Gutenberg School of Management and Economics

& Research Unit "Interdisciplinary Public Policy"

Discussion Paper Series

Are Consumers' Spending Decisions in Line With an Euler Equation?

Lena Dräger, Giang Nghiem

January 2018

Discussion paper number 1802

Contact Details:

Lena Dräger
Chair of International Macroeconomics
Johannes Gutenberg University
Jakob-Welder-Weg 4
55128 Mainz
Germany

ldraeger@uni-mainz.de

Giang Nghiem
Goethe-Universität Frankfurt am Main

Are Consumers' Spending Decisions in Line With an Euler Equation?

Lena Dräger[*]
Giang Nghiem[†]

January 30, 2018

Abstract

Evaluating two new survey datasets of German consumers, we test whether individual consumption spending decisions are formed according to an Euler equation derived from consumption life-cycle models. Measured in qualitative individual changes, our results suggest that current and planned spending are positively correlated, thus supporting the hypothesis of consumption smoothing. Also, current spending is positively correlated with inflation expectations, and negatively with nominal interest rate expectations. Interestingly, the effect of perceived real interest rates is only significant for financial market participants, financially unconstrained households and those with high financial literacy, implying that these are important conditions for the ability to smooth consumption over time. Moreover, these households are better positioned in the wealth and income distributions. In that sense, the ability to smooth consumption may be a channel through which distributional effects of policy shocks may occur. Finally, news on inflation and monetary policy observed by the consumer strengthen the effect of their inflation expectations on current spending, suggesting that imperfect information may also influence the Euler equation relationship.

Keywords: Euler equation; consumption plans; macroeconomic expectations; households; survey micro data.

JEL classification: D12; D84; C83; E52.

---

[*]Johannes Gutenberg-University Mainz, Jakob-Welder-Weg 4, 55128 Mainz, Germany. Email: ldraeger@uni-mainz.de. This is a substantially revised version of an earlier paper called *"Are Consumers Planning Consumption According to an Euler Equation?"*, which was previously published as IPP Discussion Paper No. 1621 and CESifo Working Paper No. 6249.

[†]Goethe-University Frankfurt am Main, Email: Giang.Nghiem@hof.uni-frankfurt.de

1   Introduction

In recent years, consumers' macroeconomic expectations have become increasingly important for central banks aiming at guiding and anchoring expectations of the general public. These expectations are usually measured in household survey data. While the literature so far has mainly focused on investigating the expectation formation process of consumers' macroeconomic expectations (e.g. Branch (2004), Coibion and Gorodnichenko (2015a) and Dräger et al. (2016)), an important question remains: Do consumers act on these expectations in their economic decision making? This question is crucial, since central banks implicitly assume that consumers' inflation and interest rate expectations will affect their wage negotiations as well as their consumption and saving decisions and thereby impact on actual inflation.

In light of the recent zero lower bound (ZLB) experience in the US and in European economies, several studies have used micro survey data to test for a link between inflation expectations and consumers' current spending, or their reported likelihood to consume (Bachmann et al., 2015; Burke and Ozdagli, 2013; Ichiue and Nishiguchi, 2015; D'Acunto et al., 2016). The main theoretical hypothesis underlying these studies is that in times of negative shadow interest rates, an increase in expected inflation might help to lower real interest rates, as long as the nominal interest rate stays at zero, and thereby boost consumption and investment.[1]

In this paper, we add to the previous literature by estimating Euler equation models using only household survey micro data, where we evaluate the link between consumers' decisions on individual current consumption spending on their planned spending, inflation expectations and nominal interest rate expectations. Hence, in contrast to the previous approaches, our analysis is more firmly based in terms of the theoretical life-cycle model of consumption resulting in the well-known consumption Euler equation. Thereby, we are able to distinguish between two different channels via which consumers' perception of real interest rates may affect their current spending decision: the nominal interest rate channel and the inflation channel.

Moreover, our data allows us to test for versions of the Euler equation not previously accounted for in the empirical literature using survey data, which yield important insights on the role of specific sub-groups of the population: We test for differences between financially constrained and non-constrained households as well as differences between income and age groups and the effect of financial literacy. We further evaluate how these differences between household groups feed back into households' position in the wealth and income distributions. This is important, because it shows that financial market participation is indeed an important pre-requisite for the ability to account for individual

---

[1]Note that theoretically also a negative link between inflation expectations and consumption might be possible if the adverse income effect from higher expected inflation dominates over the intertemporal substitution effect or if higher expected inflation is seen as a negative economic indicator, resulting in higher precautionary saving (Shiller, 1997; Bachmann et al., 2015).

perceptions of the real interest rate in personal consumption spending decisions and that this ability has distributional implications for households. Our results thus demonstrate a channel via which the distributional effects of monetary policy shocks, reported in Coibion et al. (2017), may be at work.

Finally, we test for interaction effects between monetary news reported by consumers and the impact of their interest rate and inflation expectations on spending decisions. This links the analysis also to models of expectation formation under rational inattention as in Sims (2003) or the epidemiology model of Carroll (2001b).

The analysis is conducted using two cross-sectional waves from a new household survey of the German population conducted by the authors at the University of Hamburg. The survey is tailored to obtain detailed information on consumers' current and planned consumption and saving behavior, as well as a large set of individual macroeconomic expectations and socio-demographic details including consumers' financial risk attitude. In addition, we use the large first two cross-sectional waves from the German Panel on Household Finances (PHF), conducted by the Bundesbank, to corroborate our results in the smaller Hamburg survey and to link the analysis with details on households' financial situation and wealth. Given the cross-sectional nature of our datasets and the qualitative survey questions analyzed, we estimate ordered probit models and evaluate the marginal effects of changes in planned consumption as well as changes in inflation and interest rate expectations on the likelihood of stating an increase in current consumption over the past 12 months, while controlling for a large set of socio-demographic factors.

Our results give evidence in favor of the consumption Euler equation in both German surveys. We find that reported changes in consumption in the previous 12 months are related positively to consumers' reported planned changes in consumption in the next 12 months. Moreover, changes in consumers' current consumption are significantly positively related to changes in expected inflation, in line with the results in Crump et al. (2015) and D'Acunto et al. (2016). Expected changes in nominal interest rates are negatively correlated with current spending, resulting in an overall negative effect of consumers' perceived real interest rate. This result is interesting due to the ZLB environment in Germany at the time of the survey and the previous contrasting evidence in other studies.

Evaluating the heterogeneous responses of consumption to macroeconomic expectations across demographic groups, we find again evidence in line with the theory. The effect of perceived real interest rates on current spending is only significant for financially unconstrained consumers, financial market participants or consumers with high financial literacy, suggesting that consumption smoothing over the life-cycle is indeed only present in specific subgroups of the population. The consumers' heterogeneous responses to changes in inflation and interest rate expectations moreover suggest a potential channel to explain the increasing wealth inequality. In fact, we find that those that are able to smooth consumption are significantly better positioned in the wealth and income distributions of our sample. Finally, we report evidence that consumers are significantly more

likely to report higher consumption spending in response to higher inflation expectations if they additionally report having heard news on inflation and, to a lesser extent, also news on monetary policy in general. This suggests that expectation formation under imperfect information may also influence the Euler equation relationship.

The present study is related to the literature testing for a link between household consumption and consumers' macroeconomic expectations. Most of the earlier literature focuses on the impact of consumers' inflation expectations on their consumption behavior, where, as pointed out by Ichiue and Nishiguchi (2015), the question arises whether the positive link predicted by consumption life-cycle models arises empirically or whether other factors such as wealth effects or precautionary saving motives dominate.

In an early contribution, Juster and Wachtel (1972) test for a link between aggregate data on consumer sentiment and inflation expectations from the University of Michigan Survey of Consumers and aggregate durables and car purchases in the US. The authors report that higher inflation reduces durables expenditures, but leads to an increase in non-durables and services expenditures, with a slightly negative effect on balance. Bachmann et al. (2015) analyze the microdata of the University of Michigan Survey of Consumers and report mostly an insignificant or even negative link between consumers' inflation expectations and their reported "readiness to spend". Nevertheless, they find a positive link for those whose inflation forecasts are relatively accurate. This could suggest that consumers' financial and economic literacy plays a role in this relationship. Similarly, Burke and Ozdagli (2013) evaluate the link of inflation expectations to actual consumer spending on a variety of durable and non-durable goods in a household panel setting covering the ZLB period in the US, and find little robust effects apart from a positive link between short-run inflation expectations and the likelihood of a car purchase. In contrast to the previous US results, Crump et al. (2015) report a positive relation between consumption growth and inflation expectations of US consumers in panel cross-sections from the new Survey of Consumer Expectations (SCE) conducted at the New York Fed. Finally, Ichiue and Nishiguchi (2015) take advantage of a longer ZLB period in Japan and report robust findings that consumers increase actual consumption, and reduce planned consumption, when they report higher inflation expectations.

Evaluating an earlier European survey dataset outside the ZLB, D'Acunto et al. (2016) report a positive relationship between German consumers' "readiness to spend" on durables and their inflation expectations, while a negative relation emerges regarding their likelihood to save. D'Acunto et al. (2016) further evaluate the impact of an unexpected VAT increase in Germany. Comparing the results with matched households in other European countries, the authors attribute a large increase in "readiness to spend" after the shock to increases in the inflation expectations after the VAT shock. Regarding the impact of further economic expectations on household consumption, Hurd and Rohwedder (2013) estimate the effect of the individual assessment of the likelihood of unemployment on household consumption during the recent Great Recession in the US

and report that spending on non-durable goods such as clothing is reduced significantly if households perceive a higher likelihood of unemployment.

Moreover, our analysis relates to the vast literature on consumption life-cycle models and the question whether households smooth their consumption (see Browning and Crossley (2001) for an overview of the empirical literature). In his seminal contribution, the model developed by Friedman (1957) states that rationally forward-looking consumers should consider their "permanent" income over their life-cycle when determining consumption and money demand and choose consumption levels that keep the marginal utility of money constant. While in this paper, we do not focus on households' consumption smoothing *per se*, our analysis relates to empirical studies estimating consumption Euler equations. Previous approaches, such as for instance Carroll (2001a) and Attanasio and Low (2004), discuss issues related to the estimation of the structural parameters in the Euler equation with GMM instruments for expectational terms. More recently, the papers by Smith and Yetman (2013) and Crump et al. (2015) use quantitative survey data for expected consumption growth and expected inflation to estimate an Euler equation relationship. In this paper, due to the qualitative nature of our survey data, we focus on the sign and significance of the correlations in the Euler equation relationship, but cannot estimate any structural parameters. Instead, we test for variants of the Euler equation frequently used in theoretical models, such as the importance of habit formation or the presence of hand-to-mouth consumers.

The rest of the paper is structured as follows. The theoretical framework for the analysis is described in section 2. Section 3 describes the new survey data set and section 4 presents the empirical results. Finally, section 5 summarizes and concludes.

2 Relating Consumers' Consumption Plans to an Euler Equation

Starting with the seminal contribution in Friedman (1957), theoretical life-cycle models of consumption propose that households aim at smoothing consumption with respect to their permanent income over the life-cycle (which may be infinite), thereby choosing consumption so as to keep the marginal utility of money constant over time (Browning and Crossley, 2001). In this model set-up, the Euler equation describes the optimal intertemporal consumption decision of households that aim at maximizing expected utility from consumption and leisure subject to a period budget-constraint. This relation has become an important building block in modern dynamic macro models (Clarida et al., 1999; Galí, 2008). Assuming constant relative risk aversion (CRRA) utility, the problem may be stated as follows:

$$\max E_0 \sum_{t=0}^{T} \beta^t \left[\frac{C_{it}^{1-\sigma}}{1-\sigma} - \frac{N_{it}^{1+\varphi}}{1+\varphi} \right] \tag{1}$$

subject to

$$P_t C_{it} + Q_t B_{it} \leq B_{i,t-1} + W_{it} N_{it} - T_{it}, \forall t \geq 0, \tag{2}$$

where T gives the final period of the consumer i's life-cycle horizon, C_{it} is individual consumption, N_{it} is hours worked, P_t is the price of the consumption good, W_{it} is the nominal wage received by consumer i, B_{it} represents the quantity of one-period, nominal riskless discount bond holdings, purchased in t, paying one unit of money at maturity in $t+1$, Q_t is the bond price, and T_{it} represents lump-sum transfers. Solving the optimization problem and log-linearizing then yields the standard Euler equation in its recursive form:

$$c_{it} = E_t c_{i,t+1} - \sigma^{-1} \left(i_t - E_t \pi_{t+1} - \ln \beta \right), \tag{3}$$

where lower case variables denote deviations from steady-state. Expected inflation is then given by $E_t \pi_{t+1}$ and i_t denotes the nominal bond yield, which in equilibrium equals the negative log of the bond price Q_t. In this framework, the marginal rate of substitution between current and future consumption thus equals the opportunity cost of choosing consumption over saving as measured by the real interest rate, adjusted for the household's time preference rate. From the theoretical Euler equation in (3), we hypothesize that current consumption is positively related to planned consumption and expected inflation, and negatively to (expected) nominal interest rates. Since the available survey data contains mostly qualitative variables, it should be noted that we cannot estimate any structural parameters of the Euler equation and, hence, are not able to test for the consumption smoothing parameter being equal to unity or the size of the intertemporal elasticity of substitution. Instead, we focus on whether the signs of the correlations between the qualitative variables is significant and correct according to the theory, i.e. whether consumers are more likely to increase current consumption if they expect their future consumption to rise or if they expect real interest rates to fall.

To evaluate whether consumers form their qualitative consumption plans in line with the simple Euler equation in (3), we take first differences and estimate the individual likelihood to report a perceived increase in current spending over the past 12 months relative to an average year from ordered probit estimates of the following regression set-up. This is necessary in order to match the theoretical relationship in (3) with the qualitative survey questions which are phrased in terms of perceived and expected changes.

$$\Delta c_{it}^{current} = \beta_0 + \beta_1 \Delta c_{it}^e + \beta_2 \Delta i_{it}^e + \beta_3 \Delta \pi_{it}^e + \mathbf{X}_{it}^{controls'} \mathbf{\Gamma} + u_{it}, \tag{4}$$

where $\Delta c_{it}^{current}$ measures consumers' individual perceived relative change in current consumption, Δc_{it}^e is their reported qualitative planned change in relative expenditures in the next 12 months, Δi_{it}^e and $\Delta \pi_{it}^e$ are individually reported expected changes in the nominal interest rate and in inflation and the vector $\mathbf{X}_{it}^{controls}$ includes individual socio-demographic controls. Since the PHF survey data does not include a question on households' expected change in expenditures, we proxy for Δc_{it}^e by the expected change in savings, Δs_{it}^e. In these specifications, we thus expect a negative correlation between expected savings and current expenditures. The exact wording of the survey questions is given in the appendix. From the theoretical Euler equation in (3), we thus hypothesize that the coefficients β_1 and β_3 are significantly positive, while β_2 is expected to be significantly negative. When estimating (4) with quantitative nominal interest rate and inflation expectations, we calculate the individual change in level expectations between the two survey waves.[2]

Note that three caveats apply: First, both the University of Hamburg survey and the PHF survey measure Δc_{it} and Δc_{it}^e as the changes in consumers' *total expenditure* over the last/next 12 months compared to an average year. Hence, this may include purchases of durable goods and, thus, strictly speaking we estimate a spending, rather than a consumption, Euler equation. Nevertheless, this question wording is frequently used in other consumer surveys to capture households' consumption and we also test for an impact of expected expenditures only on durable consumption goods using the University of Hamburg survey. Second, the questions ask about nominal, rather than real, current and planned spending. This means that the estimated parameters are linear transformations of the underlying structural ones, as discussed in Crump et al. (2015). However, it should not affect their sign or significance, especially since actual inflation was very low at the time of the survey. Third, since the dataset does not include any information about consumers' current interest rate perceptions i_{it}^p or their perception of the current real interest rate, we proxy i_t by their expected interest rate i_{it}^e. We argue that since interest rates are relatively persistent, this is a valid proxy and should not drive our results. Moreover, evaluating the impact of interest rate and inflation expectations separately has the advantage that we can distinguish between two potential channels of real interest rates affecting consumers' consumption. As a robustness check, we also estimate an Euler equation calculating perceived real interest rates as $(i_t - \pi_{it}^e)$, assuming that the current nominal interest rate i_t is common knowledge throughout the cross-section.

In order to test for the robustness of our results, we also estimate versions of an Euler equation where planned consumption is proxied with planned changes in spending on durable goods ($c_{it}^{e,dur}$). While it is generally difficult to disentangle spending and consumption in survey measures, comparing the results of this specification with those

---

[2]In the PHF data, the quantitative inflation expectation question is already phrased in terms of a change in inflation and is only available in the second wave. Quantitative nominal interest rate expectations are also only recorded in the second wave and are in levels, therefore we cannot construct an individual change in interest expectations.

where planned consumption is measured by overall spending gives some hint as to which part of overall expenditure drives the result with c_{it}^e. Finally, in order to account for a potential overestimation bias regarding both perceived and expected inflation rates, we de-trend inflation expectations by including the difference $(\pi_{it}^e - \pi_{it}^p)$ in the Euler equation model estimated with the University of Hamburg survey data.[3]

3 Data

Within the new Consumer Survey on Expectations, Consumption and Saving conducted at the University of Hamburg, telephone interviews with a representative sample of German households were conducted in two waves. The first wave was interviewed from October 20, 2015 to December 23, 2015 and consists of 313 interviews.[4] The second wave consists only of respondents who were already interviewed in the first wave and agreed to a second interview six months later, resulting in a small panel dimension. This wave consists of 183 interviews, which were conducted between May 12, 2016 and June 29, 2016. We use sample weighted observations in order to ensure the representativeness of our results with respect to the overall population.

The survey is especially suited for the analysis of an Euler equation relationship, since unlike other existing surveys it includes information on both households' individual spending patterns and their individual macroeconomic expectations.[5] Specifically, the survey includes information on consumers' expectations regarding a range of macroeconomic variables, of which we mainly use information on expected interest rates and inflation in the present analysis. Moreover, consumers are asked in detail about their current and planned consumption and savings. The specific wording of the survey questions used in the analysis is given in the appendix.[6] These questions were phrased similarly to comparable questions in the Bundesbank PHF, the European Commission Joint Harmonized Survey of Consumers and the University of Michigan Survey of Consumers. Finally, the survey includes information on a large range of socio-demographic characteristics that we employ as control variables.

In addition to consumers' inflation and nominal interest rate expectations, we control for their qualitative expectations regarding the change in the general economic situation $(y_{qual,it}^e)$, the unemployment rate $(u_{qual,it}^e)$, stock prices $(stocks_{qual,it}^e)$ as well as consumers' expectations on changes in their individual income $(income_{qual,it}^e)$.

---

[3]The authors thank Geoff Kenny for proposing this measure. Unfortunately, the PHF data does not include a measure of households' inflation perceptions.

[4]The whole survey sample is obtained from both landline and mobile telephone numbers registered in Germany, using the Häder-Gabler approach (Häder et al., 2009).

[5]Well established surveys on consumers' macroeconomic expectations such as the University of Michigan Survey of Consumers in the US do not include information on their individual spending path, while surveys such as the Bundesbank PHF include very detailed information on households' spending and saving, but only sparsely ask about households' macroeconomic expectations.

[6]The complete survey questionnaire (in German) is available from the authors upon request.

In addition, we compare our findings from the University of Hamburg survey with the results obtained from the larger cross-section of the Bundesbank Panel on Household Finances (PHF) survey. While the PHF misses a number of desirable variables for the estimation of a consumption Euler equation, such as households' expected change in expenditures, expectations on durable consumption, measures of inflation perceptions as well as additional macroeconomic expectations, we can nevertheless use it to estimate a basic qualitative consumption Euler equation. Moreover, the survey has the advantage of including a much larger cross-section and very detailed information on households' financial situation, which we use to identify several sub-groups for an analysis of the heterogeneity in responses across these groups.

The PHF is a representative sample of the German households and an integral part of the Euro Area Household Finances and Consumption Survey (HFCS). The survey is conducted by face-to-face, computer-assisted personal interviews. The first two waves took place during the periods of September 2010 - July 2011 and April-November 2014, respectively.[7] In total, 3,565 (wave 1) and 4,461 (wave 2) household interviews were collected. All households who participated in wave 1 were re-contacted, resulting in a participation rate of about 60% in the second wave. Since the survey question on nominal interest rate expectations, one of our key variables of interest, was only included in the second wave, our analysis mainly uses the second wave of the PHF survey. Moreover, the second wave is closer in timing to the University of Hamburg survey. Note that both the second wave of the PHF survey and the University of Hamburg survey took place with interest rates close to the zero lower bound in Germany, as the ECB moved the main refinancing rate to 0.15% in June 2014, to 0.05% in September 2014, and finally to 0.00% in March 2016.

Socio-demographic control variables include consumers' sex and their age (including a squared term). Additionally, we control for whether their household income falls in the lowest category (inc_l for income $< 1000 €$ per month), the medium low category (inc_ml for $1000 € \leq$ income $< 2000 €$ per month) or the medium high category (inc_mh for $2000 € \leq$ income $< 4000 €$ per month) with household incomes above $4000 €$ per month in the reference category.[8] Note that controlling for household income also partly controls for regional effects since incomes tend to be higher in West vs. East Germany and in metropolitan areas vs. rural areas. The employment status is measured in five employment groups: Those that do not work are taken as reference category and compared to consumers who are retired ($retired$), to those in a medium low category ($employ\_ml$ for those infrequently working or working in so-called mini jobs), a medium high category ($employ\_mh$ for those working part-time) and a high category ($employ\_h$ for those working full time). Finally, in the University of Hamburg survey data, we additionally

---

[7]The third wave of the PHF started in March 2017 and is currently ongoing.

[8]For the PHF data, we have information on every households' income and, hence, construct a continuous measure of household income per household member that we include as control variable.

account for consumers' financial risk attitude ($risk$) with answers to a qualitative question asking whether they take very high/above average/average/no financial risk in order to earn very high/above average/average/no specified returns.

As a unique feature, the University of Hamburg survey also records information on consumers' perception of economic news. After asking whether consumers recall any economic news they recently heard, an open question follows asking them what news they recall.[9] The answers are coded into categories. In the regression analysis, we test for effects of news on monetary policy, including information on interest rates or currency news ($news\_monetary\_policy$), on inflation ($news\_inflation$), and on financial markets, covering news on banks, stock markets and housing markets ($news\_financial\_markets$).

Summary statistics of truncated quantitative inflation and nominal interest rate expectations from the University of Hamburg survey are presented in Table 1, with the corresponding summary statistics for the PHF data in Table 2. We find an upward-bias for both inflation and nominal interest rate expectations in the University of Hamburg survey, which, however, is much more pronounced in the case of expected inflation with mean expected inflation rates of 4.88% and 3% at the median across the two waves.[10] The finding that consumers tend to overestimate inflation in recent years is also frequently found in other surveys (see Dräger and Fritsche (2013) for Germany and Coibion and Gorodnichenko (2015b) for the US). While we cannot directly compare the level of inflation expectations with the PHF data, since it records expected changes in inflation, interest rate expectations are on average lower, but in a similar range in the PHF survey.

More importantly, we find that both the heterogeneity across socio-demographic groups and the cross-sectional variation measured by the standard deviation is similar for both surveys: Expectations are generally found to be lower, i.e. forecast accuracy is found to be better, for men than for women, and rising with income. The pattern for age groups is less clearly defined, but points to somewhat better forecast accuracy of the middle-age groups compared to the young and the old. These patterns regarding households' inflation expectations across socio-demographic groups are very well documented also in other surveys and for different time-spans, see for instance Jonung (1981) for Sweden and Bryan and Venkatu (2001) for the US.

---

[9]A similar question is also included in the University if Michigan Survey of Consumers.

[10]Annual inflation in Germany in December 2015 was very low at 0.3%, with interest rates near the zero lower bound (1.17% Euro area 10-year government benchmark bond yields and 0.64% on bank deposits redeemable within 3 months in the Euro area).

Table 1: Summary Statistics of Quantitative Inflation and Interest Rate Expectations

| Variable	Mean	Median	SD	Min	Max	N
Inflation Exp. π_{it}^e	4.88	3.00	4.71	0.10	22.50	388
Male	4.84	3.00	4.69	0.20	20.00	164
Female	5.53	4.00	5.03	0.50	22.50	152
-25	5.49	5.00	4.79	1.00	20.00	34
26-45	4.81	3.00	4.54	0.50	20.00	97
46-65	5.50	3.00	5.45	0.20	22.50	125
66+	4.95	3.25	4.17	0.30	20.00	58
0-25% HH Income	4.85	3.50	4.37	0.10	22.50	55
25-50% HH Income	4.99	3.25	5.06	0.50	20.00	32
50-75% HH Income	4.21	2.50	4.63	0.20	20.00	43
75-100% HH Income	3.35	2.50	3.03	0.20	15.00	45
Interest Rate Exp. i_{it}^e	1.28	1.00	1.31	0.00	8.00	214
Male	1.18	0.80	1.26	0.00	7.50	79
Female	1.32	1.00	1.44	0.01	8.00	78
-25	1.52	1.30	1.15	0.50	4.00	13
26-45	1.23	0.60	1.17	0.10	4.00	50
46-65	1.19	1.00	1.47	0.00	8.00	58
66+	1.28	1.00	1.49	0.01	7.50	35
0-25% HH Income	1.41	1.00	1.35	0.10	5.00	31
25-50% HH Income	1.32	1.00	1.94	0.00	7.50	16
50-75% HH Income	1.06	1.00	0.80	0.10	3.00	31
75-100% HH Income	1.12	0.75	1.14	0.05	4.00	26

Note: University of Hamburg data, first and second wave. Quantitative expectations are truncated to exclude the lower and upper 2.5% of the distribution.

Table 2: Summary Statistics of Quantitative Inflation and Interest Rate Expectations, PHF Wave 2

Variable	Mean	Median	SD	Min	Max	N
Change in Inflation Exp. $\Delta\pi^e_{it}$	2.79	2.00	2.88	0.00	15.00	4,068
Male	2.53	2.00	2.63	0.00	15.00	2,418
Female	3.12	2.00	3.13	0.00	15.00	1,650
-25	3.75	3.00	3.95	0.00	15.00	137
26-45	2.81	2.00	3.04	0.00	15.00	931
46-65	2.73	2.00	2.67	0.00	15.00	1,731
66+	2.65	2.00	2.64	0.00	15.00	1,269
0-25% HH Income	2.91	2.00	3.06	0.00	15.00	963
25-50% HH Income	3.08	2.00	3.11	0.00	15.00	1,020
50-75% HH Income	2.55	2.00	2.56	0.00	15.00	1,021
75-100% HH Income	2.16	2.00	1.91	0.00	15.00	1,063
Interest Rate Exp. i^e_{it}	0.78	0.50	0.62	0.00	3.00	3,851
Male	0.80	0.60	0.64	0.00	3.00	2,307
Female	0.75	0.50	0.61	0.00	3.00	1,544
-25	0.90	0.75	0.74	0.00	3.00	123
26-45	0.81	0.50	0.65	0.00	3.00	843
46-65	0.74	0.50	0.59	0.00	3.00	1,650
66+	0.78	0.50	0.62	0.00	3.00	1,235
0-25% HH Income	0.85	0.70	0.66	0.00	3.00	859
25-50% HH Income	0.80	0.50	0.65	0.00	3.00	956
50-75% HH Income	0.70	0.50	0.55	0.00	3.00	985
75-100% HH Income	0.70	0.50	0.55	0.00	3.00	1,051

Note: PHF data, second wave. Summary statistics are reported from weighted estimations. Quantitative expectations are truncated to exclude the lower and upper 2.5% of the distribution.
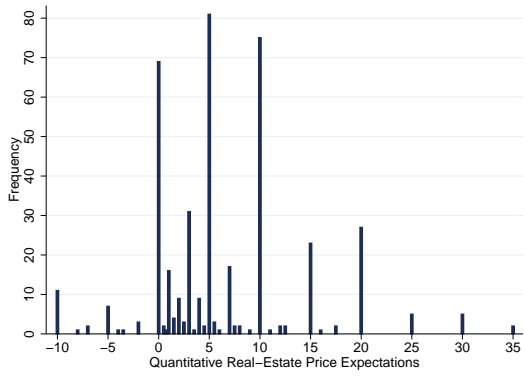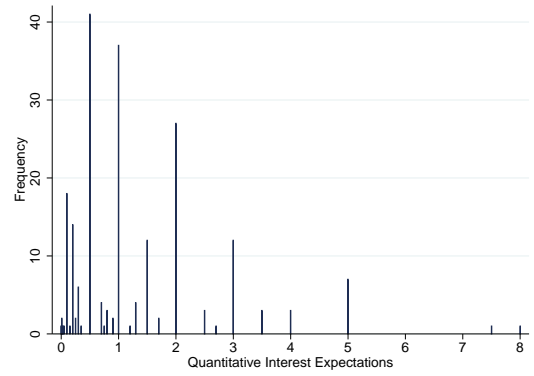
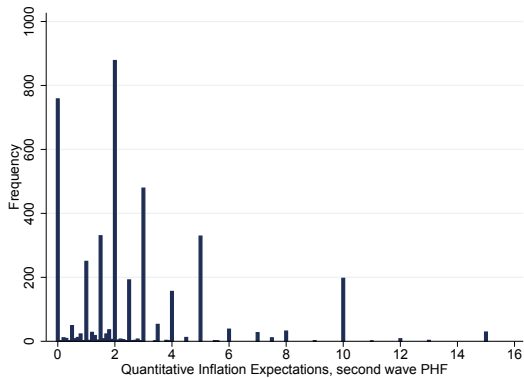Figure 1: Quantitative Expectations
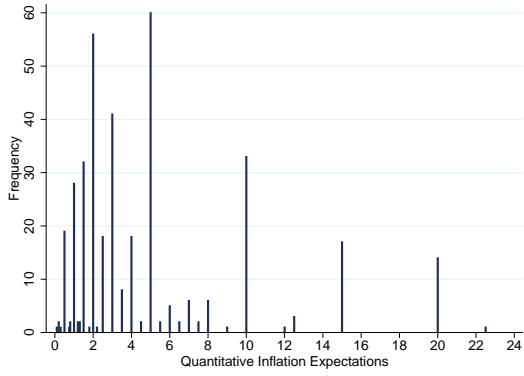
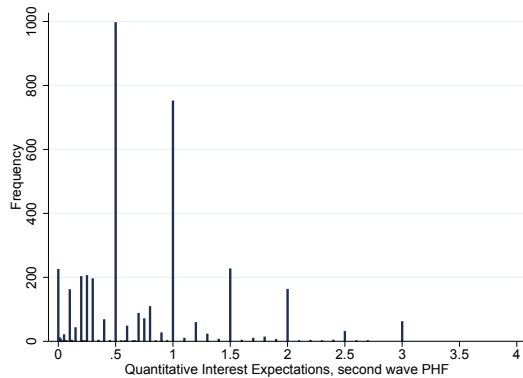(a) Inflation 1 year ahead
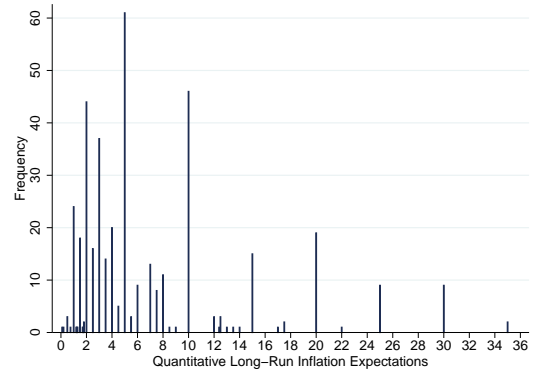
(b) Inflation 5 years ahead

(c) House price inflation

(d) Short-term interest rates

(e) Change in Inflation 1 year ahead, PHF

(f) Short-term interest rates, PHF

Figure 1 further presents histograms of consumers' truncated quantitative inflation and interest rate expectations collected from both surveys. Quantitative expectations in both surveys show a right-skewed distribution with a surprisingly large range considering the low-inflation and low-interest-rate environment in Germany at the time. While the majority of respondents expects price increases between 0-5% and interest rates at 0-2%, there is a large degree of heterogeneity in expectations particularly visible in higher numbers of answers at so-called "focal points" such as multiples of 5. This is the case for both inflation and interest rate expectations, and prevails across both the University of Hamburg and the PHF survey. Note that consumers in the University of Hamburg survey tend to have higher long-term inflation expectations, which is consistent with expectations of the expansive monetary policy stance and the booming economy pushing up prices in the future.[11]

4 Results

4.1 Estimation of a Consumption Euler Equation

In this section, we test whether changes in consumers' consumption level are affected by changes in expected spending and by changes in nominal interest rate as well as inflation expectations in line with a consumption Euler equation as in (3). Under this hypothesis, we expect a positive relationship between current and expected future spending, a negative relation with expected nominal interest rates and a positive link to expected inflation. We compare results from the University of Hamburg survey, which includes questions specifically suited to estimate a consumption Euler equation, to results from the Bundesbank PHF survey, which includes a much larger sample. All models account for a range of demographic control variables and report marginal effects from ordered probit models for the likelihood of consumers answering "total expenditures in the past 12 months were considerably higher than in an average year". In order to obtain comparable effects for different models within each survey, we evaluate all marginal effects at a hypothetical representative consumer. For the analysis of household subgroups, we leave out the relevant categories such as income or age.[12]

Table 3 presents the results for the baseline Euler equation specification using the University of Hamburg data. We test a number of variants of the consumption Euler equation, where we proxy expected changes in consumption with consumers' reported planned change in total expenditures and with the planned change in the spending on durable goods. Additionally, we estimate a set of models with qualitative expected changes in the

---

[11]Unfortunately, long-term inflation expectations are not measured in the PHF data.

[12]We define the representative consumer to be male, aged 49 (PHF 52), with monthly net household income between 1.000-2.000 € (PHF monthly log income of 9.7716), working full time and not willing to take on risk in financial investments.

nominal interest rate and inflation, as well as models with quantitative expectations.[13] Note that individual changes in quantitative level expectations are calculated between the two waves, which considerably reduces the sample size.[14] We include quantitative inflation expectations both in levels and de-trended with consumers' reported perception of current inflation π_t^p. Finally, we estimate an Euler equation with perceived real interest rates assumed to be $(i_t - \pi_{it}^e)$, where current nominal interest rates i_t are assumed to be common knowledge.

Overall, the results support the hypothesis that consumers' expenditure patterns may indeed be related to life-cycle models of consumption captured in the Euler equation: We find that consumers are more likely to report above-average spending in the past 12 months, if they expect to increase their consumption also in the coming 12 months, thus supporting the hypothesis of consumption smoothing. By contrast, the effect of planned consumption of durables is not significant in any model specification. This result gives some tentative indication that households' current spending is more affected by their future consumption expenditures, rather than the durable part of overall spending.

Moreover, changes in the perceived real interest rate also play a role for current spending patterns: Changes in qualitative nominal interest rate expectations are estimated to have a negative impact on the likelihood of reporting above-average consumption. In addition, we find highly significant positive effects of changes in qualitative inflation expectations in line with the theoretical model. In the models with quantitative expectations, however, the sample size drops considerably as we consider individual changes in expectations between the interviews. The results reveal a marginally significant negative effect of nominal interest rate expectations, but the effect of inflation expectations is not significant. The positive marginal effect of quantitative expectations de-trended by inflation perceptions becomes significant with non-clustered standard errors. Overall, the results are thus mostly in line with the Euler equation model.[15]

Next, we check the robustness of the results to the inclusion of further (macro)economic expectations, shown in Table 4. In addition to the variables in the Euler equation model, we include consumers' qualitative expectations on changes in the general economic situation, the unemployment rate and stock prices as well as expected changes in consumers' individual income.[16] All our results from the initial models with qualitative expectations in Table 3 remain robust to the inclusion of these additional controls.

---

[13]Further estimations with qualitative changes in expectations of inflation five years ahead and in expectations of house price inflation are given in the appendix in Table A3.

[14]In addition, only few consumers answered the question on quantitative nominal interest rate expectations.

[15]Marginal effects evaluated at the representative consumer for each answer category in the qualitative questions on changes in planned consumption Δc_{it}^e, interest rate expectations $\Delta i_{qual,it}^e$ and inflation expectations $\Delta \pi_{qual,it}^{e,1yr}$ are shown in Figures A1-A3 in the appendix. The results are generally in line with the average effects shown in Table 3 and 4.

[16]Note that the question on expected changes in individual income was only included in the second wave of the survey, therefore the sample size drops considerably once it is included in the regression.

Table 5 shows that the predictions of the Euler consumption equation are also supported in the much larger German sample from the PHF survey data.[17] Evidence of consumption smoothing behavior is suggested by the significantly negative link between saving expectations and current consumption in the models with qualitative inflation expectations pooled across both waves, and in the models with quantitative expectations in wave 2. In all other models, the marginal effects of saving expectations are still negative, though not statistically significant. Moreover, we also find a significantly positive relationship between households' inflation expectations and their current consumption in the PHF data across both waves. This positive relationship is robust to either using qualitative or quantitative inflation expectations. In addition, those who expect an increase in nominal interest rates are less likely to report that they have increased their consumption, again in line with the consumption Euler equation. Note that when further economic expectations (such as expectations of real income, tax, real estate price, and stock price) are accounted for, the estimates of these effects become less precise but remain statistically significant, except in the case of saving expectation in the pooled waves data (Column 2). This is due to the fact that further economic expectations and the independent variables of interest (saving, inflation, interest rate expectations) are highly correlated, so multicollinearity reduces the precision of the regressions. Overall, the results from the PHF are strongly consistent with those from the University of Hamburg survey. Taken together, our results are more in line with those in Ichiue and Nishiguchi (2015), Crump et al. (2015) and D'Acunto et al. (2016), but stand in contrast to the findings by (Burke and Ozdagli, 2013) and Bachmann et al. (2015).

---

[17]Since the survey questions on interest rate expectations were only included in the second wave of the PHF survey, we test the effects of saving and inflation expectations on current consumption for the pooled waves 1 & 2, and test the full Euler consumption equation for the second wave only.

Table 3: Consumption Euler Equation

	Qualitative Expectations		Quantitative Expectations			
	(1)	(2)	(3)	(4)	(5)	(6)
Δc_{it}^e	0.1360***		0.2393*		0.1951	0.2374*
	(0.0495)		(0.1384)		(0.1254)	(0.1377)
$\Delta c_{it}^{e,dur}$		0.0297		0.0124		
		(0.0212)		(0.0677)		
$\Delta i_{qual,it}^e$	-0.0495*	-0.0473**				
	(0.0267)	(0.0224)				
$\Delta \pi_{qual,it}^{e,1yr}$	0.0675***	0.0634***				
	(0.0232)	(0.0192)				
$\Delta i_{quant,it}^e$			-0.0070	-0.0067	-0.0596*	
			(0.0358)	(0.0310)	(0.0361)	
$\Delta \pi_{quant,it}^{e,1yr}$			-0.0042	-0.0005		
			(0.0092)	(0.0063)		
$\Delta(\pi_{quant,it}^e - \pi_{quant,it}^p)$					0.0098	
					(0.0128)	
$\Delta(i_t^{deposits} - \pi_{quant,it}^e)$						0.0047
						(0.0089)
N	298	297	83	83	82	83
Pseudo R^2	0.161	0.135	0.348	0.291	0.327	0.347
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes

Note: University of Hamburg survey. Marginal effects for the probability of answering in the highest category are reported from weighted estimations and evaluated at a hypothetical representative consumer. Models with quantitative expectations are truncated to exclude the lower and upper 2.5% of the distribution. Standard errors in parentheses are clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1

Table 4: Consumption Euler Equation Controlling for Further Economic Expectations

	Qualitative Expectations			Quantitative Expectations			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
$\Delta y^e_{qual,it}$	0.0118	-0.0034	0.0131	-0.0232	-0.0663	-0.0559	-0.0183
	(0.0258)	(0.0249)	(0.0273)	(0.0544)	(0.0510)	(0.0547)	(0.0551)
$\Delta u^e_{qual,it}$	0.0156	0.0163	0.0538*	0.0706	0.0687	0.0574	0.0439
	(0.0214)	(0.0215)	(0.0275)	(0.0484)	(0.0423)	(0.0435)	(0.0401)
$\Delta stocks^e_{qual,it}$	0.0145	0.0222	0.0057	0.0419	0.0641	0.0148	-0.0174
	(0.0225)	(0.0215)	(0.0323)	(0.0704)	(0.0649)	(0.0707)	(0.0623)
$\Delta income^e_{qual,it}$			0.0483			0.1833**	0.1074
			(0.0431)			(0.0879)	(0.0794)
Δc^e_{it}	0.1287***		0.1014*	0.2028		0.2027	0.1806
	(0.0497)		(0.0614)	(0.1259)		(0.1278)	(0.1242)
$\Delta c^{e,dur}_{it}$		0.0163			0.0957		
		(0.0225)			(0.0777)		
$\Delta i^e_{qual,it}$	-0.0598**	-0.0564**	-0.0982***				
	(0.0300)	(0.0274)	(0.0378)				
$\Delta \pi^{e,1yr}_{qual,it}$	0.0791***	0.0761***	0.0929**				
	(0.0260)	(0.0234)	(0.0435)				
$\Delta i^e_{quant,it}$				-0.0149	-0.0119	-0.0279	-0.0620*
				(0.0324)	(0.0278)	(0.0287)	(0.0359)
$\Delta \pi^{e,1yr}_{quant,it}$				-0.0008	0.0041	-0.0014	
				(0.0089)	(0.0063)	(0.0086)	
$\Delta(\pi^e_{quant,it} - \pi^p_{quant,it})$							0.0104
							(0.0115)
N	262	262	87	79	79	79	78
Pseudo R^2	0.185	0.158	0.471	0.383	0.360	0.425	0.373
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: University of Hamburg survey. Marginal effects for the probability of answering in the highest category are reported from weighted estimations and evaluated at a hypothetical representative consumer. Models with quantitative expectations are truncated to exclude the lower and upper 2.5% of the distribution. Standard errors in parentheses are clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Consumption Euler Equation, PHF data

	Pooled Waves 1 & 2		Wave 2					
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$\Delta real\_income^e_{qual,it}$		-0.0143		-0.0012	-0.0145		0.0060	-0.0037
		(0.0105)		(0.0141)	(0.0159)		(0.0144)	(0.0158)
$\Delta tax^e_{qual,it}$		0.0045		0.0056	-0.0014		-0.0019	-0.0089
		(0.0092)		(0.0121)	(0.0132)		(0.0125)	(0.0137)
$\Delta real\_estate\_price^e_{qual,it}$				0.0023	0.0037		0.0004	-0.0005
				(0.0102)	(0.0104)		(0.0109)	(0.0107)
$\Delta stock\_price^e_{qual,it}$					-0.0232**			-0.0260**
					(0.0113)			(0.0114)
$\Delta saving^e_{qual,it}$	-0.0233**	-0.0190	-0.0239	-0.0283	-0.0291	-0.0346**	-0.0393**	-0.0412*
	(0.0116)	(0.0121)	(0.0161)	(0.0177)	(0.0215)	(0.0176)	(0.0188)	(0.0217)
$\Delta i^e_{qual,it}$			-0.0297**	-0.0312**	-0.0278*	-0.0268**	-0.0274**	-0.0271*
			(0.0125)	(0.0131)	(0.0146)	(0.0134)	(0.0138)	(0.0146)
$\Delta \pi^{e,1yr}_{qual,it}$	0.0216**	0.0192**	0.0223*	0.0273*	0.0329**			
	(0.0090)	(0.0098)	(0.0132)	(0.0143)	(0.0164)			
$\Delta \pi^{e,1yr}_{quant,it}$						0.0060*	0.0080**	0.0083*
						(0.0033)	(0.0037)	(0.0042)
N	7,688	7,528	4,104	3,867	3,003	3,794	3,613	2,852
Pseudo R^2	0.008	0.008	0.014	0.019	0.026	0.015	0.021	0.028
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Note: PHF data. Marginal effects for the probability of answering in the highest category are reported from weighted estimations and evaluated at a hypothetical representative consumer. Quantitative inflation expectations are truncated to exclude the lower and upper 2.5% of the distribution. Standard errors in parentheses are clustered at the household level for the pooled waves 1 & 2, and at the municipal level for the second wave. *** p<0.01, ** p<0.05, * p<0.1

18

Table 6: Testing for Habit Formation

| | The University of Hamburg Survey | | The PHF Survey | | |
	(1)	(2)	(3)	(4) Participation Fin. Markets	(5) Non-Particip. Fin. Markets
$\Delta c_{it-1}^{current}$	0.0798*	0.0539	0.0842***	0.1241***	-0.0226
	(0.0426)	(0.0402)	(0.0298)	(0.0389)	(0.0398)
Δc_{it}^{e}	0.1129*				
	(0.0680)				
$\Delta c_{it}^{e,dur}$		0.0041			
		(0.0309)			
$\Delta saving_{qual,it}^{e}$			-0.0676***	-0.0626**	-0.0867*
			(0.0254)	(0.0292)	(0.0514)
$\Delta i_{qual,it}^{e}$	-0.0460	-0.0411	-0.0216	-0.0399*	0.0131
	(0.0307)	(0.0268)	(0.0189)	(0.0238)	(0.0245)
$\Delta \pi_{qual,it}^{e,1yr}$	0.0723**	0.0640**	-0.0087	-0.0099	-0.0062
	(0.0366)	(0.0275)	(0.0196)	(0.0253)	(0.0285)
Demographic Controls	Yes	Yes	Yes	Yes	Yes
N	93	93	1,960	1,320	638
Pseudo R²	0.417	0.357	0.030	0.044	0.044

Note: Marginal effects for the probability of answering in the highest category are reported from weighted estimations and evaluated at a hypothetical representative consumer. Column 4 and 5 use the sub-samples of those participating and not participating in financial markets, according to the definitions specified in section 4.2. Standard errors in parentheses are clustered at the household level. *** p<0.01, ** p<0.05, * p<0.1

The set-up of the University of Hamburg survey and the PHF survey also allows to test for habit formation, another feature of households' consumption preferences often included in the theoretical literature. If households form habits on consumption levels, we would expect additional persistence in their consumption path, with current consumption related to consumption levels of the previous period. We test for this hypothesis by using only the data from the second wave for those participating in both waves, and by incorporating the qualitative answers about current spending changes from the first wave as an additional regressor. The results are shown in Table 6. We find significant evidence for habit formation in both surveys, as both lagged and expected values of individual consumption or saving are significant and correctly signed.[18] Since the sample size drops considerably when only households participating in both waves are used for the estimation, the significance level of the marginal effects from both interest rate and inflation expectations is reduced. However, we still find a significant impact of inflation expectation in the Hamburg survey. In addition, the effect of interest rate expectations in the PHF survey remains significant once we condition on the subsample of households that are participating in financial markets by saving or paying off debt. In the next section, we will analyze different subgroups to elaborate on the importance of financial market participation to identify the Euler equation relationship.

4.2 Testing for the Effects of Hand-to-Mouth Consumption, Income, Financial Constraints, and Age

In this section, we investigate the heterogeneous responses of consumption to macroeconomic expectations across demographic groups, including financially unconstrained versus constrained consumers, income groups, levels of financial market participation, financial literacy, and age groups. According to the life-cycle models of consumption, agents will smooth consumption over their life-cycle by saving and dis-saving in financial markets, which results in the effects of the real interest rate on current consumption in the Euler equation. Therefore, we expect that consumers who do not save or who are financially constrained are more likely not to react to their perception of the real interest rate in their current consumption decision. Instead, they currently consume only out of current income or previous savings and wealth and are more likely to be hand-to-mouth or rule-of-thumb consumers in the terminology of New Keynesian models. By contrast, those participating in financial markets face the trade-off between current and future consumption, and are hence in theory more likely to react to their perception of the real interest rate. Age may also influence the Euler equation's predictions, as consumption and asset holdings vary over the life-cycle (Fernandez-Villaverde and Krueger, 2011). Here, we would expect that

---

[18]Note that the PHF survey includes information on current spending, but only on expected saving changes. Therefore, we can include $\Delta c_{it-1}^{current}$ from the first interview.

the young react more strongly to their nominal interest rate and inflation expectations, as they save for old age, while the old are more likely to dis-save.

Table 7 shows that there are differences between unconstrained versus hand-to-mouth consumers. The first, unconstrained, group is defined as those who stated that: (i) their household expenditures over the last twelve months were lower than their household income (*Income > Expenditure*); (ii) they save a certain amount regularly or a little each month (*Able to save*). On the other hand, the second group consists of those who answered that (i) their household expenditures over the last twelve months were higher than their household income (*Income < Expenditure*); (ii) they do not save because there is no financial room to maneuver. (*Unable to save*). While we find no significant effect of inflation expectations on changes in current consumption with hand-to-mouth household, the effect is significant and has the correct sign for the group of unconstrained consumers. On the other hand, there is a significantly negative link between saving expectation and current consumption for hand-to-mouth households, which could be due to habit formation and the "keeping up with the Joneses" effect, meaning that the poor have an incentive to increase their consumption in order to catch up with consumption levels in their peer group (Christen and Morgan, 2005; Bagwell and Bernheim, 1996). In fact, the poorer households in the PHF survey are more likely to state that they have increased their consumption and that they will save a smaller percentage of their total disposable income. The last two columns of Table 7 also reveal the significantly negative effect of saving expectation on current consumption for the lower income group (income in the bottom fifty percent). Moreover, we only find significant effects of interest rate and inflation expectations with correct signs for the higher income group (income in the top fifty percent), thus reinforcing the results of unconstrained vs. hand-to-mouth consumers.

Table 8 reports the effects of financial market participation. Again, we hypothesize that financial market participation is a pre-requisite for the ability to save and dis-save over the life cycle and, hence, an effect of nominal interest rate and inflation expectations on current consumption is more likely for households that are active on financial markets. We define active participants in the financial market as those who invest in financial instruments (such as stock, bond, or mutual funds) or own a debt (either a mortgage or consumer credit). By contrast, the non-active households are those who do not own any debt or any financial investment. As expected, current consumption of the latter group does not respond to changes in either nominal interest rate or inflation expectations. By contrast, the former group does react significantly to changes in their nominal interest rate and inflation expectations with the expected signs. We find a significant and positive effect of inflation expectations on current consumption for financial investors. Interestingly, our results highlight two different channels via which the perception of the real interest rate (nominal interest rate and inflation expectation) affects current consumption when we distinguish between two types of debtors: mortgage and consumer credit owners. While inflation expectation significantly affect current consumption for mortgage owners, interest

rate expectations do so for consumer credit holders. This finding is plausible since the interest rates of mortgages are often lower and fixed over long periods, while consumer credit holders have to pay significantly higher and more adjustable interest rates.

Table 9 tests whether financial literacy plays a significant role in the formation of households' consumption plans. Here, consumers with high financial literacy are defined as those who answered correctly to two questions about real inflation and compound interest effect defined as in Lusardi and Mitchell (2011, 2014).[19] In fact, we find that only those with high financial knowledge significantly react to changes in their inflation and interest rate expectations with the correct signs. These results are in line with Bachmann et al. (2015) who report a positive link between inflation expectations and spending attitudes only for those with a low inflation forecast error, i.e. those knowledgeable about macroeconomic issues.

Finally, Table 10 shows the results of Euler consumption equation estimations across different age groups. We find a significant effect of nominal interest rate expectations only for the young (age under 45), while that of inflation expectation is only revealed for the middle age, working group (age between 46 and 65). In addition, only the old group (age from 66 and older) shows the significantly negative effect of saving expectations on current consumption [20]. These results can be partly explained by the financial market participation of households over their life cycle (Fernandez-Villaverde and Krueger, 2011). In fact, the young are more likely to hold consumer credit and less likely to invest in financial instruments or take on a mortgage. By contrast, the middle age group is more likely to take on mortgages and accumulate financial assets, whereas the old try to withdraw from the debt market and reduce their financial assets.

Overall, our results are in line with consumption theory, both regarding changes in consumption paths over the life cycle and over financial positions as well as regarding the effect of frictions such as households with financial constraints and hand-to-mouth households. Moreover, the results suggest that these differences between population subgroups may have distributional consequences: If mainly upper-income groups are able to participate in financial markets and to use this instrument to optimally smooth consumption over time, then poorer households suffer from welfare losses as they miss the opportunity to choose an optimal consumption path over their life span. While some of these choices may be due to optimal life-cycle decisions, the financial frictions discussed above also seem to play an important role. We evaluate the impact of these frictions on the wealth distribution in the next section.

---

[19]The exact wording of the two financial literacy questions is given in the appendix.

[20]The PHF survey shows that the old are more likely to keep their consumption unchanged, while less likely to increase their saving, resulting the negative relationship between consumption and saving decisions for the old.

Table 7: Unconstrained vs. Hand-to-mouth Consumers

	Income > Expenditure (1)	Income < Expenditure (2)	Able to save (3)	Unable to save (4)	Income > Median (5)	Income < Median (6)
$\Delta saving^e_{qual,it}$	-0.0088	-0.0963*	-0.0081	-0.1029***	0.0037	-0.0533**
	(0.0202)	(0.0535)	(0.0204)	(0.0385)	(0.0275)	(0.0215)
$\Delta i^e_{qual,it}$	-0.0139	-0.0277	-0.0175	-0.0409	-0.0535***	-0.0144
	(0.0145)	(0.0476)	(0.0153)	(0.0253)	(0.0205)	(0.0155)
$\Delta \pi^{e,1yr}_{qual,it}$	0.0300*	0.0388	0.0508***	0.0256	0.0445*	0.0164
	(0.0174)	(0.0440)	(0.0175)	(0.0291)	(0.0237)	(0.0177)
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes
Further econ. expect.	Yes	Yes	Yes	Yes	Yes	Yes
N	2,141	423	2,638	493	2,018	1,849
Pseudo R^2	0.026	0.068	0.033	0.068	0.033	0.021

Note: PHF data, second wave. Average marginal effects for the probability of answering in the highest category are reported from weighted estimations. Standard errors in parentheses are clustered at the municipal level. *** p<0.01, ** p<0.05, * p<0.1

Table 8: Financial participation

	Financial Investors (1)	Mortgage Owners (2)	Consumer Credit Holders (3)	Non-Participating Financial Markets (4)
$\Delta saving^e_{qual,it}$	-0.0967***	-0.0127	-0.0045	-0.0271
	(0.0331)	(0.0335)	(0.0262)	(0.0268)
$\Delta i^e_{qual,it}$	-0.0330	0.0165	-0.0685***	-0.0080
	(0.0225)	(0.0272)	(0.0210)	(0.0168)
$\Delta \pi^{e,1yr}_{qual,it}$	0.0614**	0.0703**	0.0317	0.0076
	(0.0263)	(0.0307)	(0.0279)	(0.0164)
Demographic Controls	Yes	Yes	Yes	Yes
Further econ. expect.	Yes	Yes	Yes	Yes
N	1,307	1,216	1,196	1,211
Pseudo R^2	0.073	0.057	0.035	0.032

Note: PHF data, second wave. Average marginal effects for the probability of answering in the highest category are reported from weighted estimations. Standard errors in parentheses are clustered at the municipal level. *** p<0.01, ** p<0.05, * p<0.1

Table 9: Financial literacy

	High financial literacy (1)	Low financial literacy (2)
$\Delta saving^e_{qual,it}$	-0.0243	-0.0628
	(0.0187)	(0.0411)
$\Delta i^e_{qual,it}$	-0.0324**	-0.0225
	(0.0134)	(0.0284)
$\Delta \pi^{e,1yr}_{qual,it}$	0.0270*	0.0275
	(0.0155)	(0.0340)
Demographic Controls	Yes	Yes
Further econ. expect.	Yes	Yes
N	3,340	527
Pseudo R^2	0.027	0.042

Note: PHF data, second wave. Average marginal effects for the probability of answering in the highest category are reported from weighted estimations. Standard errors in parentheses are clustered at the municipal level. *** p<0.01, ** p<0.05, * p<0.1

Table 10: Age groups

| | $Age \leq 45$ | $46 \leq Age \leq 65$ | $Age \geq 66$ |
	(1)	(2)	(3)
$\Delta saving^e_{qual,it}$	-0.0189	-0.0185	-0.0726**
	(0.0259)	(0.0258)	(0.0312)
$\Delta i^e_{qual,it}$	-0.0661***	0.0028	-0.0083
	(0.0246)	(0.0159)	(0.0264)
$\Delta \pi^{e,1yr}_{qual,it}$	-0.0097	0.0736***	0.0024
	(0.0245)	(0.0209)	(0.0234)
Demographic Controls	Yes	Yes	Yes
Further econ. expect.	Yes	Yes	Yes
N	1,044	1,702	1,121
Pseudo R^2	0.029	0.036	0.056

Note: PHF data, second wave. Average marginal effects for the probability of answering in the highest category are reported from weighted estimations. Standard errors in parentheses are clustered at the municipal level. *** p<0.01, ** p<0.05, * p<0.1

4.3   Testing for Effects on the Wealth Distribution

In this section, we evaluate the link between the question whether households are able to adjust their consumption path to changes in macroeconomic expectations and the distributional consequences that may arise if only specific groups manage to smooth consumption over time in line with theoretically optimal behavior. In the previous section, we have shown that only consumers that are classified as non-hand-to-mouth in the sense that they are able to save, have income higher than expenditures and are invested in financial markets adjust their spending to changes in their perception of the real interest rate. Similar results apply to consumers with high financial literacy.

Next, we test whether these groups are also better off in terms of their position in the distributions of wealth, income and consumption expenditure in our sample. Thus, we hypothesize that these household types are more likely to achieve higher economic positions in the overall distribution controlling for other socio-economic factors. If for instance monetary policy shocks have distributional consequences, as shown in Coibion et al. (2017), our result would imply a potential channel for this effect: If only certain household types adjust their spending and saving decisions to changes in perceived real interest rates, either because the remaining groups are credit constrained or because they lack economic understanding to realize the change, the policy shock would result in higher inequality and, thereby, potentially lower welfare.

The PHF survey contains detailed information about household wealth, income and consumption expenditures [21]. However, due to the short panel dimension, we are not able to evaluate the evolution of the German wealth distribution over time as in Coibion et al. (2017). Instead, we focus on individual households' position within the cross-sectional distribution in the second wave of the PHF survey. Specifically, we define the distance to the median (DtM) for each households' log net assets, total income, labor income, food consumption and total expenditure. We expect that those whose consumption significantly responds to the changes in expected inflation and interest rates will be in the upper half of the distribution.

Indeed, Table 11 shows that most estimated coefficients are positive and highly statistically significant, except for the case of consumer credit holders, where we find significantly negative effects. These results suggest that the saver, non-hand-to-mouth, high financial literacy, financial investor, and mortgage holder households are in the upper half of the wealth, income and consumption distribution, while the consumer credit holders are in

---

[21] According to the official PHF definitions, household wealth (or net asset) is defined as total household assets excluding public and occupational pension wealth minus total outstanding household's liabilities; Total household income is total gross value of household's employee income, self-employment income, income from pensions and other regular social transfers, income from regular private transfers, rental income from real estate property, income from financial assets (e.g. interest or dividends), income from private companies or partnerships and other regular income.
(see https://www.bundesbank.de/Redaktion/EN/Downloads/Bundesbank/Research_Centre/)

the lower half of the wealth and expenditure distributions.[22] It should be noted that these categories are not mutually exclusive and households are likely part of several or even all of them. Nevertheless, our results suggest that being a financial investor has the largest impact on distributions analyzed here, and households in this group on average stand at levels 167%, 34%, and 24% higher than the median of wealth, total income and total expenditure distributions, respectively. In terms of the wealth position, mortgage holders are even better positioned at a level of wealth 216% higher than the median on average. Both of these groups were shown to react significantly to their inflation expectations when forming current spending decisions in Table 8. Consumer credit holders, who adjust spending significantly to their interest rate expectations in Table 8, have average levels of wealth 412% below the median and are also slightly worse off in terms of total expenditure and food consumption spending.

Overall, these results give some evidence that the distributional effects of monetary policy recently discussed in the literature may work through channels related to frictions in the Euler consumption relation.

4.4   The Effect of News

Finally, we evaluate the role of news in an Euler equation setting. Specifically, we estimate level and interaction effects of interest rate and inflation expectations with monetary news observed by the individual consumer. These news can potentially influence consumers' expectation formation on interest rates or inflation and, thus, constitute potential "news shocks" affecting the consumption Euler relationship. In terms of theory, monetary news may affect consumers' expectation formation since they rationally choose to be attentive to these issues (Sims, 2003) or since new information is diffused gradually throughout the population (Carroll, 2001b). We distinguish between news on monetary policy including news on interest rates or the exchange rate, news on inflation and news on issues related to financial markets, i.e. news about banks, stock markets and housing markets.[23] As sample sizes may drop for specific news, we estimate the relationship only with qualitative expectations in order to avoid further reductions in sample size. Again, all models are

---

[22]Consumer credit holders in the PHF survey tend to be young, which could imply that they are more likely at the starting point of wealth accumulation.

[23]News on monetary policy in this sample were mainly news observed by consumers about the interest rate setting by the ECB, potential negative effects of the low interest rate environment on saving and potential negative effects on future inflation and the future economic situation in general related to the very expansive stance of current monetary policy. News on inflation were mainly news observed about rising prices, such as consumer prices or specific prices of food or rents. News on financial market developments include mainly news observed about strong stock markets and rising house prices and some news on potential stability problems in the banking sector. Over both waves, 41 respondents mentioned news on monetary policy, 30 respondents heard news on inflation and 48 observed news on financial markets. More prevalent economic news topics were news on labor market developments, news about potential economic effects of the refugee crisis at the time of the survey and specific sector news like the Diesel scandal in the car industry.

Table 11: OLS: Determinants of Wealth, Income, Consumption Distribution

	Net Asset (DtM) (1)	Total Income (DtM) (2)	Labor Income (DtM) (3)	Food Consumption (DtM) (4)	Total Expenditure (DtM) (5)
Saver	1.5450***	0.1393***	0.1686***	0.0190	0.0306
	(0.2616)	(0.0297)	(0.0452)	(0.0266)	(0.0299)
Non-HtM HH	0.9608***	0.2296***	0.2307***	0.0161	0.0444
	(0.2220)	(0.0292)	(0.0430)	(0.0235)	(0.0308)
High financial literacy	0.6938**	0.1299***	0.0638	0.0836***	0.1444***
	(0.3026)	(0.0386)	(0.0575)	(0.0302)	(0.0335)
Financial Investor	1.6764***	0.3410***	0.3492***	0.1820***	0.2377***
	(0.1973)	(0.0372)	(0.0461)	(0.0259)	(0.0310)
Mortgage holder	2.1570***	0.1172***	0.1044**	-0.0351	-0.0169
	(0.2709)	(0.0331)	(0.0461)	(0.0268)	(0.0366)
Consumer credit holder	-4.1176***	0.0414	0.0186	-0.0516**	-0.0624**
	(0.3198)	(0.0290)	(0.0422)	(0.0214)	(0.0270)
Demographic Controls	Yes	Yes	Yes	Yes	Yes
N	4,347	4,356	2,999	4,368	4,360
R^2	0.330	0.327	0.355	0.164	0.165

Note: PHF data, the second wave. All the logarithmic levels of wealth (net asset), income and consumption are truncated to exclude the lower and upper 1% of the distribution before calculating the distance from their individual levels to the median (DtM). Demographic controls do not include the level of income. Effects are reported from weighted OLS estimations. Standard errors in parentheses are clustered at the municipal level. *** p<0.01, ** p<0.05, * p<0.1

estimated with standard errors clustered at the household level and including demographic control variables.

Since the marginal effects for dummy interaction terms cannot be directly interpreted in the non-linear model setting estimated here, we show marginal effects of interest rate and inflation expectations estimated for those that observed news in the respective category versus those that did not observe these news in Figures 2-4.

Generally, due to the relatively low number of consumers that observed monetary news, the marginal effects of changes in interest rate and inflation expectations are estimated less precisely if the consumer stated that she had heard news on monetary policy. Nevertheless, the results in Figure 2 suggest a higher effect of inflation expectations on current consumption if the consumer observed any news on the ECB's current low interest rate policy. While the marginal effect is significant at the 10% level, it is not significantly different from the positive effect of inflation expectations in the part of the population that did not recall these news. It is, however, consistent with the fact that many consumers in the survey stated having heard of the central bank's low interest rate policy in conjunction with fears of this resulting in higher future inflation.

Similarly, the impact of inflation expectations on current consumption becomes significantly stronger if the consumer observed any news on price changes, where the marginal effect rises from about 0.09 to about 0.16. Since news on inflation in our survey are generally recollections of rising prices (even though aggregate inflation was very low at the time of the survey), the effect is again consistent with expectation formation under rational inattention (Sims, 2003). Similar to our results in section 4.2, the effect of news on inflation and monetary policy thus points out that consumers that are (able to be) attentive to macroeconomic developments are better able to incorporate the effect of perceived real interest rates into their consumption decision. By contrast, the negative marginal effect of nominal interest rate expectations is significant only for those consumers that did not observe any news on inflation.

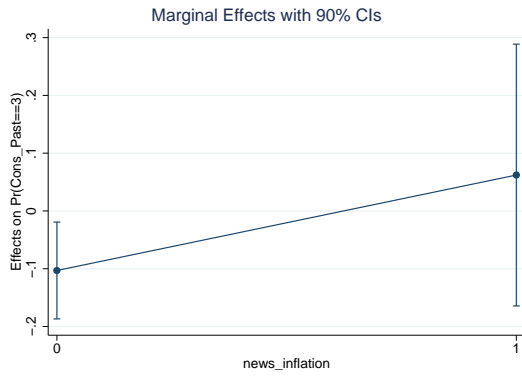Figure 2: Interaction Effects with News on Monetary Policy
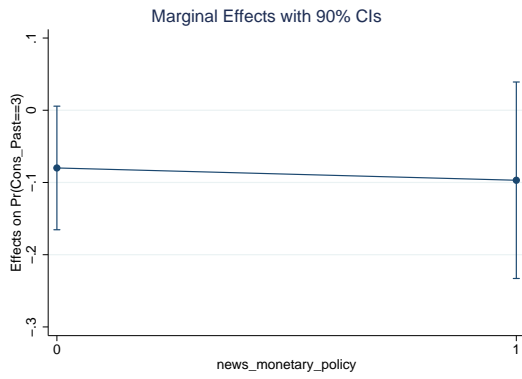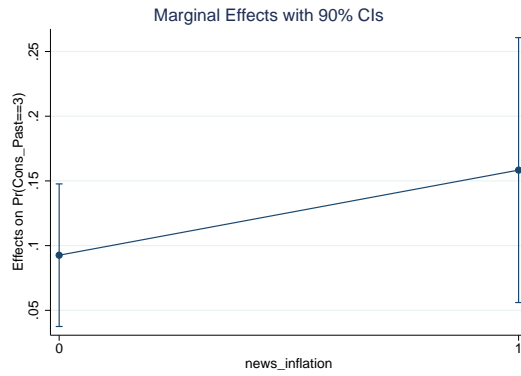

(a) Qualitative Interest Rate Expectations
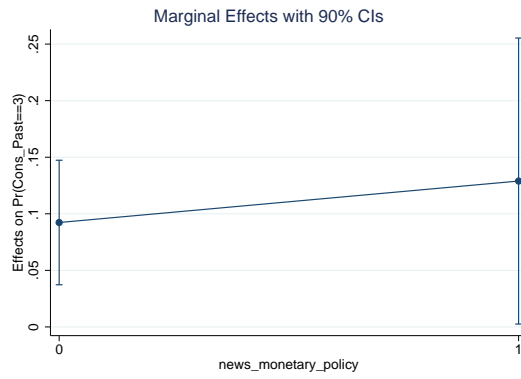
(b) Qualitative Inflation Expectations

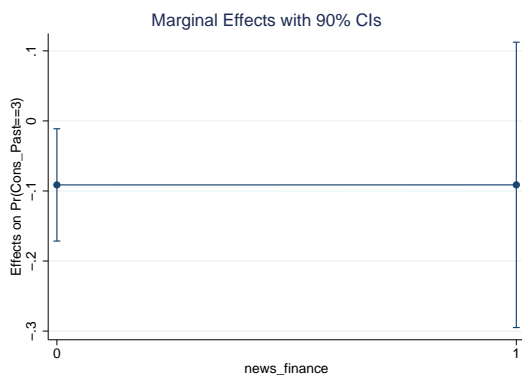Figure 3: Interaction Effects with News on Inflation

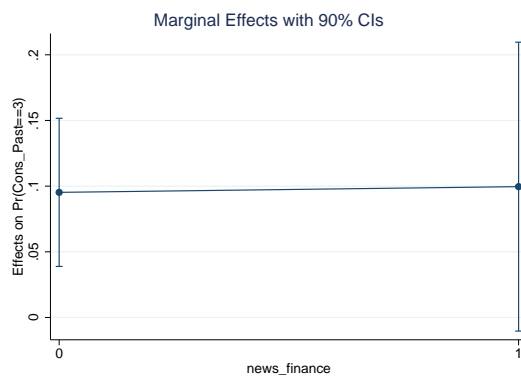(a) Qualitative Interest Rate Expectations

(b) Qualitative Inflation Expectations

Figure 4: Interaction Effects with News on Financial Markets

(a) Qualitative Interest Rate Expectations

(b) Qualitative Inflation Expectations

30

Finally, we check whether news on financial market development also influence the marginal effects of nominal interest rate and inflation expectations on current consumption. This could be the case for instance if consumers relate news on rising stock prices to higher economic growth, and, thereby, higher expected inflation and higher expected interest rates. As shown in Figure 4, however, the marginal effects estimated are almost identical between the sample that did or did not observe news on financial markets, but become insignificant in the former case.

5   Conclusion

In this paper, we evaluate two new survey datasets of German consumers with respect to their individual expenditure allocation. Framing the analysis in the Euler equation that results from consumers' optimal consumption allocation in a life-cycle model, the theory predicts that reported current consumption depends positively on expected consumption, negatively on nominal interest rates and positively on expected inflation.

The results in this paper suggest that German consumers surveyed in 2014 (the PHF) and 2015/2016 (the Hamburg University Survey) indeed report qualitative consumption paths with correlations in line with an Euler equation model: First, changes in current spending depend positively on planned changes in spending in the next year, thus supporting the hypothesis of consumption smoothing. Second, current consumption is positively correlated with expected changes in inflation, and negatively with nominal interest rate expectations, implying an overall negative link to the perceived real interest rate. These correlations are robust to the inclusion of further macroeconomic expectations.

In addition, we find that the perceived real interest rate affects consumers' consumption allocation significantly only in the sub-group of consumers who are able to save, financially unconstrained, active on financial markets or have a high financial literacy, while there is no effect for consumers in the financially constrained control groups, respectively. This is again in line with the life-cycle model of consumption. Importantly, the consumers' heterogeneous responses to changes in inflation and interest rate expectations also suggests a potential channel to explain the distributional effects of monetary policy shocks. Indeed, we find that households that are able to smooth consumption over time via adjusting to the perceived real interest rate are also significantly better positioned in the wealth and income distributions.

Finally, monetary news observed by the consumer interact with the impact of consumers' real interest rate expectations: Both news on inflation and on monetary policy are related with a stronger effect inflation expectations on current spending decisions. This suggests that expectation formation under imperfect information may also influence the Euler equation relationship.

Overall, the analysis yields some interesting insights into consumers' decision making regarding their consumption allocation. Macroeconomic expectations matter for economic

decisions, and the effects are in line both with economic theory and with the current German situation of a booming economy with very low inflation and interest rates near the ZLB at the time of the survey. Interestingly, consumers in the survey on average over-estimate current inflation strongly and the impact of their inflation expectations on current spending patterns is even more pronounced for the small sub-set of consumers who report having heard about rising prices, in line with theories if rational inattention (Sims, 2003). This gives some tentative indication that consumers' over-estimation of inflation in Germany may help to stabilize demand in deflationary periods, as also suggested by Coibion and Gorodnichenko (2015b) for the US, but further research is needed to explore whether the expectations channel influencing spending decisions remains valid outside the zero lower bound. At the same time, this channel is only found to be active for the sub-set of the population that is able to adjust their spending to changes in the perceived interest rate. As a cautionary note, therefore, ultra-expansionary monetary policy at the ZLB could lead to undesirable distributional effects, as also pointed out by Coibion et al. (2017).

6   Acknowledgements

References

Attanasio, O. P. and H. Low (2004). Estimating Euler equations. *Review of Economic Dynamics 7*, 406–435.

Bachmann, R., T. O. Berg, and E. R. Sims (2015). Inflation expectations and readiness to spend: Cross-sectional evidence. *American Economic Journal: Economic Policy 7*(1), 1–35.

Bagwell, L. S. and B. D. Bernheim (1996). Veblen Effects in a Theory of Conspicuous Consumption. *The American Economic Review*.

Branch, W. A. (2004). The theory of rationally heterogeneous expectations: Evidence from survey data on inflation expectations. *Economic Journal 114*(497), 592–621.

Browning, M. and T. Crossley (2001, Summer). The lifecycle model of consumption and saving. *Journal of Economic Perspectives 15*(3), 3–22.

Bryan, M. and G. Venkatu (2001, October). The demographics of inflation opinion surveys. *Federal Reserve Bank of Cleveland Commentary 1015*.

Burke, M. A. and A. Ozdagli (2013). Household Inflation Expectations and Consumer Spending: Evidence from Panel Data. Technical Report 13-25, Federal Reserve Bank of Boston Research Department Working Papers.

Carroll, C. D. (2001a, November). Death to the log-linearized consumption euler equation! (and very poor health to the second-order approximation). *Advances in Macroeconomics 1*(1), Article 6.

Carroll, C. D. (2001b). The Epidemiology of Macroeconomic Expectations. *NBER Working Paper 8695*.

Christen, M. and R. M. Morgan (2005). Keeping Up With the Joneses: Analyzing the Effect of Income Inequality on Consumer Borrowing. *Quantitative Marketing and Economics 3*, 145–173.

Clarida, R., J. Galí, and M. Gertler (1999). The Science of Monetary Policy: A New Keynesian Perspective. *Journal of Economic Literature 37*(4), 1661–1707.

Coibion, O. and Y. Gorodnichenko (2015a). Information rigidity and the expectation formation process: A simple framework and new facts. *American Economic Review 105*(8), 2644–78.

Coibion, O. and Y. Gorodnichenko (2015b). Is the Phillips Curve Alive and Well After All? Inflation Expectations and the Missing Disinflation. *AEJ: Macroeconomics 7*(1), 197–232.

Coibion, O., Y. Gorodnichenko, L. Kueng, and J. Silvia (2017). Innocent Bystanders? Monetary policy and inequality. *Journal of Monetary Economics*.

Crump, R. K., S. Eusepi, A. Tambalotti, and T. G. (2015). Subjective Intertemporal Substitution. *Federal Reserve Bank of New York Staff Reports 734.*

D'Acunto, F., D. Hoang, and M. Weber (2016). Unconventional Fiscal Policy, Inflation Expectations, and Consumption Expenditure. Technical Report 5793, CESifo Working Paper.

Dräger, L. and U. Fritsche (2013). Don't worry, be right! survey wording effects on inflation perceptions and expectations. *Macroeconomics and Finance Series University of Hamburg 8/2013.*

Dräger, L., M. J. Lamla, and D. Pfajfar (2016). Are Survey Expectations Theory-Consistent? The Role of Central Bank Communication and News. *European Economic Review 85*(C), 84–111.

Fernandez-Villaverde, J. and D. Krueger (2011). Consumption and Saving over the Life Cycle: How Important Are Consumer Durables? *Macroeconomic Dynamics 15*(05), 725–770.

Friedman, M. A. (1957). *A Theory of the Consumption Function.* Princeton University Press.

Galí, J. (2008). *Monetary Policy, Inflation, and the Business Cycle: An Introduction to the New Keynesian Framework.* Princeton University Press.

Häder, S., S. Gabler, and C. Heckel (2009). *Telefonbefragungen über das Mobilfunknetz,* Chapter Stichprobenziehung, Gewichtung und Realisierung, pp. 21–49. Wiesbaden: VS Verlag für Sozialwissenschaften.

Hurd, M. D. and S. Rohwedder (2013). Expectations and Household Spending. Technical Report 2013-300, Michigan Retirement Research Center Research Paper.

Ichiue, H. and S. Nishiguchi (2015). Inflation Expectations and Consumer Spending at the Zero Bound: Micro Evidence. *Economic Inquiry 53*(2), 1086–1107.

Jonung, L. (1981). Perceived and Expected Rates of Inflation in Sweden. *American Economic Review 71*(5), 961–968.

Juster, F. T. and P. Wachtel (1972). Inflation and the Consumer. *Brookings Papers on Economic Activity 3*(1), 71–121.

Lusardi, A. and O. S. Mitchell (2011). Financial literacy around the world: an overview. *Journal of Pension Economics and Finance 10*(4), 497–508.

Lusardi, A. and O. S. Mitchell (2014). The Economic Importance of Financial Literacy: Theory and Evidence. *Journal of Economic Literature 52*(1), 5–44.

Shiller, R. (1997). Why do people dislike inflation? In C. H. Romer and D. H. Romer (Eds.), *Reducing Inflation: Motivation and Strategy*, pp. 13–70. University of Chicago Press.

Sims, C. A. (2003). Implications of Rational Inattention. *Journal of Monetary Economics 50*(3), 665–690.

Smith, G. W. and J. Yetman (2013). Estimating Dynamic Euler Equations with Multivariate Professional Forecasts. *Economic Inqiry 5*(1), 445–458.

7 Appendix

7.1 Robustness Checks

This section contains robustness checks for the University of Hamburg survey regarding the sensitivity of the results to each of the two waves. Specifically, we estimate the consumption Euler equation in its baseline specification separately for the first and the second wave of the University of Hamburg survey, see Table A1. We further control for sample selection bias into the second wave by estimating the model with a Heckman correction.

Regarding the consumption Euler equation estimation with qualitative expectations, the positive impact from expected inflation stays robust across both waves, while the negative nominal interest rate effect becomes significant only in the second wave. The consumption-smoothing effect of expected consumption is again significant throughout both waves.

Next, we estimate the model with a Heckman correction that accounts for a potential selection bias for being selected into the second wave. The model is estimated in a two-step procedure where the selection equation measures the probability of being in the second wave conditional on the Euler equation variables and a larger set of demographic characteristics. Generally, our results remain robust with the correction and the correlation coefficient ρ of the residuals between the measurement and the selection equations is strongly insignificant. Since due to the correction the models effectively use only observations from the second wave, We can compare the estimates to those from columns (3) and (4). All coefficients remain close to their counterparts without correction. Hence, the results suggest that sample selection may not be a problem here. However, this result should be interpreted cautiously as it may also be due to missing suitable instruments of the selection equation.

Table A2 shows similar robustness checks for the PHF data. We find that the positive impact of expected inflation on consumption decisions remains robust across both waves. Also, the Heckman correction estimation reveals an insignificant correlation coefficient ρ of the residuals between the measurement and the selection equations, implying that attrition bias should be small. However, the impact of inflation expectations becomes insignificant in the Heckman specification.

Finally, it is important to note that the PHF survey uses a multiple imputation technique and stratified multistage sampling design to handle the problem of the non-response items, which should be taken into account in the analysis. Thus, all our estimations use sample weights and standard errors are clustered at the municipal level, except for the pooled waves estimation, which is clustered at the household level. Also, since there are no imputed values for our variables of interest (such as consumption, saving behaviors and all economic expectations), our results would not be affected by the choice of imputed

values. In fact, as a robustness check, we conduct estimations using the "mi" and "svy" Stata packages that take into account both imputed values and sampling design for the baseline analysis. As shown in Table A4 in the appendix, all results remain robust.

Table A1: Robustness Checks Consumption Euler Equation

	Baseline Model	First Wave	Second Wave	Heckman corr. Second Wave
	(1)	(2)	(3)	(4)
Δc_t^e	0.1360***	0.1297**	0.1527**	0.1647**
	(0.0495)	(0.0661)	(0.0767)	(0.0788)
$\Delta i_{qual,t}^e$	-0.0495*	-0.0397	-0.0832**	-0.0903**
	(0.0267)	(0.0378)	(0.0361)	(0.0453)
$\Delta \pi_{qual,t}^{e,1yr}$	0.0675***	0.0422*	0.1068***	0.1170***
	(0.0232)	(0.0254)	(0.0380)	(0.0391)
N	298	205	93	298
Pseudo R^2	0.161	0.129	0.393	–
ρ selection eq.	–	–	–	-.043
p-value $\rho = 0$, χ^2				0.906
Demographic Controls	Yes	Yes	Yes	Yes

Note: University of Hamburg survey. Marginal effects for the probability of answering in the highest category are reported from weighted estimations and evaluated at a hypothetical representative consumer. P-values for $\rho = 0$ are from a Wald test (χ^2 statistics) for independence from the sample selection equation measuring the potential bias for being selected into the second wave. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table A2: Robustness Checks Consumption Euler Equation PHF

	Pooled Waves	First Wave	Second Wave	Heckman corr. Second Wave
	(1)	(2)	(3)	(4)
$\Delta Saving_t^e$	-0.0233**	-0.0258	-0.0233	-0.0180
	(0.0116)	(0.0173)	(0.0154)	(0.0138)
$\Delta\pi_{qual,t}^{e,1yr}$	0.0215**	0.0232*	0.0293**	0.0057
	(0.0090)	(0.0124)	(0.0123)	(0.0163)
N	7,688	3,432	4,256	7,688
Pseudo R^2	0.008	0.010	0.012	–
ρ selection eq.	–	–	–	.266
p-value $\rho = 0$, χ^2				0.143
Demographic Controls	Yes	Yes	Yes	Yes

Note: The PHF Survey. Marginal effects for the probability of answering in the highest category are reported from weighted estimations and evaluated at a hypothetical representative consumer. P-values for $\rho = 0$ are from a Wald test (χ^2 statistics) for independence from the sample selection equation measuring the potential bias for being selected into the second wave. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

7.2 Survey Question Wording, University of Hamburg Survey

The wording of the survey questions regarding current and planned consumption is as follows:

- Current consumption $\Delta c_{it}^{current}$: *"How would you say do your total expenditures in the past 12 months compare to an average year in the past? They were"*

    - Considerably higher
    - About the same
    - Considerably lower
    - Don't know
    - No answer

- Expected consumption Δc_{it}^{e}: *"How would you say will your total expenditures in the next 12 months compare to an average year in the past? They will be"*

    - Considerably higher
    - About the same
    - Considerably lower
    - Don't know
    - No answer

- Expected consumption of durable goods $\Delta c_{it}^{e,dur}$: *"In the next 12 months, do you expect to spend more or less on large purchases such as furniture or electronic devices or such than in an average year in the past?"*

    - A lot more
    - Somewhat more
    - About the same
    - Somewhat less
    - A lot less
    - Don't know
    - No answer

- Consumption climate $c_{it}^{climate}$: *"When looking at the current economic situation, do you think now is a good or an bad time for people to make large purchases such as furniture or electronic devices and so on?"*

    - Now is a good time

- Neither a good, nor a bad time

- Now is a bad time

- Don't know

- No answer

Regarding the survey questions on consumers' interest rate and inflation expectations, we compare the results with qualitative and quantitative expectations:

- Qualitative nominal interest rate expectations $\Delta i_{it}^{e,qual}$: *"How do you think interest rates on saving accounts on average will develop over the next 12 months? They will"*

  - Increase strongly

  - Increase somewhat

  - Stay about the same

  - Decrease somewhat

  - Decrease strongly

  - Don't know

  - No answer

- Quantitative nominal interest rate expectations $i_{it}^{e,quant}$: *"What do you think, how high will interest rates on saving accounts be on average over the next 12 months?"*

  - ... Percent

  - Don't know

  - No answer

- Qualitative inflation expectations $\Delta \pi_{it}^{e,qual}$: *"How do you think prices in general will develop over the next 12 months compared to the previous 12 months? They will"*

  - Increase more than before

  - Increase at about the same rate

  - Increase less strongly than before

  - Stay about the same

  - Fall

  - Don't know

  - No answer

- Quantitative inflation expectations $\pi_{it}^{e,quant}$: *"How many percent do you think prices in general will increase/decrease on average over the next 12 months?"*

  - ... Percent
  - Don't know
  - No answer

Wordings for additional control variables:

- Qualitative inflation perceptions $\Delta\pi_{it}^{p,qual}$: *"How do you think prices in general have developed over the past 12 months? They have"*

  - Increased strongly
  - Increased moderately
  - Increased slightly
  - Stayed about the same
  - Fallen
  - Don't know
  - No answer

- Quantitative inflation perceptions $\pi_{it}^{p,quant}$: *"How many percent do you think prices in general have increased/decreased on average over the past 12 months?"*

  - ... Percent
  - Don't know
  - No answer

- Qualitative business expectations $\Delta econ_{it}^{e,qual}$: *"How do you think the economy in Germany in general is going to develop over the next 12 months? It will"*

  - Improve considerably
  - Improve somewhat
  - Stay about the same
  - Deteriorate somewhat
  - Deteriorate considerably
  - Don't know
  - No answer

- Qualitative unemployment expectations $\Delta u_{it}^{e,qual}$: *"How do you think unemployment in Germany in total is going to develop over the next 12 months? It will"*

  - Increase considerably

- Increase somewhat

- Stay about the same

- Drop somewhat

- Drop considerably

- Don't know

- No answer

- Qualitative stock price expectations $\Delta stocks_{it}^{e,qual}$: *"How do you think stock prices in Germany in general are going to develop over the next 12 months? They will"*

  - Increase considerably

  - Increase somewhat

  - Stay about the same

  - Fall somewhat

  - Fall considerably

  - Don't know

  - No answer

- Qualitative personal income expectations $\Delta income_{it}^{e,qual}$: *"How do you think the economic situation of your own household is going to develop over the next 12 months? It will"*

  - Improve considerably

  - Improve somewhat

  - Stay about the same

  - Deteriorate somewhat

  - Deteriorate considerably

  - Don't know

  - No answer

- News heard $news_{it}$: *"In the recent months, have you heard or read about any positive or negative business or economic news in general?"*

  - Yes, positive

  - Yes, negative

  - Yes, both

  - No, neither positive nor negative

  - Don't know

  - No answer

- News categories open question: *"If yes, what did you hear or read?"*

  - ...

  - Don't know

  - No answer

- Financial risk attitude $risk_{it}$: *"When taking decisions on savings or financial investment, which of the following statements best describes your personal attitude?"*

  - I take considerable risks and want to gain very high profits

  - I take above average risks and want to gain above average profits

  - I take average risks and want to gain average profits

  - I am not willing to take any financial risks

  - Don't know

  - No answer

Definitions for financial market participation:

- Respondents who do not save:

  - Question *"Which of the following statements best describes the current financial situation of your household?"*

  - Answer *"The household does not save"*

- Respondents active on financial markets:

  - Question *"In which assets do you normally save?"*

  - Answers *"Bonds, stocks, life insurance, private pension scheme (e.g. Riester), building and loan association"*

- Respondents paying off debt:

  - Question *"In which assets do you normally save?"*

  - Answer *"Paying off credit or a mortgage"*

7.3 Survey Question Wording, Bundesbank PHF Survey

The wording of the survey questions regarding current consumption $\Delta c_{it}^{current}$ is as follows:

- *"If you exclude financial investments: Would you say that the last 12 months' expense correspond to a normal year in terms of the total expenditures of your household?"*

  – Yes

  – No

  – Don't know

  – No answer

- *"Were the expenditures higher or lower than in a normal year?"*

  – Higher

  – Lower

  – Don't know

  – No answer

Survey questions regarding saving, interest rate, and inflation expectations:

- Saving expectation $\Delta saving_{qual,it}^{e}$: *"If you now compare the next twelve months with the last two years: Will your household save or invest a larger, smaller or roughly equivalent percentage of the disposable household income in total?"*

  – A larger percentage

  – A smaller percentage

  – An equivalent percentage

  – Don't know

  – No answer

- Qualitative interest rate expectation $\Delta i_{qual,it}^{e}$: *"What do you think, how will interest rates change for your savings accounts over the next twelve months on average?"*

  – Increase significantly

  – Increase somewhat

  – Stay approximately the same

  – Fall somewhat

  – Fall significantly

  – Don't know

- No answer

- Different

- Quantitative interest rate expectation $i^e_{qual,it}$: *"What do you think, how high will interest rates in your savings accounts be over the next twelve months on average?"*

    - ... Percent

    - Don't know

    - No answer

    - Different

- Qualitative inflation expectation $\Delta\pi^{e,1yr}_{qual,it}$: *"What do you think, how will the general price level change in the next twelve months?"*

    - Rise significantly

    - Rise somewhat

    - Stay approximately the same

    - Fall somewhat

    - Fall significantly

    - Don't know

    - No answer

- Quantitative inflation expectation $\Delta\pi^{e,1yr}_{quant,it}$: *"What do you think, by what percentage will the general price level in the next 12 months?"*

    - ... Percent

    - Don't know

    - No answer

Survey questions regarding further economic expectations:

- Qualitative real income expectation $\Delta real\_income^e_{qual,it}$: *"What do you think, will the income of your household rise faster or slower in the next twelve months than the cost of living or approximately as same as the cost of living"*

    - Will rise more than the cost of living

    - Will rise about as much as the cost of living

    - Will rise less than the cost of living

    - Don't know

- – No answer

- Qualitative tax expectation $\Delta tax^{e,1yr}_{qual,it}$: *"What do you think, how will taxes and social security contributions change over the next twelve months?"*

  - – Rise significantly

  - – Rise somewhat

  - – Stay approximately the same

  - – Fall somewhat

  - – Fall significantly

  - – Don't know

  - – No answer

- Qualitative real estate price expectation $\Delta real\_estate\_price^{e}_{qual,it}$: *"What do you think, how will real estate prices in your area change in the next twelve months?"*

  - – Increase significantly

  - – Increase somewhat

  - – Stay approximately the same

  - – Fall somewhat

  - – Fall significantly

  - – Don't know

  - – No answer

- Qualitative stock price expectation $\Delta stock\_price^{e}_{qual,it}$: *"What do you think, how will stocks in Germany perform over the next twelve months?"*

  - – Increase significantly

  - – Increase somewhat

  - – Stay approximately the same

  - – Fall somewhat

  - – Fall significantly

  - – Don't know

  - – No answer

Survey questions regarding Unconstrained vs. Hand-to-mouth Consumers:

- *"If you exclude financial investments: Would you say that the normal expenditures of your household over the last twelve months were. . . "*

- Higher than the income of your household

- Approximately equal to the income

- Lower than the income of your household

- Don't know

- No answer

- *"I would now like to ask a few questions about the attitude of your household with respect to saving: Which of the statements in the following list best describes the saving patterns of your household?"*

    - We save a certain amount regularly, e.g. in a savings account, a savings agreement, in stock or life insurance policy

    - We save a little each month, we determine the amount, depending on the financial situation.

    - We save something if something is left to save.

    - We do not save because there is no financial room to maneuver.

    - We do not want to save.

    - Don't know

    - No answer

Survey questions regarding Financial literacy:

- LITERACY - COMPOUND INTEREST EFFECT: *"Let us assume you have a balance of €100 in your savings account. This balance bears interest at an annual rate of 2%, and you leave it there for 5 years. What do you think: How high is your balance after 5 years?"*

    - Higher than €102

    - Exactly €102

    - Lower than €102

    - Don't know

    - No answer

- LITERACY - INFLATION: *"Let us assume that the interest paid on your savings account is 1% per year and the inflation rate is 2% per year. What do you think: After a year, will you be able to buy just as much, more or less than today with the balance in your savings account?"*

    - More

- Just as much

- Less than today

- Don't know

- No answer

7.4 Further Results

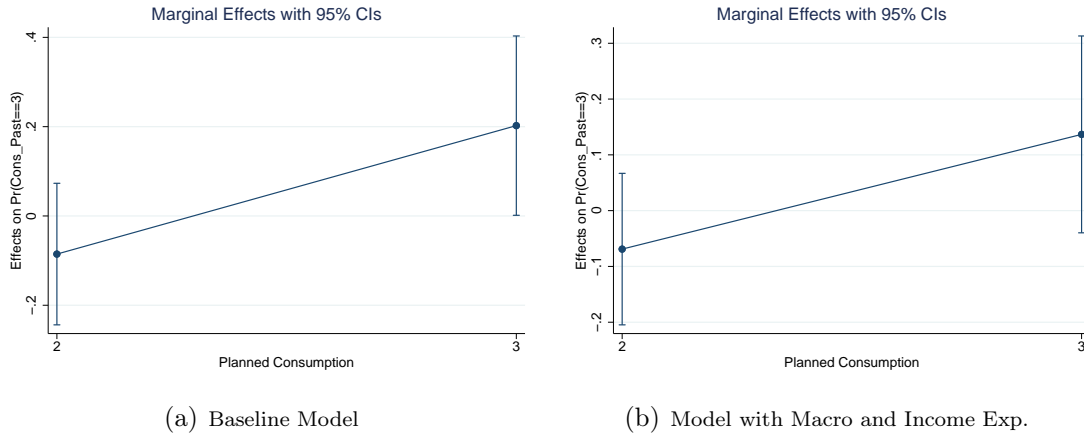Figure A1: Marginal Effects of Planned Consumption Across Ordinal Categories

(a) Baseline Model

(b) Model with Macro and Income Exp.

Figure A2: Marginal Effects of Qualitative Interest Rate Expectations Across Ordinal Categories

(a) Baseline Model

(b) Model with Macro and Income Exp.
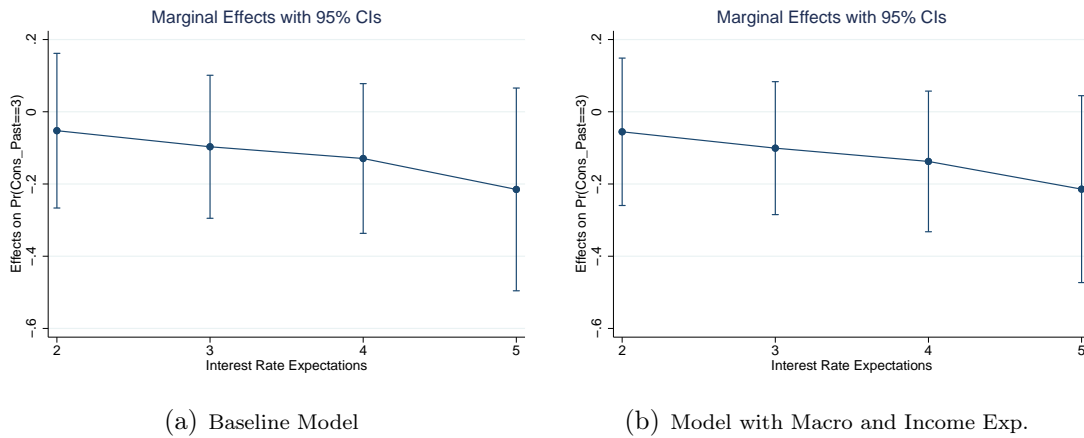
Figure A3: Marginal Effects of Qualitative Inflation Expectations Across Ordinal Categories

(a) Baseline Model

(b) Model with Macro and Income Exp.
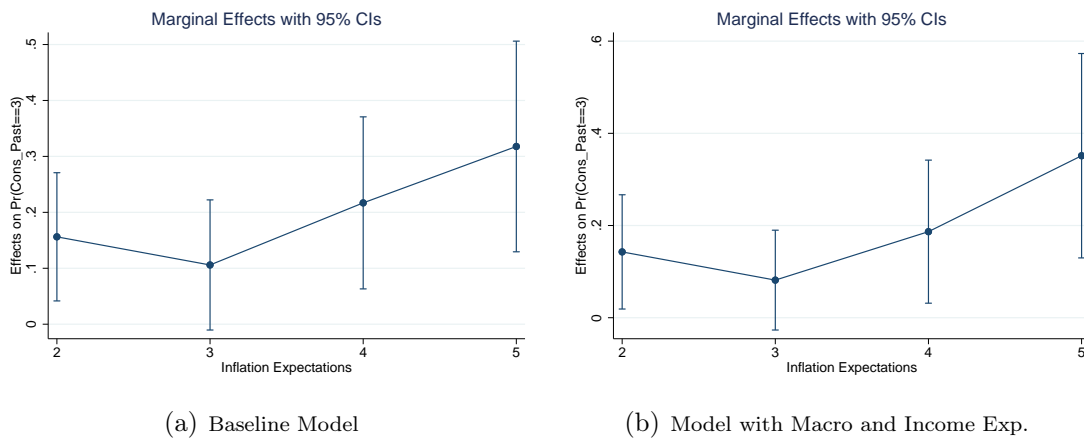
Table A3: Robustness Checks: Euler Equation with Long-Run and House Price Inflation Expectations

	(1)	(2)	(3)
Δc_{it}^{e}	0.1360***	0.1666***	0.1476***
	(0.0495)	(0.0587)	(0.0519)
$\Delta i_{qual,it}^{e}$	-0.0495*	-0.0406	-0.0429
	(0.0267)	(0.0303)	(0.0268)
$\Delta \pi_{qual,it}^{e,1yr}$	0.0675***		
	(0.0232)		
$\Delta \pi_{qual,it}^{e,5yrs}$		0.0109	
		(0.0230)	
$\Delta \pi_{qual,it}^{e,house}$			0.0206
			(0.0219)
N	298	292	296
Pseudo R^2	0.161	0.134	0.138
Demographic Controls	Yes	Yes	Yes

Note: University of Hamburg survey. Marginal effects for the probability of answering in the highest category are reported from weighted estimations and evaluated at a hypothetical representative consumer. Standard errors in parentheses are clustered at the household level. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A4: Consumption Euler Equation, PHF data

	(1)	(2)	(3)	(4)	(5)	(6)
$\Delta real\_income^e_{qual,it}$		-0.0004	-0.0143		0.0062	-0.0045
		(0.0142)	(0.0158)		(0.0146)	(0.0157)
$\Delta tax^e_{qual,it}$		0.0050	-0.0021		-0.0026	-0.0096
		(0.0121)	(0.0131)		(0.0125)	(0.0136)
$\Delta real\_estate\_price^e_{qual,it}$		0.0026	0.0042		0.0004	-0.0003
		(0.0102)	(0.0104)		(0.0109)	(0.0107)
$\Delta stock\_price^e_{qual,it}$			-0.0233**			-0.0261**
			(0.0113)			(0.0113)
$\Delta saving^e_{qual,it}$	-0.0259	-0.0284	-0.0295	-0.0367**	-0.0398**	-0.0415*
	(0.0161)	(0.0175)	(0.0211)	(0.0176)	(0.0186)	(0.0213)
$\Delta i^e_{qual,it}$	-0.0295**	-0.0311**	-0.0277*	-0.0264**	-0.0271**	-0.0266*
	(0.0125)	(0.0130)	(0.0145)	(0.0134)	(0.0137)	(0.0145)
$\Delta i^e_{qual,it}$	0.0226*	0.0276*	0.0334**			
	(0.0133)	(0.0143)	(0.0165)			
$\Delta \pi^{e,1yr}_{quant,it}$				0.0061*	0.0081**	0.0085**
				(0.0033)	(0.0036)	(0.0042)
N	4,104	3,867	3,003	3,794	3,613	2,852
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes

Note: PHF data, the second wave. Marginal effects for the probability of answering in the highest category are reported from "mi" and "svy" Stata estimations and evaluated at a hypothetical representative consumer. Quantitative inflation expectations are truncated to exclude the lower and upper 2.5% of the distribution. *** p<0.01, ** p<0.05, * p<0.1