.0
2%	19.3	44.7	22.7	10.7	2.5
3%	9.5	23.5	33.4	29.6	4.0
4-5%	2.1	9.3	23.8	52.4	12.4
6% or more	12.8	11.3	12.7	30.2	32.9

Table 10: Transition matrix, model, 1 to 3

	1% or less	2%	3%	4-5%	6% or more
1% or less	37.0	27.7	20.6	11.4	3.3
2%	19.9	39.7	20.9	16.1	3.3
3%	14.5	22.0	27.5	29.9	6.0
4-5%	6.0	13.5	23.3	42.9	14.3
6% or more	12.3	12.1	15.5	32.0	28.2

Table 11: Transition matrix, model, 1 to 4

	1% or less	2%	3%	4-5%	6% or more
1% or less	32.0	25.8	22.3	16.1	3.8
2%	19.5	37.8	20.2	18.5	4.1
3%	16.8	21.1	25.3	29.7	7.2
4-5%	9.0	14.9	22.5	38.8	14.9
6% or more	12.1	13.0	17.0	31.8	26.1

Table 12: Summary Statistics

Variable	Mean	St. Dev.
Expected inflation (brackets)	2.689	1.292
Net worth	120.513	164.122
Assets	181.415	176.055
Liabilities	60.902	72.541
Savings balances	28.870	55.609
Disposable household income	23.487	9.650
Number of household members	2.336	1.220
Couple	0.719	0.450
Children in the house	0.306	0.461
Very high urbanization	0.153	0.360
High urbanization	0.254	0.435
Moderate urbanization	0.210	0.408
Low urbanization	0.214	0.410
Very low urbanization	0.169	0.375
Female	0.321	0.467
Retired	0.323	0.467
College degree	0.452	0.498
30 years and younger	0.033	0.178
31-40 years	0.144	0.351
41-50 years	0.170	0.376
51-60 years	0.224	0.417
61 years and older	0.430	0.495
NxT observations	9,605	
N unique households	1,642	

Summary statistics for the regression sample, based on the linked survey-administrative data. All monetary values are deflated euro values (1990=100) divided by 1,000. Variables "Couple"–"61 years and older" are dummy variables.

Table 13: Inflation Expectations and Levels of Net Worth, Assets, Liabilities and Savings Balances

	Net Worth		Assets		Liabilities		Savings Balances	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inflation expectations	−3.219*	−1.540***	−5.026***	−1.576***	−1.796*	−0.872*	−0.149	−0.104
	(1.703)	(0.536)	(1.717)	(0.527)	(0.970)	(0.461)	(0.479)	(0.151)
Regional unemployment	0.451	−2.100**	−2.597	−4.744***	−1.558	−3.079***	−0.948	−0.895***
	(3.226)	(0.956)	(3.304)	(1.014)	(1.350)	(0.723)	(0.636)	(0.302)
Couple	−7.581	−2.798	3.366	5.150	18.071***	11.791*	−4.965*	−2.739
	(12.224)	(7.507)	(12.032)	(6.537)	(5.928)	(6.756)	(2.762)	(2.743)
Number of household members	6.874	1.370	9.891	8.411**	−1.349	6.364**	1.110	2.351**
	(7.544)	(3.667)	(6.600)	(3.343)	(3.484)	(2.989)	(1.550)	(1.129)
Children in the house	−19.973	12.337*	−23.863	12.224*	0.440	4.131	−6.986*	−0.746
	(17.061)	(7.050)	(14.984)	(6.717)	(6.846)	(5.883)	(3.695)	(1.964)
High urbanization	21.378*	−18.568	23.099**	−14.116	−1.176	5.803	−2.714	−5.114*
	(11.036)	(19.370)	(11.279)	(19.965)	(6.573)	(17.051)	(2.702)	(3.026)
Moderate urbanization	33.005***	−8.854	33.714***	18.205	−2.173	38.386*	−0.505	−11.036***
	(10.346)	(25.373)	(10.828)	(27.789)	(6.605)	(19.731)	(3.062)	(4.017)
Low urbanization	55.815***	−3.634	55.003***	27.361	6.286	30.743*	−0.746	−15.425***
	(12.692)	(26.581)	(12.613)	(26.363)	(7.114)	(18.308)	(3.015)	(4.656)
Very low urbanization	40.092***	−12.115	52.508***	0.308	13.413*	14.103	0.039	−15.818**
	(11.186)	(24.834)	(11.485)	(27.966)	(8.025)	(22.090)	(3.352)	(6.596)
Female	−4.199		−3.048		0.712		−2.229	
	(7.688)		(8.383)		(4.224)		(1.735)	
Retired	1.405	−3.710	2.128	−9.112**	−1.024	−6.793*	−3.204	−0.732
	(9.904)	(4.499)	(10.337)	(4.472)	(5.155)	(3.633)	(3.183)	(2.625)
College education	33.718***	−10.749*	49.111***	−2.196	22.501***	9.884*	3.828**	−2.797
	(8.051)	(6.380)	(8.360)	(7.685)	(3.864)	(5.194)	(1.936)	(1.901)
31-40 years	−2.681	24.395***	12.122	27.914***	21.644***	11.715*	0.242	0.163
	(8.511)	(6.717)	(8.935)	(9.304)	(6.172)	(6.110)	(2.049)	(1.542)
41-50 years	48.163***	38.447***	42.788***	40.829***	3.589	10.805	7.117***	2.377
	(10.974)	(7.882)	(11.451)	(10.509)	(7.153)	(7.500)	(2.491)	(2.017)
51-60 years	89.385***	52.000***	57.982***	50.207***	−18.823***	7.544	9.932***	5.397**
	(11.223)	(9.935)	(11.418)	(12.040)	(6.658)	(8.413)	(2.336)	(2.638)
61 years and older	129.048***	59.309***	87.898***	54.687***	−30.576***	1.868	19.544***	5.598*
	(12.540)	(11.053)	(13.001)	(13.107)	(6.978)	(9.476)	(3.419)	(3.388)
ln(household income)	96.839***	28.408***	131.297***	30.701***	44.557***	5.178	26.287***	10.007***
	(13.153)	(4.830)	(15.364)	(5.628)	(5.735)	(3.874)	(2.844)	(2.002)
Household fixed effects	no	yes	no	yes	no	yes	no	yes
F-stat household fixed effects		54.671		48.643		19.436		22.344
p-value household fixed effects		0.000		0.000		0.000		0.000
Adjusted R^2	0.193	0.921	0.231	0.913	0.193	0.801	0.118	0.807
Mean dependent variable	120.513	120.513	178.369	178.369	81.431	81.431	25.947	25.947
Fraction non-zero	0.914	0.914	0.996	0.996	0.880	0.880	0.991	0.991
N households	1,642	1,642	1,585	1,585	1,317	1,317	1,603	1,603
N observations	9,605	9,605	9,611	9,611	7,941	7,941	9,596	9,596

All columns are estimated with OLS, and standard errors are clustered at the level of the household. Regressions in columns (2), (4), (6) and (8) include household fixed effects. All models include a constant and a time trend. Dependent variables are divided by a 1,000. The baseline for urbanization is "Very high urbanization", and "30 and younger" for age.
*/**/*** correspond to 10%/5%/1%.

Table 14: Inflation Expectations and Flows of Net Worth, Assets, Liabilities and Savings Balances

	Flow Net Worth		Flow Assets		Flow Liabilities		Flow Savings Balances	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inflation expectations	−0.531***	−0.602***	−0.430***	−0.583***	−0.010	−0.022*	−0.055*	−0.006
	(0.099)	(0.131)	(0.099)	(0.130)	(0.009)	(0.011)	(0.033)	(0.044)
Regional unemployment	2.866***	4.497***	2.663***	4.285***	−0.065***	−0.073***	0.106**	0.193***
	(0.143)	(0.200)	(0.132)	(0.185)	(0.015)	(0.016)	(0.051)	(0.068)
Couple	−0.796*	−0.863	−1.028***	−1.526	−0.011	−0.257	−0.313**	−0.097
	(0.418)	(1.167)	(0.376)	(1.078)	(0.050)	(0.161)	(0.144)	(0.433)
Number of household members	0.059	0.227	0.061	−0.463	0.041	0.213**	−0.002	0.081
	(0.256)	(0.667)	(0.233)	(0.714)	(0.029)	(0.099)	(0.074)	(0.231)
Children in the house	−1.004*	−0.859	−0.540	0.450	0.036	−0.014	−0.453**	−0.321
	(0.588)	(1.320)	(0.539)	(1.300)	(0.068)	(0.180)	(0.178)	(0.436)
High urbanization	0.164	−1.073	0.018	−4.819**	−0.007	−0.044	−0.002	0.326
	(0.334)	(1.762)	(0.310)	(1.972)	(0.045)	(0.212)	(0.143)	(0.567)
Moderate urbanization	−0.059	−2.141	−0.081	−4.081**	−0.034	−0.268	−0.114	−0.637
	(0.372)	(2.019)	(0.347)	(1.829)	(0.048)	(0.262)	(0.144)	(0.641)
Low urbanization	0.106	1.228	0.026	−2.251	0.010	−0.581**	−0.002	−0.916
	(0.389)	(2.855)	(0.363)	(2.827)	(0.047)	(0.266)	(0.152)	(1.048)
Very low urbanization	−0.582	−5.841*	−0.376	−7.553**	0.012	−0.953***	−0.221	−2.124*
	(0.425)	(3.071)	(0.390)	(2.982)	(0.052)	(0.360)	(0.154)	(1.159)
Female	0.195		0.259		0.042		−0.077	
	(0.261)		(0.242)		(0.030)		(0.094)	
Retired	−0.521	0.942	−0.191	1.221	0.081*	0.054	−0.200	−0.045
	(0.382)	(0.898)	(0.362)	(0.859)	(0.045)	(0.078)	(0.138)	(0.308)
College education	−0.645**	0.453	−0.506**	−0.671	−0.030	0.002	0.015	−0.507
	(0.264)	(1.701)	(0.243)	(1.515)	(0.030)	(0.121)	(0.093)	(0.481)
31-40 years	−1.542**	−1.984	−1.875***	−1.690	0.092	0.041	−0.114	0.501
	(0.637)	(1.516)	(0.599)	(1.580)	(0.094)	(0.151)	(0.203)	(0.350)
41-50 years	−2.080***	−2.129	−2.702***	−2.183	0.119	−0.154	−0.475**	0.138
	(0.643)	(1.792)	(0.605)	(1.816)	(0.094)	(0.190)	(0.213)	(0.482)
51-60 years	−3.076***	−3.218	−3.387***	−3.203	0.147	−0.168	−0.609***	0.109
	(0.629)	(2.024)	(0.587)	(2.026)	(0.093)	(0.215)	(0.213)	(0.581)
61 years and older	−3.781***	−3.212	−3.702***	−3.036	0.166*	−0.265	−0.670***	0.524
	(0.661)	(2.245)	(0.616)	(2.220)	(0.095)	(0.238)	(0.223)	(0.664)
ln(household income)	1.642***	5.699***	1.802***	5.783***	−0.193***	−0.134*	1.017***	1.626***
	(0.352)	(0.974)	(0.322)	(0.927)	(0.041)	(0.078)	(0.141)	(0.293)
ihs(net worth)	0.155***	0.362***	0.094***	0.227***	−0.009***	−0.016***	0.029***	0.020*
	(0.016)	(0.031)	(0.015)	(0.033)	(0.003)	(0.005)	(0.005)	(0.011)
Household fixed effects	no	yes	no	yes	no	yes	no	yes
F-stat household fixed effects		1.230		1.137		1.849		1.015
p-value household fixed effects		0.000		0.001		0.000		0.352
Adjusted R^2	0.074	0.121	0.066	0.095	0.059	0.214	0.022	0.026
Mean dependent variable	−0.514	−0.514	−0.392	−0.392	−0.141	−0.141	0.577	0.577
Fraction non-zero	0.954	0.954	0.953	0.953	0.282	0.282	0.939	0.939
N households	1,663	1,663	1,670	1,670	1,653	1,653	1,677	1,677
N observations	7,124	7,124	7,127	7,127	7,124	7,124	7,125	7,125

All columns are estimated with OLS, and standard errors are clustered at the level of the household. Regressions in columns (2), (4), (6) and (8) include household fixed effects. All models include a constant and a time trend. Dependent variables are divided by a 1,000. The baseline for urbanization is "Very high urbanization", and "30 and younger" for age. Net worth is transformed using the inverse hyperbolic sine. */**/*** correspond to 10%/5%/1%.

Table 15: Inflation Expectations and Other Economic Expectations

A. Levels	Net Worth		Assets		Liabilities		Savings Balances	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inflation expectations	−3.066	−3.144***	−3.378	−3.093***	−0.659	−0.533	0.386	−0.253
	(2.848)	(0.836)	(2.676)	(0.720)	(1.340)	(0.593)	(0.856)	(0.295)
House price expectations	−1.399*	1.263***	−0.095	1.146***	0.927***	−0.384**	−0.721***	0.132
	(0.714)	(0.258)	(0.655)	(0.234)	(0.330)	(0.169)	(0.248)	(0.114)
Mortgage interest rate expectations	0.586	1.601***	−1.228	0.896*	−1.293	−1.173**	−0.064	0.195
	(2.058)	(0.527)	(1.957)	(0.491)	(0.852)	(0.464)	(0.509)	(0.236)
Regional unemployment	−3.916	−3.854***	−9.301**	−4.987***	−2.454	−0.552	−0.830	−0.672
	(5.702)	(1.447)	(4.240)	(1.086)	(1.887)	(0.964)	(1.353)	(0.482)
ln(household income)	92.112***	32.508***	124.097***	28.949***	41.149***	7.187	34.219***	13.028***
	(19.913)	(7.942)	(17.066)	(5.774)	(7.375)	(5.936)	(4.961)	(3.625)
Other control variables	yes	yes	yes	yes	yes	yes	yes	yes
Household fixed effects	no	yes	no	yes	no	yes	no	yes
F-stat household fixed effects		55.241		50.689		17.461		18.110
p-value household fixed effects		0.000		0.000		0.000		0.000
Adjusted R^2	0.197	0.939	0.221	0.934	0.202	0.826	0.115	0.816
Mean dependent variable	160.551	160.551	226.051	226.051	92.389	92.389	31.245	31.245
Fraction non-zero	0.936	0.936	1.000	1.000	0.964	0.964	0.997	0.997
N households	1,029	1,029	995	995	925	925	1,013	1,013
N observations	4,570	4,570	4,574	4,574	4,259	4,259	4,570	4,570

B. Flows	Flow Net Worth		Flow Assets		Flow Liabilities		Flow Savings Balances	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Inflation expectations	−0.895***	−1.391***	−0.712***	−1.088***	0.002	0.027	0.092	0.141
	(0.186)	(0.262)	(0.178)	(0.237)	(0.022)	(0.033)	(0.068)	(0.088)
House price expectations	0.748***	0.860***	0.730***	0.890***	−0.003	−0.001	−0.002	0.005
	(0.063)	(0.081)	(0.060)	(0.074)	(0.007)	(0.009)	(0.023)	(0.027)
Mortgage interest rate expectations	0.303*	0.381**	0.139	0.220	0.023	−0.006	0.025	0.026
	(0.162)	(0.189)	(0.142)	(0.178)	(0.018)	(0.023)	(0.056)	(0.084)
Regional unemployment	2.677***	5.288***	2.374***	4.839***	−0.090*	−0.186***	0.210**	0.299**
	(0.270)	(0.424)	(0.237)	(0.387)	(0.048)	(0.063)	(0.095)	(0.142)
ln(household income)	3.014***	7.946***	2.147***	7.510***	−0.419***	−0.594**	1.376***	2.779***
	(0.738)	(2.132)	(0.689)	(2.090)	(0.108)	(0.261)	(0.265)	(0.686)
ihs(net worth)	0.236***	0.383***	0.139***	0.163**	−0.015***	−0.004	0.030***	0.009
	(0.025)	(0.055)	(0.025)	(0.079)	(0.005)	(0.015)	(0.009)	(0.024)
Other control variables	yes	yes	yes	yes	yes	yes	yes	yes
Household fixed effects	no	yes	no	yes	no	yes	no	yes
F-stat household fixed effects		1.094		1.149		1.305		1.008
p-value household fixed effects		0.044		0.004		0.000		0.436
Adjusted R^2	0.123	0.145	0.096	0.132	0.079	0.151	0.016	0.018
Mean dependent variable	−1.508	−1.508	−1.568	−1.568	−0.281	−0.281	0.587	0.587
Fraction non-zero	0.962	0.962	0.962	0.962	0.372	0.372	0.947	0.947
N households	986	986	979	979	986	986	988	988
N observations	3,538	3,538	3,540	3,540	3,539	3,539	3,539	3,539

All columns are estimated with OLS, and standard errors are clustered at the level of the household. Regressions in columns (2), (4), (6) and (8) include household fixed effects. Dependent variables in Panel A. are in levels, as in Table 13, and flows in Panel B. All models include a constant, a time trend and the same background variables used in Tables 13 and 14. Dependent variables are divided by a 1,000. The baseline for urbanization is "Very high urbanization", and "30 and younger" for age. In Panel B. variable net worth is transformed using the inverse hyperbolic sine.
*/**/*** correspond to 10%/5%/1%.