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What Matters in Households' Inflation Expectations?

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Abstract:

We provide evidence that households discretize their inflation expectations so that what matters for durable consumption decisions is the broad inflation regime they expect. Using survey data, we document that a large share of the adjustment in the average inflation expectation comes from the change in the share of households expecting stable prices; these households also consume relatively less than the ones expecting positive inflation. In contrast, variations of expectations across households expecting a positive inflation rate are associated with much smaller differences in individual durable consumption choices. We illustrate how this mitigates the expectation channel of monetary policy.

JEL Classifications: D12, D84, E21, E31, E52

Keywords: inflation expectations, Euler equation, survey data, imperfect information, adjustment costs, stabilization policies

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1 Introduction

Inflation expectations matter a great deal for central banks. They are considered both a measure of the banks' credibility to achieve their price stability objective and a channel to manage current aggregate demand. In particular, when the economy is at its lower bound on nominal interest rates, committing to a policy that boosts expected inflation is deemed expansionary because it lowers the real rate and increases the incentive to consume rather than save.[1] It is thus no surprise that central banks devote a lot of resources to monitor the inflation expectations of various agents, typically via surveys.

However, how the inflation expectation channel operates in practice remains unclear when one looks at these expectation data.[2] In particular, households seem to be poorly informed about current and future inflation: They disagree strongly about it, with a significant fraction of respondents having expectations that are far beyond the range of inflation realizations observed over the past years.[3] Given how bad households' inflation expectations are, one can question whether they really matter for households' decisions, and, consequently, for the transmission of monetary policy.

In this paper, we provide new evidence that households' inflation expectations have an impact on their individual consumption decisions. Our main insight is that what matters is the broad *inflation regime*—rather than the precise inflation rate—households expect. We obtain this result by using both qualitative and quantitative answers to a household survey of inflation expectations. We show that differences in individual qualitative assessment are associated with differences in individual consumption choices that are much larger than the quantitative differences within the same qualitative assessment. The relevance of different broad inflation regimes is consistent with discretization or consideration sets that can be obtained under rational inattention.[4] As we illustrate, under such discretization, the inflation expectation channel is still at play but is much less potent than in the standard New Keynesian (NK) model used for monetary policy analysis.

We use individual data from a rich survey of French households covering about 2,000

[1] See Krugman (1998); Eggertsson and Woodford (2003); Werning (2012).
[2] See Coibion et al. (2018b) for a survey of recent evidence.
[3] This is consistent with models of imperfect information, as Coibion and Gorodnichenko (2012) show.
[4] See, e.g., Caplin et al. (2018), Jung et al. (2019), and Mackowiak et al. (2018) for a recent survey.

individuals every month since January 2004. This survey provides detailed qualitative and quantitative information on both perceived and expected inflation, but also on households' perceived and expected own and aggregate economic and financial situations, households' durable consumption choices, and socio-economic characteristics.

We start by documenting new facts on how these households form their inflation expectations. First, a large share of households (more than 30 percent) expect prices to "stay about the same" over the next year. Second, this share fluctuates a lot over time and consistently with realized inflation. More specifically, when imputing a strictly zero quantitative inflation expectation to agents expecting prices to remain stable, we show that fluctuations in the associated *extensive margin* of aggregate inflation expectation—that is, variations in the share of households expecting positive inflation instead of stable prices—accounts for nearly 75 percent of the variance of the average inflation expectation. This implies that variations in the *intensive margin*—that is, changes in the average expected inflation within households expecting positive inflation—contributes much less. In addition, the share of households expecting stable prices decreases when realized inflation declines. This correlation is stronger when realized inflation is low (typically below 2 percent). By contrast, the intensive margin correlates less with inflation when it is low.

We then assess the impact of inflation expectations on households' consumption decisions. We find that households expecting positive inflation over the next year have a higher probability of buying new durable goods in the current year compared with households expecting that prices will remain stable over the same period. By contrast, households with different positive inflation expectations have a similar propensity to buy durable goods over the current year. This finding holds true for various measures of durable consumption used in the literature[5] and for all types of households.[6]

[5]As with many surveys, the French survey has information on only durable consumption. Nevertheless, durable consumption is the most important margin of adjustment in total private consumption fluctuations over the business cycle, and so the intertemporal substitution of private consumption induced by variations in expected inflation—hence in the real interest rate—should predominantly go through changes in durable consumption plans.

[6]Consistent with the literature emphasizing that dispersion of inflation expectations and their connection with consumption decisions are related to variations in individual information frictions as cognitive abilities (e.g. D'Acunto et al., 2019a,b,c), we find stronger effects of inflation for older, richer, and more educated households but, consistent with "discretization," we find that these effects are driven by the extensive margin.

Importantly, the French survey provides a rich set of information that allows us to address some important potential sources of endogeneity that merit consideration when studying the link between consumption and inflation expectations. To be more specific, we can control for individual perceived current inflation. This addresses the fact that inflation expectations are formed based on current prices, in particular shopping experiences, and thus the positive correlation might come from a decision to buy, causing individual perception of current inflation to rise and individual inflation expectations to rise as well. We also can control for expected own financial and consumption expectations as well as aggregate macroeconomic perspectives. This mitigates the concern that households' consumption reacts to a shock that raises inflation but also can have an impact on their expected real income. Finally, we can control for households' perceptions of whether the current period is a good time to save, which relates to their nominal interest rate perceptions. This limits the endogeneity stemming from the households that understand that the central bank reacts to higher expected inflation by tightening interest rates, which would lower consumption.

We also provide some additional results and robustness checks. In particular, we emphasize that it is important to control for expected individual consumption and future business conditions to obtain a positive effect of expected inflation on durable consumption. The effect can otherwise be negative, as several households expect more inflation to go with worse business conditions. While the individual controls can lead to different quantitative results, none of them is individually crucial for our qualitative results that only the extensive margin of inflation expectations matters. We also confirm our findings using the short panel dimension that is available in the survey. Finally, we confirm our main results on a similar survey conducted in Germany and on the University of Michigan Surveys of Consumers in the United States.

Our findings have important implications for the use of inflation expectations for policy guidance. The large dispersion typically observed in the distribution of households' inflation expectations does not mean these are uninformative: An important and informative component of this dispersion is the share of households expecting prices to remain stable.

In addition, our findings that households discretize their views on future inflation also have implications for macroeconomic policies. First, the ability to manage current aggregate demand by manipulating inflation expectations is more limited than in models where inflation expectations would react continuously to news. To be effective, forward guidance policies need to have an impact on the share of households expecting prices to remain stable and convince them to switch to a positive inflation regime. Moreover, once all agents expect positive inflation, any further increment in their expectations does not have additional stimulative effects, which puts a cap on the stimulative impact of forward guidance. Second, inflation expectations can de-anchor despite inflation expectations remaining positive on average. This would happen when an important and stable share of households expect prices to remain about the same, thus putting a persistent drag on current aggregate demand. Reanchoring will require a substantial share of households to be convinced that they should switch to a positive inflation regime. We illustrate these policy implications using a simple NK model with heterogeneous households' beliefs.

Literature Our paper is related to the literature using survey data to characterize the formation of inflation expectations. Several papers show that the formation is consistent with models of imperfect information (Mankiw et al., 2003; Coibion and Gorodnichenko, 2012, 2015; Andrade and Le Bihan, 2013; Andrade et al., 2016). Some studies focus more specifically on households' expectations and emphasize that deviations from perfect information can lead to sluggish adjustment to news (Carroll, 2003; Armantier et al., 2016; Fuhrer, 2018), overadjustment to dispersed information (Bordalo et al., 2020) or to salient prices (Cavallo et al., 2017; D'Acunto et al., 2019d), or dependence on historical inflation experiences (Malmendier and Nagel, 2016). D'Acunto et al. (2019a,b,c) show that cognitive constraints, as proxied by IQ, matter for how households form and react to their inflation expectations. With respect to this literature, we emphasize the complementary mechanism by which agents, no matter their type, make decisions based on their broad view of future inflation. We also show that such discretization of beliefs has important implications for the effects of monetary policy.

Discretization has received important theoretical foundations based on rational inat-

tention (Matejka, 2015; Matejka and McKay, 2015; Caplin et al., 2018; Stevens, 2019; Jung et al., 2019). Lab experiments confirm this type of behavior for price setting decisions (see Khaw et al., 2017, for such evidence). As far as we know, our paper is the first to provide evidence of such discretization in surveys of macroeconomic expectations.

Our paper also contributes to the literature using surveys of households to assess whether policies aimed at increasing expected inflation are expansionary or not. On the one hand, Bachmann et al. (2015) and Burke and Ozdagli (2013) find a weak negative or no impact of US households' inflation expectations on durable consumption. On the other hand, D'Acunto et al. (2016) find that higher inflation expectations among German households driven by large pre-announced VAT hikes increased durable consumption, Vellekoop and Wiederholt (2019) show that Dutch households save less when they expect more inflation, and Crump et al. (2018) find that individual US households' expected consumption growth reacts negatively to their inflation expectation.[7] Finally, Coibion et al. (2019a) show that an exogenous shock on expected inflation leads Dutch households to reduce their durable consumption—consistent with a stagflation logic, higher expected inflation is associated with lower expected income and thus with lower current consumption.[8] We find evidence that increasing inflation expectations can be expansionary if a larger share of households expect that prices will increase rather than stay the same.[9]

Finally, our work is connected to the literature rationalizing why the inflation expectation channel is much less potent in the data than in models with sticky prices, complete markets, or rational expectations with perfect information (see Del Negro et al., 2015). These include models with limited adjustment of inflation expectations to news due to informational and cognitive constraints (Mankiw and Reis, 2002; Gabaix and Laibson, 2002; Sims, 2003; Woodford, 2003; Reis, 2006; Mackowiak and Wiederholt, 2009; Alvarez et al., 2012; Wiederholt, 2015; Angeletos and Lian, 2018; Andrade et al., 2019; Garcia-

[7] Ichiue and Nishiguchi (2015), Dräger and Nghiem (2020) and Duca-Radu et al. (2020) report similar results for Japan, Germany, and the euro area.

[8] See also the recent contribution of Nunes and Park (2020). Another mechanism generating such a negative impact is Knightian uncertainty on future inflation, as Binder (2017) and Michelacci and Paciello (2019a) emphasize in their study of US and UK households.

[9] Consistent with the findings of Crump et al. (2018), our results also imply that the growth rate of consumption declines when the share of households with expected positive inflation increases as we control for expected future individual durable consumption in our regression analysis.

Schmidt and Woodford, 2019; Gabaix, 2020), limited intertemporal substitution due to non-diversifiable idiosyncratic risk and credit constraints (McKay et al., 2016; Kaplan et al., 2018; Auclert, 2019), a combination of the two (Farhi and Werning, 2019), or decisions under Knightian uncertainty (Michelacci and Paciello, 2019b).[10] We provide survey evidence that discretization is an important dimension of the causal model households use to map their inflation expectation into their economic decisions.

2 Data

This section presents the main features of the French survey's individual data that we use in this paper.

2.1 General design and sample

We use the underlying individual data from the monthly consumer confidence survey conducted by the Institut National de la Statistique et des Etudes Economiques (INSEE), the French public statistical agency. This survey is part of the harmonized European household confidence indicators released by the European Commission for all countries in the European Union. The microdata we use were collected at a monthly frequency over the period January 2004 through December 2018.[11] Every month, about 2,000 interviews are carried out via phone calls. Every household is surveyed during three consecutive months, so our data set contains a limited panel dimension. Every month, a new sample of households is surveyed (about 1,100 new calls) to replace households departing the survey after three interviews and to replace households that do not respond to the second or third interview request. The sample is designed by INSEE to be representative of the overall French population (sampling weights are calculated by the size of city in which the respondent lives, respondent's age, household composition, occupation, socio-professional category, education level). Overall, our sample contains a little more than

[10] The literature on imperfect information often focuses on households and wedges in the Euler equation. Coibion et al. (2018a) provide empirical evidence of information constraints for firms. See Afrouzi (2020) for a recent theoretical analysis of the wedges in the Phillips curve that these constraints imply.

[11] Before 2008, the survey was not conducted in August.

330,000 individual observations over the 15-year period, that is, about 2,000 observations per month on average. The total number of households surveyed is about 160,000; 42 percent were surveyed three times, 25 percent were surveyed twice, and 33 percent only once.

The questionnaire contains a little more than 20 questions. Most of these questions are about households' qualitative perceptions of the current and future macroeconomic situations, their quality of life, unemployment, and the evolution of prices but also on their own financial situation and their saving and consumption behavior or intentions. In addition, during the first interview, households provide socio-demographic information (such as age, education level, income, employment status, gender, etc.) and information about the household's composition. The full questionnaire is reported in Appendix C.

2.2 Expected inflation and consumption decisions

Our empirical analysis focuses mainly on two types of questions in the survey: (1) households' expectations about future inflation over the next 12 months and (2) households' purchases of durable goods.

Expected inflation The survey asks two types of questions about households' inflation expectations. First, households are asked to provide a *qualitative* answer on the expected evolution of prices:

Question 1. *In comparison with the past 12 months, how do you expect consumer prices will develop in the next 12 months? They will...*

1. *Increase more rapidly,* ***2.*** *Increase at the same rate,* ***3.*** *Increase at a slower rate,* ***4.*** *Stay about the same,* ***5.*** *Fall,* ***6.*** *Don't know.*

In what follows, we will refer informally to the answer "stay about the same" as the expectation of stable prices. Second, households are asked to give their *quantitative* estimation (in percentage) of expected inflation:

Question 2. *By what percentage do you think consumer prices will go up/down over the next* 12 *months? Consumer prices will increase/decrease by XX.X percent.*

An important comment to make is that households answering "stay about the same" to the qualitative question are not asked about their quantitative estimation of expected inflation. Following the practice with this survey, we impute a 0 percent inflation rate for these households to the quantitative question.[12]

This imputation oversamples households answering "0" to the quantitative question on expected inflation. Indeed there is no missing quantitative value for households answering "stay about the same" to the qualitative question (since these households are not asked to answer this question), whereas there is a significant proportion of non-response for the other qualitative answers. To correct for this oversampling of households answering "0" among all households answering the quantitative question, we estimate a model of the determinants of the non-response using information on the characteristics of households that do not respond to the quantitative question but do respond that prices are going to increase (Table D.2 in Appendix D.1). Using these estimates, we calculate for each household answering "stay about the same" the estimated probability of non-response to the quantitative question on expected inflation conditional on its observed characteristics. We then replace "0" with missing values for households with the highest estimated probability of a missing observation so that the response rate for the quantitative expected inflation associated with the answer "stay about the same" is similar to the ones observed for other answers to the qualitative question.

Importantly, the French survey also contains similar qualitative and quantitative questions about households' perceived inflation over the preceding 12 months. In particular, the qualitative question is:

Question 3. *How do you think consumer prices have evolved over the last 12 months? They have...*

1. *Risen a lot,* ***2.*** *Risen moderately,* ***3.*** *Risen slightly,* ***4.*** *Stayed about the same,* ***5.*** *Fallen,* ***6.*** *Don't know.*

If the answer to Question 3 is not "stayed about the same,"—as with Question 2, we impute 0 percent for these households—households are asked the following quantitative

[12]See footnote 8 in Arioli et al. (2017). We further discuss the impact of this imputation in Section 3.2, and we provide some robustness results for other imputations in Appendix E.3.

question:

Question 4. *By what percentage do you think consumer prices have gone up/down over the past 12 months? Please give an estimate. Record up to one decimal place.*
Consumer prices have increased/decreased by XX.X percent.

Durable goods The survey asks questions about households' *own* individual consumption and about their perception of *general* consumption of durable goods. More precisely, the survey asks a question on households' *own* consumption:

Question 5. *Have you made any major purchase over the last 12 months? (washing machine, refrigerator, furniture, dishwasher, etc.)*

1. *Yes,* ***2.*** *No,* ***3.*** *Don't know.*

The survey also asks a question about whether the household thinks it is the right time for people in general to make major purchases of durable goods. The exact wording is as follows:

Question 6. *In view of the current general economic situation, do you think now is the right time for people to make major purchases (such as furniture, washing machines, electronic or computer equipment, etc.)?*

1. *Yes, now is the right time,* ***2.*** *It is neither the right time nor the wrong time,* ***3.*** *No, it is the wrong time,* ***4.*** *Don't know.*

As noted, the survey asks households about their consumption of durable goods and more specifically "major purchases" of furniture, washing machines, electronic or computer equipment. The answers to the question are only qualitative, so we are able to observe whether households have decided to adjust their stock of durable goods (beyond depreciation), but we are not able to observe the amount of money spent by households.

Surveys used in several recent works assessing the impact of households' inflation expectations on households' consumption decisions often provide information only on whether households think that the time is the right time to make purchases of durable goods (see Bachmann et al., 2015; Duca-Radu et al., 2020). Questions on households' own durable consumption are used by Dräger and Nghiem (2020) among others and

can also be found in the Japanese survey (see Ichiue and Nishiguchi, 2015) but only in terms of growth rates. The New York Fed survey asks about quantitative growth rate of households' own overall consumption (see Armantier et al., 2016; Crump et al., 2018). In what follows, we use both qualitative variables as proxies for consumption.

2.3 Summary statistics

Let us briefly describe some summary statistics on the average inflation expectations and the decision to consume durable goods.

Inflation expectations Figure 1 plots the average and the median inflation expectations (calculated date by date over all households) and the actual headline inflation rate. This figure illustrates two well-known facts in the literature: Inflation expectations (1) overestimate the actual inflation rate, but (2) they are strongly correlated with it.

More precisely, Table 1 reports the average expected inflation rates: The average inflation expectation is 2.8 percent, whereas the average inflation rate over the sample period is about 1.5 percent. The correlation between the average expected inflation rate and the actual headline inflation rate is about 0.8.[13]

Finally, let us note that inflation expectations are also asymmetric in the French survey: A very small share of households reports negative inflation rates (about 1 percent of all households; see Table D.3 in the Appendix), and the share of negative inflation remains quite constant over time.

Durable consumption decisions Let us briefly describe the durable consumption variables. We report some summary statistics in Table 2.[14]

Only a minority of households made major purchases over the preceding 12 months (about 31 percent). A similar observation can be made for households on their opinion about the right time to make large purchases (15 percent of households believe it is the

[13]The overestimation is much smaller when we consider the median expected inflation instead of the mean, suggesting that few but very large inflation expectations contribute a lot to this overestimation when we use the mean expected inflation rate.

[14]See Appendix F for the connection between durable consumption and total consumption.

right time to make major purchases).[15]

Furthermore, the fraction of households answering that they made major purchases is positively correlated with the annual growth of consumption (see also dynamic correlations in Appendix D.3). This is consistent with the fact that a large share of aggregate consumption variations comes from variations in the frequency of purchases of durable goods, as emphasized in Berger and Vavra (2015).

3 The extensive margin of inflation expectations

In this section, we establish a set of new, stylized facts about the heterogeneity of inflation expectations. First, a large share of households expects prices to "stay about the same." Second, the variations of the average inflation expectations are mainly driven by the variations of this share of households expecting prices to "stay about the same"—that is, by variations in the *extensive margin*. Like aggregate inflation expectations, the extensive margin is well correlated with inflation: When inflation is higher, a smaller share of households expects prices to remain stable. In contrast, the intensive margin—the variations of the average of inflation expectations of households expecting positive inflation—is of less importance.

3.1 A large share of households expect prices to "stay about the same"

Let us first look at the cross distribution of inflation expectations as plotted by Figure 2. We can make different observations. The first one is that, despite actual inflation being between –1 and 4 percent with a mean of 1.5 percent over the time period of the sample, inflation expectations show much more dispersion in the cross section. However, despite

[15] Appendix Table F.1 reports some simple statistics on households' actual spending on durable goods (including home appliances, TVs, computers, phones, and furniture, but excluding cars) in France for the years 2005 and 2011 (overall and by product category—based on the household consumption survey). Only 60 percent of households report durable spending. Among households reporting durable spending, the median amount is a little less than 750 euros. This implies that about 30 percent of households report durable consumption of more than 750 euros (which would correspond to the threshold for "large purchases" in the household survey).

this heterogeneity, about one-third of households report that they expect prices "to stay about the same" (that is, zero inflation). There are also peaks in the distribution for values of expected inflation equal to 5, 10, 15, and 20, but the sum of all these peaks corresponds to a little more than 20 percent of the answers.

Fact 1 (Heterogeneity)**.** *Inflation expectations are heterogeneous, but a large fraction of households expect stable prices.*

Who answers that they expect prices to "stay about the same"? The short answer is that it can possibly be everyone, regardless of age, education, gender, or income, with some quantitative differences: Relatively fewer households that are more educated and higher-income tend to answer that they expect stable prices. We report more details on these findings in Appendix E.2.

3.2 Fluctuations in the extensive margin explain a lot of the fluctuations in the average expectation

We now investigate how fluctuations in the share of households expecting prices to "stay about the same"—which we call the *extensive margin* of inflation expectations—contribute to the overall evolution of the average inflation expectation. We compare this with the contribution of fluctuations of the average expectation of households reporting non-stable prices—the *intensive margin* of inflation expectations. In this exercise we follow the survey in the sense that we assume that households answering that they expect prices to "stay about the same" literally expect zero inflation over the next year. We relax this assumption below. The decomposition we rely on was introduced by Klenow and Kryvtsov (2008) in the literature on micro-price data.

Baseline result More precisely, let $\pi^e_{i,t|t+1}$ denote individual i's inflation expectation at date t for date $t+1$, and let I_{it} be an indicator variable verifying $I_{it} = 1$ if $\pi^e_{i,t|t+1} > 0$ and $I_{it} = 0$ otherwise. The average of individual expectations, $\pi^e_{t|t+1} = \frac{1}{n_t}\sum_{i=1}^{n_t} \pi^e_{i,t|t+1}$,

can be decomposed into two components:

$$\pi^e_{t|t+1} = fr_t \times dp^e_{t|t+1},$$

with $fr_t = \left(\frac{1}{n_t}\sum_{i=1}^{n_t} I_{it}\right)$, the fraction of households with positive inflation expectations, and with $dp^e_{t|t+1} = \left(\sum_{i=1}^{n_t} I_{it}\right)^{-1}\left(\sum_{i=1}^{n_t} \pi^e_{i,t|t+1}\right)$, the average among households having non-zero inflation expectations.

Using a first-order approximation around the average inflation, we can decompose fluctuations in the average inflation expectation of households into changes in both the extensive and the intensive margins:

$$\pi^e_{t|t+1} - \overline{\pi}^e = \underbrace{\left(fr_t - \overline{fr}\right)\overline{dp}^e}_{extensive} + \underbrace{\left(dp^e_{t|t+1} - \overline{dp}^e\right)\overline{fr}}_{intensive} + O(t).$$

Figure 3 plots the result of the decomposition between these two margins: The extensive margin matters a lot for variations of the aggregate inflation expectation, in particular when the average inflation expectation is below its long-run average.

From this expression, we can write the contribution to the variance of aggregate expected inflation $\pi^e_{t|t+1}$ of the intensive and the extensive margins as well as the co-movement between the two:

$$V\left(\pi^e_{t|t+1}\right) = \underbrace{V\left(dp^e_{t|t+1}\right)\overline{fr}^2}_{intensive} + \underbrace{V\left(fr_t\right)\overline{dp^e}^2 + 2cov\left(fr_t, dp^e_{t|t+1}\right)\overline{dp^e fr}}_{extensive}.$$

Table 3 reports results of this decomposition. The extensive margin accounts for about 75 percent of the total variance of the average inflation expectation, with 50 percent coming from the mere variance of the share of households in the survey answering that they expect stable prices.

What does "stay about the same" mean? In the following paragraphs, we provide some motivation for our imputation as well as some robustness of our decomposition results when we adopt alternative imputing choices.

As we detailed above, in the French survey, there are no quantitative inflation expectations for households answering that they expect prices will "stay about the same." We input a 0 for these households, following the practice with this survey (see Arioli et al., 2017). From our point of view, we understand that this statistical treatment is motivated by the fact that households are first asked about their qualitative views on future inflation and that a decline in prices or a mild increase in prices is in the menu of what they can answer.[16] So households reporting that they expect prices to "stay about the same" expect an inflation rate that is close enough to zero that it can arguably be proxied by zero.[17]

In Table 3, we confirm our results by using other imputed values for households answering that they expect prices will "stay about the same" (in Appendix E.3, we provide more details on how to obtain this table and other robustness checks). We observe that the average inflation expectation increases with the imputed value, while the variance and the contribution of the extensive margin decrease. However, we find that even when imputing an inflation of 2 percent for households expecting that prices will "stay about the same," the extensive margin still accounts for more than 50 percent of the fluctuations of average inflation expectations. Overall, our main result is quite robust to the imputed value used for "stay about the same," and the contribution of the extensive margin cannot be neglected to assess the variations of inflation expectations.

In the end, this leads to the following stylized fact:

Fact 2 (The contribution of the extensive margin)**.** *A large share of the adjustment in the average inflation expectation comes from the change in the share of households expecting stable prices (the extensive margin); changes in the average expectation of households reporting positive inflation (the intensive margin) contribute much less.*

[16] We report in Table D.3 in the Appendix for each answer to the qualitative question some moments of the distribution of answers to the quantitative question.

[17] In an additional survey conducted in September 2007 by INSEE on a small sample of households, households answering that they expect prices will "stay about the same" were asked about their quantitative inflation expectation. A majority expected 0 percent inflation.

3.3 Variations in the extensive margin are not just random

Variations in the extensive margin are not pure noise. As Table 1 illustrates, the correlation between the actual inflation rate and the proportion of households expecting stable prices is about –0.7. This is stronger than the correlation between realized inflation and the average non-zero inflation expectation (the intensive margin), which equals 0.6.

Figure 4 plots the average proportion of "[prices] stay about the same" answers against inflation. Interestingly, the relation is quite nonlinear: The proportion of households answering that they expect prices will "stay about the same" decreases quickly when the actual inflation rate goes from 0 percent to 2 percent, but for higher levels of inflation, the curve is flatter. By contrast, the average non-zero inflation expectation is rather flat for inflation between 0 percent and 2 percent, whereas it increases quite sharply when inflation is above 2 percent.

Table 3 further illustrates that the extensive margin matters more in a low-inflation environment. It reports the contributions of the extensive and the intensive margins to the variations in the average inflation expectation in low- and high-inflation regimes, that is, when inflation is respectively below and above median inflation over our sample. While 50 percent of this overall variation comes from the mere variance of the share of households answering that they expect prices will "stay about the same," this latter contribution accounts for 64 percent in low-inflation periods but only 35 percent in high-inflation periods. Overall, the contribution of the extensive margin to the variance of inflation is about 90 percent in a low-inflation environment (versus about 60 percent in a higher-inflation environment).

Fact 3. *The extensive margin is negatively correlated with realized inflation and increases more for low-inflation realizations.*

Overall, the lower the inflation rate, the more households expect prices to remain stable, the more the extensive margin contributes to the average expected inflation, and the more the extensive margin reacts to realized inflation. Finally, note that in Appendix E.2, we provide evidence that the correlation between realized inflation and the extensive margin holds true for any type of household (gender, income, age, etc.).

4 The extensive margin of inflation expectations and consumption decisions

In this section, we investigate how households relate their consumption decisions to their inflation expectations. For that, we use cross-sectional differences between households in terms of consumption decisions and inflation expectations. Our main finding is that, in the cross section, variations in the extensive margin of the consumption of durable goods are significantly related only to variations in the extensive margin of inflation expectations. Our findings are robust to using different measures of consumption decisions.

4.1 A discrete choice model of durable consumption

Theoretical setup We assume that consumption of durable goods is subject to fixed costs such that the adjustment of the stock of durables is a discrete variable. This is consistent with our data, since one-third of the respondents declare they bought durables over the preceding year. In this section, we provide only some key insights on how expected inflation affects durable consumption in a model with fixed adjustment costs and refer the reader to Appendix A for a full description of the model.

Let $d_{i,t-1}$ be household i's initial stock of durables and $d^*_{i,t}$ its desired stock of durables absent adjustment costs. The decision to buy durable goods between $t-1$ and t, $b_{i,t}$ is a binary process that follows:

$$b_{i,t} = \begin{cases} 1 & \text{if } z^*_{i,t} > 0 \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

with $z^*_{i,t}$ a latent variable that compares the opportunity cost of not adjusting—given by the gap between the desired stock of durables $d^*_{i,t}$ and the existing stock $(1-\delta)d_{i,t-1}$, with δ being the depreciation rate—with the adjusting cost κ_i, which potentially differs across individuals.

We assume that the optimal quantity of durable goods $d^*_{i,t}$ is a function of households'

expectations and individual characteristics:

$$d^*_{i,t} = f\left(c^e_{i,t|t+1},\, rr^e_{i,t|t+1};\, x_{i,t}\right) = f\left(c^e_{i,t|t+1},\, r_{i,t} - \pi^e_{i,t|t+1};\, x_{i,t}\right), \tag{2}$$

where $c^e_{i,t|t+1}$ is household i's expected own total consumption; $rr^e_{i,t|t+1}$ is household i's perceived ex ante real rate, which is equal to $r_{i,t} - \pi^e_{i,t|t+1}$, with $r_{i,t}$ the nominal interest rate perceived at date t; and $x_{i,t}$ denotes individual observable characteristics. Here, inflation expectations play a role, as they impact the perceived real rate.

Note that this setup can accommodate imperfect information, as we do not make any assumption on the information set of households.

Empirical specification We estimate the marginal effect of individual i's expected inflation, $\pi^e_{i,t|t+1}$, on their individual consumption decisions as observed in the survey of households.

For the decision variable $b_{i,t}$, our data set provides two measures that are widely used by the literature.

First, we consider individuals' *own* decisions to make major purchases (answers to Question 5) as our dependent variable. This gives us information on whether household i bought some durable goods over the past year (between $t-1$ and t).

Second, we consider as an alternative measure of consumption whether households think that it is the right time to consume durables (answers to Question 6).

Remark (Proxies for consumption)**.** *It is important to note that both proxies for consumption have pros and cons.* $b_{i,t} = 1$ *in our setup means that households have* ***currently*** *modified their* ***own*** *stock of durables. Question 6 does better on the first dimension, as it is about the current view of households. Question 5 does better on the second dimension, as it is about households' own consumption, but performs less well on the first dimension, as it is about the consumption over the preceding 12 months.*

Moreover, we postulate that the latent variable $z^*_{i,t}$ follows:

$$z^*_{i,t} = \alpha + \beta \pi^e_{i,t|t+1} + \gamma X_{i,t} + \lambda_t + \mu z_i + \epsilon_{i,t}, \tag{3}$$

with $\pi^e_{i,t|t+1}$ being the inflation expectation formed at date t by household i over the next year (between t and $t+1$) (Questions 1 and 2). X_{it} is a set of controls that includes households' answers to other questions on the macroeconomic environment (unemployment, general French economic situation [past and future], living standard in France [past and future]) and to questions on their personal plans (plan for buying durable goods), their ability to save, and their financial situation (past, current, and future). We also include households' inflation perceptions over the preceding year, π^p_{it}. λ_t are fixed time effects controlling for all aggregate variations, and z_i is a set of household observed controls such as age, composition of the household, occupation, income, working regime, education, gender, region, and city size.[18]

Finally, we estimate this probit model via a maximum likelihood technique, and standard errors are clustered at the month level.

Controlling for potential endogeneity We do not have exogenous variations in $(\pi^e_{i,t|t+1})$, so we cannot be sure that a positive correlation with consumption decisions $(z^*_{i,t})$ does not stem from omitted variables correlated with both variables. That being said, we can control for three important potential endogeneity problems.

To start with, households that decide to consume more can also expect other households to consume more, thus pushing up inflation and inflation expectations. Likewise, households that recently decided to buy might pay more attention to inflation than other households do and, because inflation is persistent, declare a higher expected inflation than other households. We can attenuate these endogeneity biases by controlling for individuals' perceived inflation.[19]

Households that are willing to consume potentially may pay more attention to future inflation. Controlling for perceived inflation is also a way to account for this. We provide evidence in Appendix G.1 that households consuming more do not necessarily pay more attention to future inflation. More precisely, we show that the forecast errors on inflation—which are arguably a measure of the degree of attention to future inflation—

[18] In our baseline regression, we do not introduce unobserved household heterogeneity. Below, we discuss how we can introduce household effects u_i to use the very short panel dimension of the data.

[19] Note that perceived inflation is correlated with expected inflation in the survey, as is also pointed out by Montag (2019).

between households that consume durables and those that do not consume durables do not differ statistically significantly.

Additionally, higher inflation expectations could be associated with shocks that also affect (positively or negatively, depending on the shock) households' future income, hence current consumption. To address this potential reverse causality issue, we control for consumption plans. We also control for households' expected own financial situations as well as expected future macroeconomic expectations.

Finally, because of monetary policy, higher expected inflation could be correlated with different perceptions of the nominal interest rate, which would also affect durable consumption choices. We address this concern by controlling for households' subjective views on whether it is a right time to save, which is related to the nominal interest rate (see Appendix Figure F.2).[20] We also estimate the link between consumption and inflation expectation over the effective lower bound period assuming households did not expect any central bank reaction to inflation at that time.

4.2 What matters for adjusting durable consumption

We now report our results for the two variables connected to consumption decisions. More precisely, Table 4 reports the results for the answers to Question 5 on household purchases of durable goods over the preceding 12 months, and Table 5 reports the results for the answers to Question 6 on "right time to purchase." Overall, we find qualitatively similar results for both questions. This shows that our results on the importance of the extensive margin does not hinge on the specific question on consumption that we use.

In particular, we report marginal effects corresponding to a positive decision to make purchases obtained from this model.[21] Marginal effects should be read as the effect (in percentage points) of a 1 percent deviation of an exogenous variable on the probability

[20] Note that the right time to save also may be interpreted as a measure of the willingness to save. In this view, this variable can be simply negatively correlated with consumption for the same reason that savings can be negatively correlated with consumption. As will become clearer, this control is not critical to obtaining our results.

[21] Marginal effects are computed from estimates of the probit model for the question on household purchases over the preceding 12 months and from estimates of an ordered probit for the question on the right time to make large purchases.

of answering positively about making major purchases in the preceding 12 months. In these tables, we use the quantitative answer for inflation expectations (Question 2).

If we consider all answers to the question about inflation expectations (even implausible ones), we find no significant effect of expected inflation on the decision to buy durable goods (column 2 of Table 4). This motivates us to look for the effects of both the extensive and intensive margins, which we find to be relevant in accounting for the fluctuations of aggregate inflation expectation.

The extensive margin matters When we focus on the intensive margin (that is, restricting our sample to households expecting a non-zero inflation—column 3 of Tables 4 and 5), the connection between inflation expectations and durable consumption is very small and not significant. In contrast, when we look at the extensive margin (that is, use as a regressor a dummy variable that equals 1 when expected inflation is positive—column 4 in Tables 4 and 5), we find a strongly significant connection. When households expect prices to increase, their probability of making large purchases increases by about 1 percentage point.

The intensive margin does not To investigate the effects along the intensive margin of inflation expectations, we recode the quantitative variable into a qualitative variable taking six values: below 0 percent, 0 percent, between 0 percent and 3 percent, between 3 percent and 5 percent, between 5 percent and 10 percent, and higher than 10 percent. We find (column 5 in Tables 4 and 5) that the effect of higher inflation expectations is not different when the household's answer is a value between 0.5 percent and 3 percent or a value between 5 percent and 10 percent. When households report a positive inflation expectation—a value between 0 percent and 10 percent—their probability of making large purchases is higher by about 1 percentage point compared with when they report a zero inflation expectation. Finally, an answer with a value higher than 10 percent has the same effect on consumption decisions as an answer indicating an expectation of stable prices.

As a robustness check, we run the same regressions with the two consumption variables

but with finer brackets. The results are reported in Figure 5. Looking at finer brackets also allows us to observe that the absence of effects along the intensive margin is not driven by any particular value of inflation expectations.

The role of outliers We also estimate the baseline regression for answers indicating expectations of inflation lower than 10 percent (column 6 in Tables 4 and 5).[22] More precisely, we still consider the quantitative inflation expectation, but in interaction with a dummy variable equal to 1 if the inflation value is below 10 percent. We find a positive and significant effect of expected inflation on the decision to buy durable goods. As shown in Figure 5, the positive effect obtained for answers indicating expectations of inflation lower than 10 percent is driven by the extensive margin.

Do other regimes matter? To confirm our findings, we consider the qualitative answer for inflation expectations (Question 1).[23] The results are reported in Table 6. Here we focus on Question 5 on household purchases of durable goods over the preceding 12 months.

The previous results hold when we extend the sample to households reporting only qualitative answers to the inflation expectation questions. We first consider a dummy variable equal to 1 if the household's answer to the question on future development of inflation is that that they expect prices to "stay about the same." We find that when a household expects something different from "stay about the same," they are more likely to make major purchases. In that case, the probability of making major purchases is higher by about 1 percentage point compared with when the household answers "stay about the same."

Second, when taking into account the five different answers to the qualitative question (Question 1), we do not find a monotonic relationship. Overall, the main effect of inflation expectations on durable consumption comes through an extensive margin of inflation

[22] In Appendix Table D.2, we report results on the determinants of households answering that their inflation expectations are higher than 10 percent. Low-income households, less educated households, and younger people are more likely to answer that their inflation perception/expectation exceeds 10 percent.

[23] Table D.3 in the Appendix reports the connections between the qualitative and quantitative questions.

expectations. Households are more likely to consume when they expect non-stable prices, but the propensity to consume is less sensitive to the value of inflation when they expect a positive inflation rate.

But these differences are of second order compared with the difference between expecting stable prices or positive inflation. So, even if households think there exists different sub-regimes in the positive inflation regime, the distinction that really matters when it comes to consumption decisions is between the "[prices] stay about the same" regime and the positive inflation regime.

Heterogeneity across households Finally, we investigate how Fact 4 differs depending on households' characteristics (results are reported in Appendix G.2). Overall, if we find a stronger effect of inflation expectations for higher-income, older (but not too old), and more educated households, we do not find a different pattern for these households. There is no statistically significant difference between men and women. In contrast, for younger, less educated, and lower-income—in the bottom quartile of the income distribution—households, inflation expectations do not necessarily have a statistically significant effect on durable consumption.[24]

This suggests that our findings are not driven by individuals with lower cognitive abilities—insofar as we are able to measure them by proxies such as education[25]—as our findings also apply to arguably more able households. Another piece of related evidence is that we do not observe any specific patterns at 5 percent for inflation expectations in Figure 5.[26]

Main fact Overall, there is some link between inflation expectations and the decision to consume durables, but only when households' inflation expectations shift from stable

[24]Let us note that the precision of households' expectations about inflation is correlated with their use: Younger, less educated and/or lower-income households have less precise expectations and they use them less for consumption decisions. For these households, it is less valuable to form accurate expectations. On the other hand, as they are less educated, their ability to form precise expectations may also be more costly.

[25]See D'Acunto et al. (2019a,b,c) for a discussion of such proxies and the role of IQ in informational frictions.

[26]Rounding, for example, at 5 percent can be indicative of less precise inflation expectations, potentially associated with lower cognitive abilities.

prices to positive inflation.

In the end, the following fact summarizes our findings:

Fact 4. *The extensive margin of individual inflation expectations is positively linked with individual durable consumption decisions. In contrast, durable consumption does not vary with the intensive margin of inflation expectations in a statistically significant way.*

Another way to phrase Fact 4 is that the decision to consume durable goods is uniform across households expecting positive inflation, as shown in Figure 5. Households then do not seem to give value to the exact level of inflation expectation that they report, provided that it leads to non-stable prices.

Indeed, in models featuring durable consumption subject to fixed costs, as in, for example, Berger and Vavra (2015) or McKay and Wieland (2019), the extensive margin of durable consumption is decreasing with the real interest rate. If agents do put value in their exact level of inflation expectation, under the assumption that households share the same perception of current nominal interest rates, Fact 1 implies that agents should have very different perceptions of the real rate (with a difference of more than 7 percent). Households should then have very different levels of willingness to consume durables, but this is not what we observe in Fact 4.

Going back to the model Let us reinterpret our findings through the lens of our consumption model—equation (2). For this purpose, let us rewrite the willingness to consume durable goods but with a modified dependence with respect to inflation expectations:

$$d^*_{i,t} = f\left(c^e_{i,t|t+1},\, r_{i,t} - g(\pi^e_{i,t|t+1});\, x_{i,t}\right), \tag{4}$$

where $g(.)$ is a function. A function that would make Equation (4) consistent with Fact 4 is:[27]

$$g(\pi) = \bar{\pi}_i 1_{\pi>0} \text{ with } \bar{\pi}_i > 0.$$

[27] An alternative using the qualitative question is $g(Answer) = \bar{\pi}_i 1_{Answer \neq \bar{\pi}}$ prices stay about the same, with a constant $\bar{\pi}_i > 0$.

$\bar{\pi}_i$ is a constant that is specific to an individual but does not depend on time nor on business cycle conditions.

In Appendix B, we provide an interpretation of such a function based on information-processing costs.[28] More precisely, we show that when it is unconditionally very likely that prices remain constant and information-processing costs are sufficiently large, it is optimal to focus on such approximation of inflation.

5 Further results

In this section, we further qualify our results. To start with, we discuss the importance of the set of controls that we use in our benchmark regression. Second, we provide further evidence on the impact of inflation expectations across years, households, and for another large euro area country (Germany) and the United States.

5.1 The role of controls

Which controls in our benchmark regression results reported in Table 4 are important for our baseline result? To address that question, we decompose our baseline estimate by progressively including controls about perceived and expected own and macroeconomic variables: future consumption, the intention to save, perceived inflation, expected business cycle conditions, and finally, expected business cycle conditions and unemployment.

Table 8 reports the results. Interestingly, when removing every control about the future macroeconomic outcomes and personal situation, we obtain results that are consistent with those of Coibion et al. (2019a): Expected inflation has a negative impact on durable consumption. This is consistent with the stagflation view of inflation whereby higher future inflation is associated with worse perceived economic conditions and prospects. As a consequence, policies that aim at more accommodation by increasing expected inflation must be perceived as being expansionary instead of detrimental to the

[28] In contrast, the evidence reported in Appendix G.1 shows that attention does not vary with households' decisions, which suggests that limited attention is not the main driving force of the dispersion of consumption decisions and inflation expectations.

economic situation in order to be effective.[29]

Adding controls progressively reveals that expected future consumption contributes 20 percent of the effect of the extensive margin. Adding the expected financial situation increases the contribution to 60 percent of the total impact. While controlling for past and current financial situation increases it to 70 percent of the total effect. Finally, adding controls for the expected macroeconomic conditions (business conditions and unemployment) accounts for another 30 percent of the total effect. This means that the interest rate control does not add much to all of this, probably because if agents think this is an important determinant of macroeconomic outcomes they already incorporate the central bank reaction into their macroeconomic forecasts.[30]

Another interesting result is that adding controls reduces the negative effect of the intensive margin. This becomes non-significant, again showing that higher inflation expectations are seen as bad macroeconomic news.

5.2 Panel regressions

In our benchmark regressions, we use the cross section of households to identify the effects of inflation expectations on households' decisions to consume. In this subsection, we provide further evidence using the (short) panel dimension of our data set.

There are several challenges to using this panel dimension. First, households are interviewed only three times and during consecutive months. Moreover, households may not answer when they are contacted for the second or the third interview (in our sample only

[29] Another related challenge is that forward guidance policies might be interpreted as bad news that the trap will last longer than expected. For instance, Andrade et al. (2019) show that US forward guidance announcements led some households to revise downward, instead of upward, their inflation and growth expectations.

[30] One can also show that none of these controls is critical for our results: When removing one of these regressors from the benchmark regression, we obtain, at most, small and weakly significant differences. For example, without controlling for perceived inflation, the coefficient in the regression is larger, which is consistent with the endogeneity bias resulting from the fact that agents consuming more experience higher prices and may therefore also expect higher inflation. However, controlling for perceived inflation, as we do in our benchmark regression, still leads to a positive and significant relation between consumption and inflation expectations. The same holds true for future consumption. Not controlling for it would lead to overestimating the influence of inflation expectation on consumption. However, here again, taking into account such control still leads to a positive and significant relation between consumption and inflation expectations.

40 percent of households respond three times to the questionnaire). Overall, our panel dimension is very short, which limits the possibility of obtaining consistent and precise panel estimates. Second, the data set does not always report household identifiers, and we use several characteristics of households that are arguably fixed over time (geographical location, year of birth [for head of household and partner], occupation [of household head and partner], household composition, and education) to identify households and reconstruct the panel dimension.

Our main set of regressions consists of probit models with household random effects. We report the results of these regressions in Table 7. The overall picture does not substantially differ from what we obtain with our benchmark regressions. To further confirm these results, we also report in Appendix G.3 the results of logit models with fixed household effects, but only for the qualitative answers to keep the sample sufficiently large. We compare the results with a probit model with households random effects. We also report in this appendix the results of regressions by interview. All these results are consistent and very similar to our benchmark regressions: Households are more likely to consume when they expect "non-stable" prices.

5.3 Additional country evidence

To further check the robustness of our results, we investigate the case of Germany and the United States, using the University of Michigan Surveys of Consumers (US Michigan surveys) for the latter. We also find evidence of qualitative inflation regimes, but we point out that the extension of our results should take into account the potential differences across surveys and their design and the potential difference in inflation regimes that households may expect in different countries.

Germany. We report the results in Appendix H. Unlike the French survey, the German one does not include Question 5 on households' own consumption, only Question 6, on whether it is the right time to make durable goods purchases.

On the set of variables that are common for the two surveys, the results that we obtain are qualitatively—and, to some extent, quantitatively—similar. More precisely,

we also obtain an extensive margin of inflation expectations that responds to business cycle fluctuations and also drives the answer to the question of whether it is the right time to purchase durable goods.[31]

US Michigan survey. Despite important differences between the questionnaires of the French survey and the Michigan survey of US households, we can use the Michigan survey to conduct an empirical exercise that is comparable to our baseline. Like the French survey, the Michigan survey asks whether it is the "right time" to purchase durable goods and also asks qualitative and quantitative questions on inflation expectations. Appendix I provides the results as well as more details about the design of the Michigan survey and further discussion of how it differs from euro-area surveys.

Overall, we also find evidence of discretization such that households consume differently when they expect different inflation regimes. In particular, as with the euro area, we find a key dimension between households expecting 0 percent inflation and those expecting positive but small inflation.

6 Policy implications

The importance of the extensive margin of inflation expectations has several implications. In this section, we clarify these for the missing deflation puzzle, forward guidance, and de-anchoring risk. To do so, we first introduce a New Keynesian (NK) model in which we allow (1) agents to have heterogeneous views about inflation and (2) consumption decisions react only to shifts between 0 percent and strictly positive inflation expectations.

An NK model with heterogeneous and discrete beliefs We illustrate our discussion with simulations of a simple three-equation NK model featuring a zero lower bound (ZLB) constraint and households that are heterogeneous because of their inflation expectations, as in Andrade et al. (2019).

[31] Our results also hold when we exclude the period in which Germany announced a VAT change that exogenously increased inflation expectation at the time; see D'Acunto et al. (2016).

In addition to this heterogeneity across households, we assume that households have discrete inflation expectations and consumption decisions akin to our previous evidence such that:

$$c_{it} = E_t c_{it+1} + \sigma^{-1}(r_t) + \delta_t + dc_{it},$$

with r_t being the nominal interest rate, δ_t a common preference shock, $dc_{it} = dc^+$ if individual i at date t thinks inflation is going to be positive over the next period, and $dc_{it} = 0$ if individual i at date t thinks prices will remain broadly stable. Our setup implies an aggregate Euler equation of the following kind:

$$c_t = E_t c_{t+1} + \sigma^{-1}(r_t) + \delta_t + s_t dc^+,$$

with s_t being the share (in deviation from the steady state) of households that, at date t, expect a positive inflation regime over the next year.

We contrast the reaction of the discrete New Keynesian (DNK) model with the usual NK setup with no heterogeneity that features a standard Euler equation:

$$c_t = E_t c_{t+1} + \sigma^{-1}[r_t - E_t(\pi_{t+1})] + \delta_t.$$

In what follows, we calibrate the model using standard parameter values and compute the equilibrium path for inflation and output under three different scenarios. First, we consider that a deterministic preference shock puts the economy at the ZLB for T_{ZLB} periods and lowers the fraction of households thinking that inflation is positive by $d\overline{s}^-\%$. Then we consider that in addition to this shock, the central bank gives forward guidance that it will keep its interest rate at 0 for a T_{MP} additional period of accommodation and convince a fraction $d\overline{s}^+\%$ of households that inflation is going to be positive. Finally, we investigate the case where, in addition to the preference shock, inflation expectations de-anchor and are at $d\overline{\pi}\%$ below the target (here 0 percent) for the last T_{DA} periods of the ZLB period.

In these exercises, we calibrate the preference shock to $\delta_t = -10\%$ for the periods

when the ZLB is binding and 0 otherwise. We chose $dc^+ = .08\%$, consistent with our estimation results on annual durable goods.[32] We also assume that the intensive margin of durable consumption does not change over time and that non-durable goods do not react to changes in the real interest rate.

Missing deflation Figures 6a and 6b illustrate the reaction of the two economies to a shock putting the economy at the ZLB for 12 quarters and lowering the share of households expecting positive inflation by $d\overline{s}^- = 10\%$ during the trap (which corresponds to a one standard deviation shock in s_t). In the standard NK model, this shock is extremely detrimental. The ZLB constraint induces a deflationary spiral that makes the output contraction and the initial deflation quite dramatic, with a quarterly output loss of more than 10 percent and a quarterly deflation of about 7 percent at impact. This reaction seems to be extreme compared with what happened during the Great Recession. By contrast, the presence of households with discrete views makes this deflationary spiral much less potent, thus the recession induced by the same shock, while significant, is more than two times lower at impact both for inflation and output. This reaction seems much more comparable to what happened during the Great Recession.

From this point of view, the importance of the extensive margin limits the extend to which expected inflation becomes negative in a trap. This is consistent with the fact that individuals' inflation expectations helped to stabilize the economy during the Great Recession, as emphasized by, for example, Coibion and Gorodnichenko (2015).[33]

Forward guidance The importance of the extensive margin for consumption decisions also has implications for monetary policy, as our results draw limits to the expectation channel. In particular, this applies to policies such as forward guidance.

Let us assume that the central bank has the ability to steer households' expectations—

[32] More precisely, our back-of-the-envelope computation is based on Table 4, using the fact that 31 percent of households report a durable good purchase over the preceding 12 months (Table 2).

[33] Note that this mitigation of the inflation expectation channel could be reinforced if one assumes that firms have the same expectation as households, as assumed by, for example, Coibion and Gorodnichenko (2015). In that case, pricing decisions by firms would react only to discrete changes in expected inflation regimes.

which is not a foregone conclusion.[34] As figures 6a and 6b also illustrate, forward guidance on interest rates is much less potent in the model with heterogeneous and discrete beliefs than in the standard NK model. A central bank committing to keep interest rates at 0 percent for four extra periods at the end of the trap has an extremely expansionary impact on the economy. This is the well-known forward-guidance puzzle underlined by, for example, Del Negro et al. (2015).

By contrast, the expectation channel and hence forward guidance are much less potent with discrete beliefs. Note that to be effective, forward guidance policies need to convince a substantial share of households expecting prices to remain stable to switch to a positive inflation regime. The conditions under which such policies will achieve this remain to be explored, but we assume that $d\bar{s}^{+} = 10\%$ for the 12+4 quarters during which interest rates are at 0 percent.

However, an important consequence of discrete inflation expectations is that when households already expect positive inflation, a further increase in their expectations would not translate into more households purchasing durable goods. This finding thus suggests that forward guidance can be effective when it has an impact on the households expecting prices to remain stable. Once all households are out of this regime, there is no possibility of increasing consumption by raising inflation expectations further. More generally, the expectation channel of policies is limited and less powerful: Once it has been used, it cannot be further used. This finding is illustrated in 6a and 6b under the forward-guidance max DNK scenario, which assumes that 100 percent of households expect a positive inflation regime at the end of the trap. This limit in the impact of forward guidance is consistent with McKay and Wieland (2019), who obtain it in a model with sticky prices and adjustment costs on durable consumption.

De-anchoring risk Persistently low realizations of inflation leads to the fear that inflation expectations themselves can adjust downward, thus leading to even lower current realizations of inflation—the de-anchoring risk. Our findings shed some light on this risk.

Figures 7a and 7b illustrate the reaction of the two economies to a shock putting the

[34] Andrade et al. (2019) and Coibion et al. (2019b) discuss the means by which a central bank can affect these expectations and the difficulties of doing so.

economy at the ZLB for 12 quarters and lowering the inflation expectation of households by 2 percent for the last four quarters of the trap. This is extremely detrimental in the NK model, again because of the power of the expectation channel. Somehow this is the reverse face of the same coin as the forward-guidance puzzle.

We contrast that reaction with the one of an NK economy with households with discrete beliefs that on average also have an expectation that is 2 percent lower than steady state for the four last periods of the trap. Given that the average inflation expectation is roughly 3 percent among households reporting positive inflation expectation, this corresponds to an additional drop in the share of households expecting positive prices $s_t = 2/3$.

The figures illustrate that even when the whole de-anchoring is explained by a change in the extensive margin of inflation expectation, the detrimental impact to the economy is much milder than it is in the standard NK model. Yet, the impact of de-anchoring remains significantly detrimental. Importantly, this de-anchoring and the associated depressed aggregate demand can happen even though households do not expect a deflation—a large and persistent share of households may well expect prices to "stay about the same," and average inflation expectations may remain positive.

7 Conclusion

In this paper, we provide new evidence on how households form their inflation expectations and how these expectations matter for their consumption decisions. Our findings point out that what matters in households' inflation expectations is the subjective and broad inflation regime that households expect. More precisely, we show that the most important component in the French survey is the share of households that expect prices to "stay about the same." This extensive margin of inflation expectations is positively related to households' consumption decisions, whereas the likelihood of durable consumption is uniform across households expecting a positive inflation rate. We provide evidence that such findings extend to the German and US surveys. Finally, we draw implications for the expectation channel of monetary policy.

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Tables

Table 1: Simple Statistics on Inflation Expectations

	Aggregate Moments	Correlation with Headline π	Correlation with π excl. Energy
Average Expectation	2.82	0.79	0.48
	(0.64)		
% of Stable Prices	0.33	-0.68	-0.26
	(0.11)		
Average of non-zero inflation	4.15	0.63	0.63
	(0.46)		

Note: this table reports simple statistics calculated using individual answers to the quantitative question on inflation expectations. We first calculate statistics date by date and then compute the average of this time series. The first column reports simple average of the time series. The second and third columns report correlation coefficients of the aggregate moment calculated date by date and the headline HICP inflation (source Eurostat) and HICP inflation excluding energy and unprocessed food (source Eurostat). "Average" is the simple average of all answers (including zeros) to the quantitative question. "% of Stable Prices" is the average proportion of answers exactly equal to 0. "Average of Non-Zero Inflation" is the average of inflation expectations when not equal to 0.

Table 2: Stylised Facts on Durable Consumption

	Frequency	Corr. with consumption	
		Overall	Durables
Right Time to Purchase			
Yes	0.15	0.38	0.44
Neutral	0.51	0.68	0.64
No	0.34	-0.66	-0.67
Own Major Purchases - Past 12 Months			
Yes	0.31	0.45	0.41
No	0.69	-0.45	-0.41

Note: this table reports simple aggregate statistics using the answers to the two questions on durable consumption ("Have you made major purchases during the last 12 months?" and "Do you think it is the right for people to make large purchases?"). We first compute the average proportion of answers for every answer category date by date and then compute the average of these time series. The first column reports the average proportion of answers in a given category. The other columns report correlation over time of the proportion of answers in a given category and annual growth rate of: col. 2, overall monthly consumption (source INSEE); col. 3 durable expenditures (source INSEE).

Table 3: Aggregate Expectation Time Variations: Extensive vs. Intensive Margins

Imputed Value (in %)	Average Agg. Expect.	Var. of Agg. Expect.	Contrib. Extensive	% of Variance Ext.	Freq.
		Baseline			
0 - All sample	2.82	0.41	0.30	73.2	49.4
0 - Low inflation	2.43	0.41	0.36	88.4	64.2
0 - High inflation	3.20	0.42	0.25	58.4	35.0
		Robustness			
0.5	2.98	0.35	0.24	69.0	44.6
1	3.14	0.30	0.19	63.8	39.1
1.5	3.30	0.25	0.15	57.5	32.8
2	3.47	0.21	0.11	49.7	25.7
2.5	3.63	0.18	0.07	40.2	18.2

Note: this table reports simple statistics on the mean and variance of aggregate inflation expectations depending on the average value imputed to households answering that prices will stay about the same (col. 1) and assuming no time variation in the average expectations of these households' answers. Assumption "0" is our baseline scenario. Col. 2 is the average aggregate expectation over time (over all types of answers to the quantitative question, imputed or not). Col. 3 reports the time variance of this average aggregate expectation. Col. 4 reports the contribution of the extensive margin to the overall variance of inflation. Col. 5 reports the relative contribution of the extensive margin to the overall variance (the relative contributions of extensive and intensive margins sum to 100 percent). Col 6. reports the relative contribution of the time variations of the share of answers "stay about the same." See Appendix E.3 for more details.

Table 4: Marginal Effects of Inflation Expectations on Own Major Purchases over the Last 12 Months

	All	Intensive (Excl. 0)	Extensive	All Quali.	All Excl. outliers
π^e	0.005	-0.045			0.226***
	(0.027)	(0.037)			(0.074)
$\pi^e \neq 0$			1.021***		
			(0.337)		
π^e by intervals:					
$[10\%; +\infty[$				0.043	
				(0.574)	
$[5\%; 10\%[$				1.491***	
				(0.462)	
$[3\%; 5\%[$				1.257***	
				(0.492)	
$]0\%; 3\%[$				1.240***	
				(0.417)	
0%				Ref.	
$< 0\%$				-0.258	
				(1.332)	
Controls	Yes	Yes	Yes	Yes	Yes
Obs.	136,574	92,002	136,574	136,574	114,786

Note: this table reports marginal effects (in percentage points) from probit regressions where the endogenous variable is a dummy variable equal to 1 if the household answers "Yes" to the question, "Have you made major purchases during the last 12 months?" Control variables include year and month dummies, household characteristics (age, location [city, region] diploma, job, income), survey wave (1, 2, or 3), answers to other questions on French economic conditions (standard of living, unemployment, etc.), and answers to the questions about future plans for major purchases, right time to save, and perceived inflation. Standard errors are clustered at the date level. *p<0.1; **p<0.05; ***p<0.01.

Table 5: Marginal Effects of Inflation Expectations on Right Time to Purchase

	All	Intensive (Excl. 0)	Extensive	All Quali.	All Excl. outliers
π^e	0.006	-0.021			0.096**
	(0.015)	(0.019)			(0.045)
$\pi^e \neq 0$			0.632***		
			(0.185)		
π^e by intervals:					
$[10\%; +\infty[$				-0.096	
				(0.296)	
$[5\%; 10\%[$				0.790***	
				(0.280)	
$[3\%; 5\%[$				1.176***	
				(0.300)	
$]0\%; 3\%[$				0.848***	
				(0.251)	
0%				Ref.	
$< 0\%$				-0.070	
				(0.821)	
Controls	Yes	Yes	Yes	Yes	Yes
Obs.	134,117	90,566	134,117	134,117	112,676

Note: this table reports marginal effects (in percentage points) from ordered probit regressions where the endogenous variable is a variable taking one of three different values depending on the answer to the question, "Do you think now is the right time for people to make major purchases?": 0 if the household answers "No, it is the wrong time"; 1 if "It is neither the right time nor the wrong time"; and 2 if "Yes, now is the right time." Marginal effects are calculated for the value "Yes." Control variables include year and month dummies, household characteristics (age, location [city, region] diploma, job, income), survey wave (1, 2, or 3), answers to other questions on French economic conditions (standard of living, unemployment, etc.), and answers to the questions about future plans for major purchases, right time to save, and perceived inflation. Standard errors are clustered at the date level. *p<0.1; **p<0.05; ***p<0.01.

Table 6: Marginal Effects of Inflation Expectations on Own Major Purchases over the Last 12 Months: Qualitative Answer

	All Answers - Quantitative		Non-Missing Quantitative Answers	
	(1)	(2)	(3)	(4)
$\pi^e \neq 0$	0.835***		1.021***	
	(0.213)		(0.337)	
Increase more rapidly		1.721***		1.442***
		(0.333)		(0.522)
Increase at the same rate		0.727***		0.924***
		(0.231)		(0.361)
Increase at a slower rate		1.277***		1.339***
		(0.284)		(0.464)
Stay about the same		Ref.		Ref.
Fall		0.821		-0.243
		(0.763)		(1.333)
DK		-0.677		-
		(0.447)		-
Controls	Yes	Yes	Yes	Yes
Obs.	312,921	312,921	136,574	136,574

Note: this table reports marginal effects (in percentage points) from probit regressions where the endogenous variable is a dummy variable equal to 1 if the household answers "Yes" to the question, "Have you made major purchases during the last 12 months?" The first two columns report results for all answers to the qualitative question on expectations. The last two columns report results excluding households with missing observations on the quantitative question on both inflation expectations and perceptions. Control variables include year and month dummies, household characteristics (age, location [city, region] diploma, job, income), survey wave (1, 2, or 3), answers to other questions on French economic conditions (standard of living, unemployment, etc.), and answers to the questions about future plans for major purchases, right time to save, and perceived inflation. Standard errors are clustered at the date level. *p<0.1; **p<0.05; ***p<0.01.

Table 7: Marginal Effects of Inflation Expectations on Own Major Purchases over the Last 12 Months—Probit with Random HH Effect

	All	Intensive (Excl. 0)	Extensive	All Quali.	All Excl. outliers
π^e	0.002	-0.027			0.143**
	(0.023)	(0.033)			(0.065)
$\pi^e \neq 0$			0.636**		
			(0.285)		
π^e by intervals:					
$[10\%; +\infty[$				0.186	
				(0.490)	
$[5\%; 10\%[$				0.685	
				(0.421)	
$[3\%; 5\%[$				0.953**	
				(0.425)	
$]0\%; 3\%[$				0.674*	
				(0.391)	
0%				Ref.	
$< 0\%$				0.160	
				(1.210)	
Controls	Yes	Yes	Yes	Yes	Yes
Obs.	136,574	92,002	136,574	136,574	114,786

Note: this table reports marginal effects (in percentage points) from panel probit regressions with random household effect, where the endogenous variable is a dummy variable equal to 1 if the household answers "Yes" to the question, "Have you made major purchases during the last 12 months?" Control variables include year and month dummies, household characteristics (age, location [city, region] diploma, job, income), survey wave (1, 2, or 3), answers to other questions on French economic conditions (standard of living, unemployment, etc.), and answers to the questions about future plans for major purchases, right time to save, and perceived inflation. *p<0.1; **p<0.05; ***p<0.01.

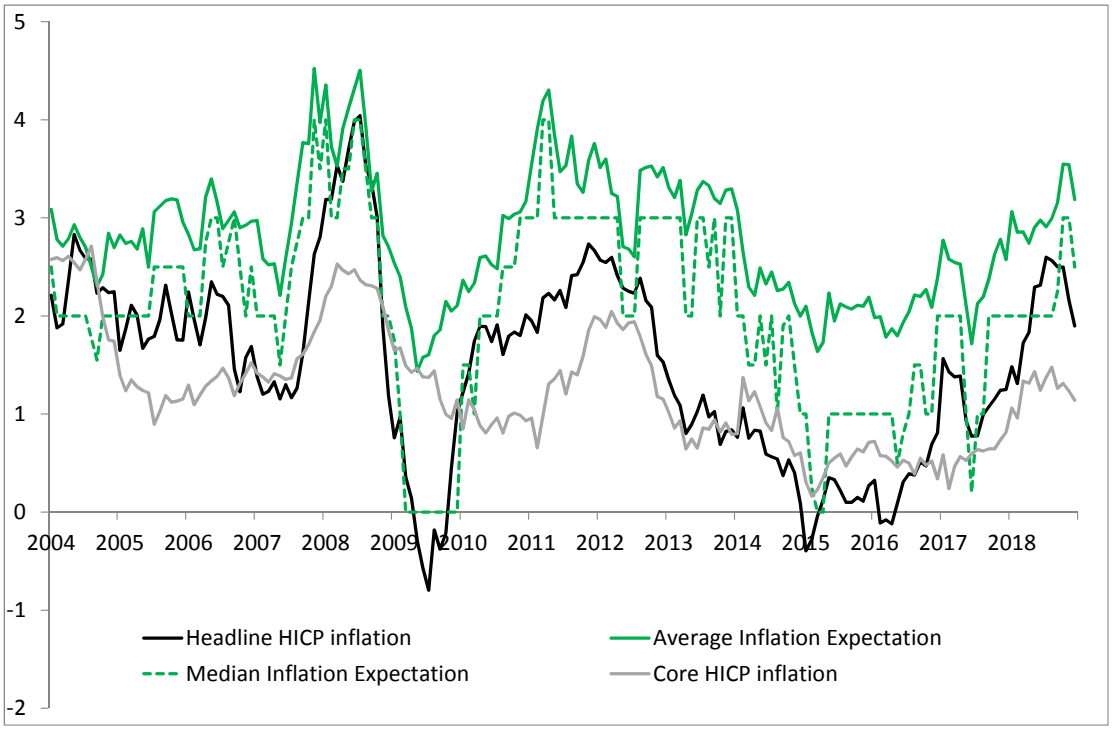
Table 8: Marginal Effects of Inflation Expectations on Own Major Purchases over the Last 12 Months: Robustness

	All π^e Excl. outliers	π^e excl 0 Intensive	$\pi^e \neq 0$ Extensive
No Perceived / Expected Variables	-0.125**	-0.543***	-0.000
	(0.052)	(0.072)	(0.297)
+ Perceived Inflation	0.051	-0.400***	-0.057
	(0.057)	(0.084)	(0.338)
+ Expected Own Durable Consumption	0.022	-0.284***	0.197
	(0.057)	(0.084)	(0.335)
+ Expected Own Financial Situation	0.108*	-0.197**	0.636*
	(0.058)	(0.085)	(0.337)
+ Past and Current Own Financial Situation	0.147**	-0.137	0.732**
	(0.058)	(0.085)	(0.332)
+ Expected Business Cycle & Unemployment	0.200***	-0.062	1.020***
	(0.058)	(0.085)	(0.330)
+ Good Time to Save (Baseline)	0.226***	-0.045	1.021***
	(0.037)	(0.074)	(0.337)

Note: this table reports marginal effects (in percentage points) from probit regressions where the endogenous variable is a dummy variable equal to 1 if the household answers "Yes" to the question, "Have you made major purchases during the last 12 months?" In all regressions, we keep basic control variables such as year and month dummies, household characteristics (age, location [city, region], diploma, job, income), and survey wave (1, 2, or 3). Other control variables include answers to other questions on French economic conditions (standard of living, unemployment, etc.) and answers to the questions about future plans for major purchases, right time to save, and perceived inflation. In the first regression we remove all the other control variables, whereas in other regressions we add control variables one by one. Standard errors are clustered at the date level. *p<0.1; **p<0.05; ***p<0.01.

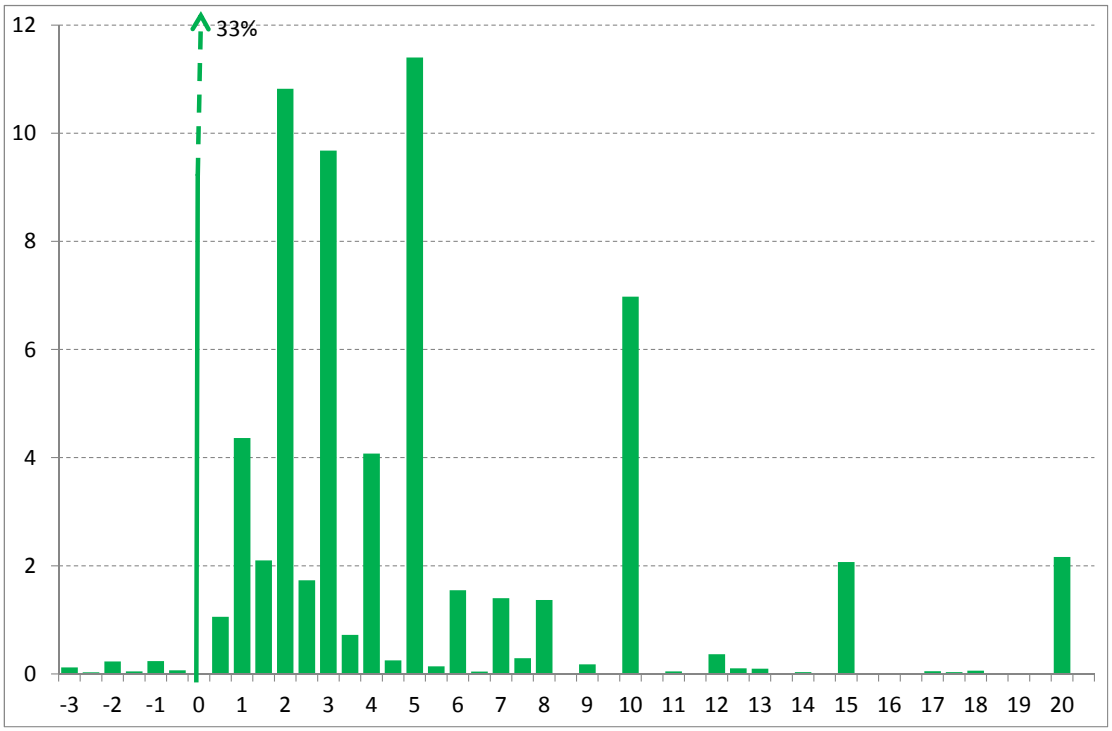
Figures

Figure 1: Expected Inflation and Headline HICP inflation



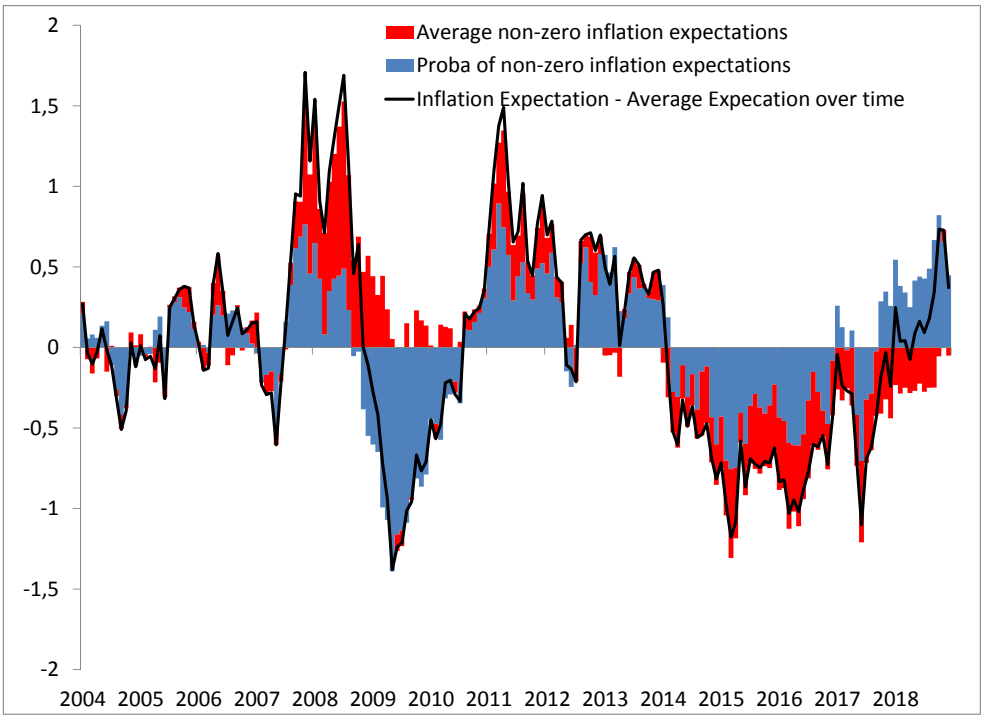
Note: using answers to the quantitative questions on inflation expectations (we drop quantitative inflation perceptions larger than 20 percent), we compute the simple average/median of all answers date by date. Before 2008, the survey was not conducted in August. For those years, we replace aggregate statistics by a simple interpolation between July and September. We also plot as benchmarks headline HICP inflation (source Eurostat) and HICP inflation excluding energy (source Eurostat).

Figure 2: Cross Distribution of Inflation Expectations



Note: here we represent the distribution of inflation expectations across households computed over the period January 2004 through December 2018. The proportion of answers above 20 percent is not reported. The distribution is unweighted.

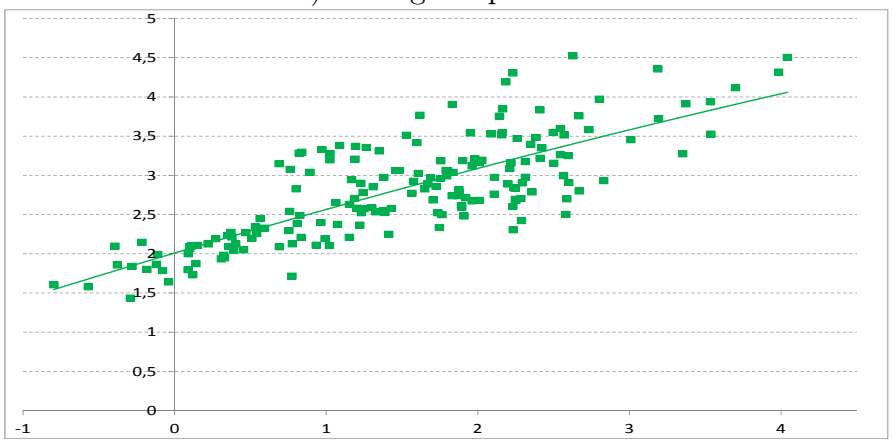
Figure 3: Aggregate Inflation Expectations Decomposition—Extensive vs. Intensive Margins



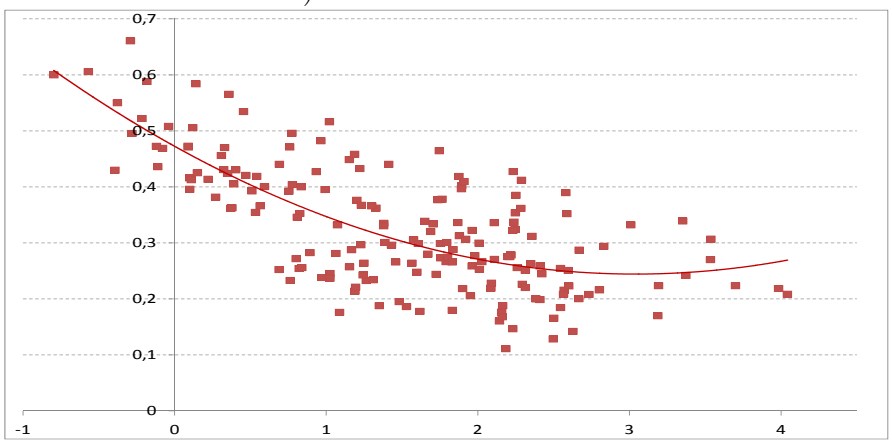
Note: we plot contributions to aggregate inflation expectations. Black line: aggregate average expected inflation—mean aggregate average expected inflation. Blue histogram: contribution of time variations of the probability of non-zero answers (extensive margin). Red histogram: contributions of time variations in the average expected inflation (intensive margin).

Figure 4: Share of Stable Prices, Average Non-Zero Expected Inflation and Headline CPI Inflation

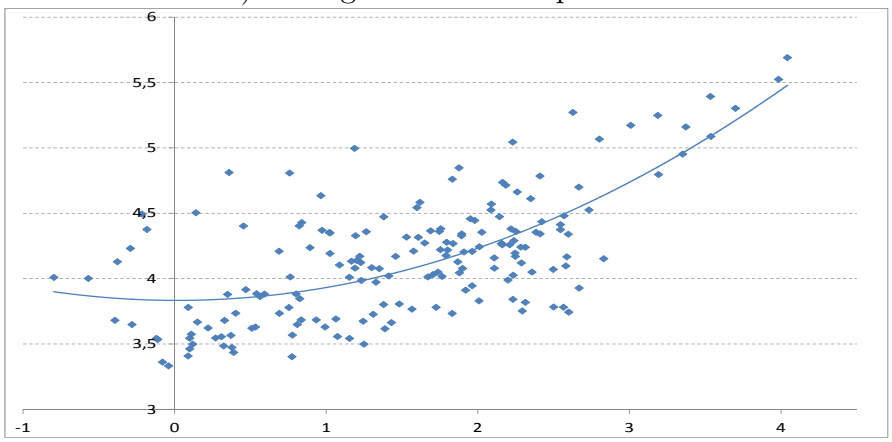
a) Average Expectation



b) Share of Stable Prices



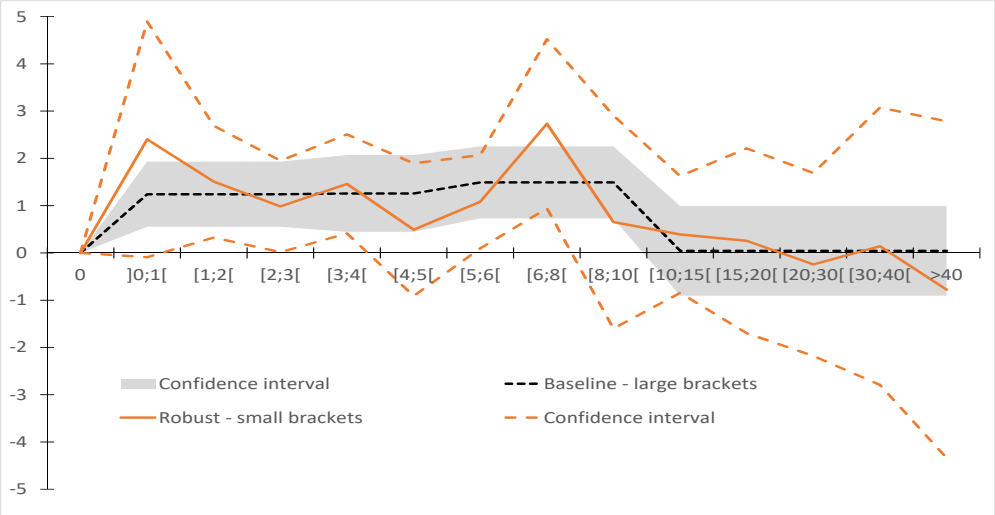
c) Average Non-Zero Expectation



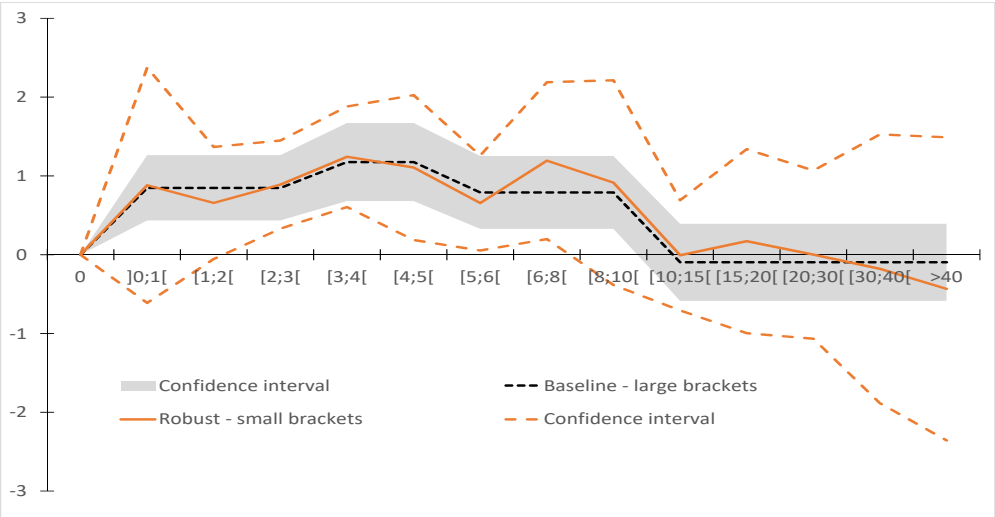
Note: Panel (a) is the scatter plot of average expectation and headline CPI inflation (monthly data). The green line is a simple polynomial of degree 2 fitting the data. Panel (b): we first compute date by date the proportion of individuals reporting expected stable prices (that is, 0 percent inflation), and (b) is the scatter plot of this monthly proportion and headline CPI inflation. In red, each dot represents the share of individuals answering that they expect stable prices over the next 12 months for a given month (and thus the inflation rate). The red line is a simple polynomial of degree 2 fitting the data. Panel (c): we compute the average inflation expectation (when individuals do not answer that they expect stable prices) date by date. The figure is the scatter plot of this monthly average and headline CPI inflation. The blue line is a simple polynomial of degree 2 fitting the data.

Figure 5: Marginal Effect of Inflation Expectations on Decision to Buy

a) Own Durable Consumption



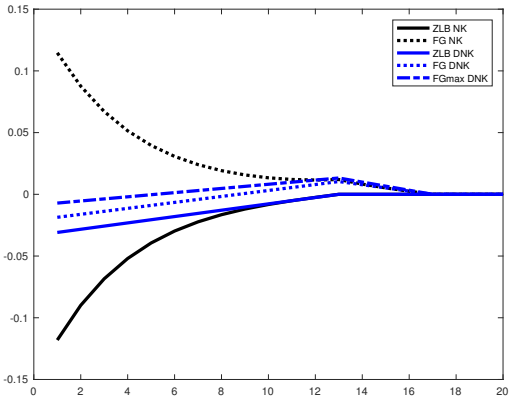
b) Right Time to Buy



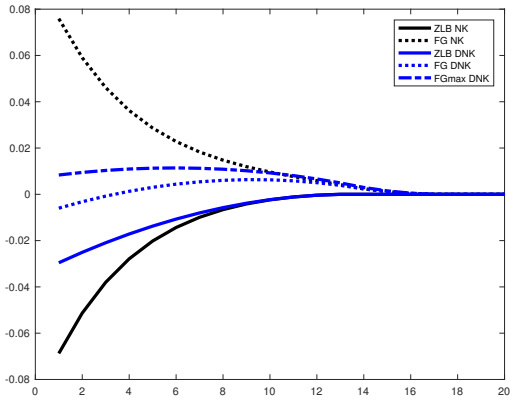
Note: These two figures plot our estimates of marginal effects of inflation expectations on decision to buy durables (Panel (a) "Own Durable Consumption"; Panel (b) "Right Time to Consume"). The orange line reports results where we have grouped answers by "smaller" brackets. The reference is 0 percent (negative answers were grouped in a single bracket but not reported on the graph). Marginal effects are reported in percentage points. Dashed orange lines correspond to the 95 percent confidence interval. The dashed dark line corresponds to our baseline estimates with "large" brackets (as reported in Tables 4 and 5), and the gray shaded area corresponds to the 95 percent confidence interval associated with these estimates.

Figure 6: ZLB and FG with Discrete Beliefs

(a) Output gap



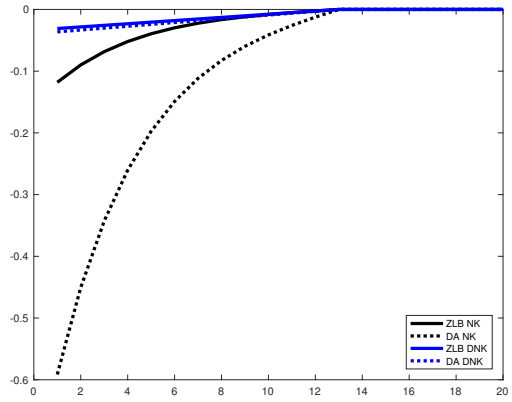
(b) Inflation



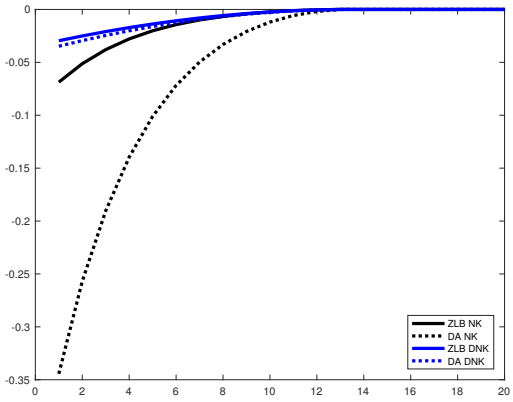
Note: The plain black line (ZLB NK) corresponds to the reaction of the standard NK model to a shock pushing the economy to the ZLB, and the dotted black line (FG NK) to a forward guidance shock. The plain blue line (ZL DNK) corresponds to the reaction of the sparse NK model to a shock pushing the economy to the ZLB, and the dotted blue line (FG DNK) to a forward guidance shock. Finally, the dashed blue line (FG max DNK) corresponds to a case where 100 percent of households expect positive inflation after the shock. See Section 6 for further explanations.

Figure 7: ZLB and Deanchoring with Discrete Beliefs

(a) Output gap



(b) Inflation



Note: The plain black line (ZLB NK) corresponds to the reaction of the standard NK model to a shock pushing the economy to the ZLB, and the dotted black line (DA NK) to a de-anchoring shock. The plain blue line (ZLB DNK) corresponds to the reaction of the discrete NK model to a shock pushing the economy to the ZLB, and the dotted blue line (DA DNK) to a de-anchoring shock. See Section 6 for further explanations.

Appendix—for Online Publication

A Model of durable consumption

In this appendix, we introduce a model of a continuum of agents consuming both non-durable and durable goods but allowing for households' individual beliefs on future inflation. We derive from this model the equation that we use to estimate the extensive margin of durable consumption.

Households We consider a continuum of a mass 1 of agents indexed by $i[0,1]$. Each agent i consumes both durable and non-durable goods so as to maximize the following expected lifetime utility function:

$$\mathbb{E}_{i,0}\left\{\sum_{t\geq 0}\beta^t\left[\frac{\left(c_{i,t}^{\gamma}d_{i,t}^{1-\gamma}\right)^{1-\theta}-1}{1-\theta}\right]\right\}$$

where $\beta\in(0,1)$ is the discount factor and γ and θ are positive parameters. $E_{i,0}$ denotes the expectation operator at date-0 given agent i information set.

Agents can trade risk-free nominal bonds that yield a nominal interest rate i_t between periods t and $t+1$. We denote by $a_{i,t}$ the amount of these risk-free assets purchased at date-t. Agents inelastically supply one unit of labor. Agents can differ in terms of productivity, and we denote the nominal wage received by agent i at date t by $W_{i,t}$.

Modifying the stock of durable goods entails a real cost that we denote by $\Xi(d_{i,t},d_{i,t-1})$. The stock of durable goods depreciates at a rate δ.

By denoting the price level in period t by P_t, we can then write the budget constraint faced by household i at date t as:

$$P_t(c_{i,t}+d_{i,t})+a_{i,t}+P_t\Xi(d_{i,t},d_{i,t-1})\leq W_{i,t}+(1+r_{i,t-1})a_{i,t-1}+P_td_{i,t-1}(1-\delta)$$

At date-t, we denote the information set available to agent i by $\mathcal{I}_{i,t}$, and we adopt the following notation:

$$E\left(.|\mathcal{I}_{i,t}\right)=E_{i,t}\left(.\right).$$

Assumption A.1. *Households perfectly observe current macroeconomic variables, that is, the nominal interest rate and the current price level* $\{r_t,P_t\}$.

Despite observing the current price level, households cannot directly observe the future price level P_{t+1} and, thus, have to form a belief on the future inflation rate $E_{i,t}\left(\pi_{t+1}\right)$.

Recursive formulation The recursive problem solved by agents is:

$$V(a_{-1},d_{-1},W,\mathcal{I})=\max\left[V^{adjust}(a_{-1},d_{-1},W,\mathcal{I}),V^{noadjust}(a_{-1},d_{-1},W,\mathcal{I})\right]$$

with

$$V^{adjust}(a_{-1}, d_{-1}, W, \mathcal{I})) = \max_{c,d,a} \frac{(c^\gamma d^{1-\gamma})^{1-\theta}}{1-\theta} + \beta E\left(V(a, d, W', \mathcal{I}))|\mathcal{I})\right)$$
$$\text{s.t.}$$
$$c + d + a = W + \frac{1+r}{1+E_{-1}\pi} a_{-1} + d_{-1}(1-\delta) + \Xi(d, d_{-1})$$
$$a \geq -(1-\delta)d.$$

and

$$V^{noadjust}(a_{-1}, d_{-1}, W, \mathcal{I}) = \max_{c,a} \frac{(c^\gamma d_{-1}^{1-\gamma})^{1-\theta}}{1-\theta} + \beta E\left(V(a, d_{-1}(1-\delta), W', \mathcal{I}))\,|\mathcal{I}\right)$$
$$\text{s.t.}$$
$$c + a = W + \frac{1+r}{1+E_{-1}\pi} a_{-1}.$$

Connection with our reduced form formulation Let us label by $\delta^*(a_{-1}, d_{-1}, W, \mathcal{I}))$ the solution to the maximization of $V^{adjust}(a_{-1}, d_{-1}, W, \mathcal{I}))$.

Lemma A.1. *There exists $\kappa < \infty$ such that if $d^*(a_{-1}, d_{-1}, W, \mathcal{I})) \geq (1-\delta)d_{-1} + \kappa$ then*

$$V^{adjust}(a_{-1}, d_{-1}, W, \mathcal{I})) \geq V^{noadjust}(a_{-1}, d_{-1}, W, \mathcal{I})$$

Proof. Let us first note that when $\Xi(d, d_{-1}) = 0$,

$$V^{adjust}(a_{-1}, d_{-1}, W, \mathcal{I})) \geq V^{noadjust}(a_{-1}, d_{-1}, W, \mathcal{I}).$$

when $d^*(a_{-1}, d_{-1}, W, \mathcal{I})) \geq (1-\delta)d_{-1}$. When $\Xi(d, d_{-1}) \to \infty$, $V^{adjust}(a_{-1}, d_{-1}, W, \mathcal{I})) < V^{noadjust}(a_{-1}, d_{-1}, W, \mathcal{I})$ for any $d^*(a_{-1}, d_{-1}, W, \mathcal{I}))$ or, equivalently when $d^*(a_{-1}, d_{-1}, W, \mathcal{I})) \geq (1-\delta)d_{-1} + \kappa$ with $\kappa \to \infty$.

Given that $V^{adjust}(a_{-1}, d_{-1}, W, \mathcal{I}))$ is a continuous and monotone of $\Xi(d, d_{-1})$ (the derivative of $V^{adjust}(a_{-1}, d_{-1}, W, \mathcal{I}))$ with respect to $\Xi(d, d_{-1})$ is $-\lambda$ where λ is the Lagrange multiplier associated with the budget constraint), we can use the intermediary value theorem to conclude that there exists $\zeta(a_{-1}, d_{-1}, W, \mathcal{I})$ so that $V^{adjust} \geq V^{noadjust}$ if and only if $\Xi(d, d_{-1}) \leq \zeta(a_{-1}, d_{-1}, W, \mathcal{I})$. In particular, $V^{adjust}(\zeta) = V^{noadjust}$. Let $d^*(\zeta)$ be the solution for durables of the maximization of $V^{adjust}(\zeta)$. Let us denote by $\kappa = d^*(\zeta) - (1-\delta)d_{-1}$.

By increasing the cost $\Xi(d, d_{-1})$ above ζ, we obtain that $d^*(\Xi(d, d_{-1}) - (1-\delta)d_{-1}$ is smaller than κ as d^* is an decreasing function of the cost and $V^{adjust}(\Xi(d, d_{-1}) < V^{noadjust}$ by the definition of ζ.

Conversely, by decreasing the cost $\Xi(d, d_{-1})$ below ζ, we obtain that $d^*(\Xi(d, d_{-1}) - (1-\delta)d_{-1}$ is higher than κ as d^* is an decreasing function of the cost and $V^{adjust}(\Xi(d, d_{-1}) > V^{noadjust}$ by the definition of ζ.

In the end, $d^*(\Xi(d, d_{-1}) \geq (1-\delta)d_{-1} + \kappa$ is sufficient to ensure that:

$$V^{adjust}(a_{-1}, d_{-1}, W, \mathcal{I})) \geq V^{noadjust}(a_{-1}, d_{-1}, W, \mathcal{I})$$

□

Let us note that it is also possible that $V^{adjust}(a_{-1}, d_{-1}, W, \mathcal{I})) \geq V^{noadjust}(a_{-1}, d_{-1}, W, \mathcal{I})$ when $d^*\left(a_{-1}, d_{-1}, W, \mathcal{I})\right)$ is sufficiently low compared to $1-\delta)d_{-1}$, which corresponds to a case where the household is willing to sell and not buy durable goods. In this regard, Lemma A.1 focuses only on purchases of durables.

Finally, let us note that the functional form assumed for d^* in equation (2) is in line with the problem solved and $V^{adjust}(a_{-1}, d_{-1}, W, \mathcal{I}))$. This choice is indeed a function of the nominal interest rate $E_{i,t}(r_t)$, the evolution of the price level $E_{i,t}(\pi_{t+1})$—more precisely, the problem depends on the real rate $E_{i,t}(r_t) - E_{i,t}(\pi_{t+1})$—and the household's future situation.

Identification assumption As noted above, households' decisions depend on the real rate $E_{i,t}(r_t) - E_{i,t}(\pi_{t+1})$ and not only on inflation expectations $E_{i,t}(\pi_{t+1})$. The following lemma clarifies how we can identify the effect of inflation expectations in our setting:

Lemma A.2. *Under Assumption A.1, $E_{j',t}(r_t) = E_{j,t}(r_t)$ for any j and j'.*

As a result, any difference in willingness to consume durable goods results only from differences in inflation expectations.

Let us emphasize that Assumption A.1 requires that agents can observe current but not future macroeconomic variables. As this can be observed in Lemma A.2, a milder condition for this lemma would be to assume that agents can perfectly observe the nominal interest rate only. In general, our identification builds on the idea that it is easier to observe nominal interest rates—that are observable today in markets or through banks—rather than future inflation rates—which have to be computed and will be observable only in the future.

B A costly information-processing interpretation

In this appendix, we provide a costly information-processing interpretation of the way people take into account inflation expectations in their consumption decision. More precisely, we build a model in which agents have to make decisions based on their beliefs on future inflation, but computing the optimal decision rule given an expected level of inflation is costly. We show that such costs to process information leads households to react in the same way to different levels of inflation expectations. When the most likely state is that inflation remains constant and information-processing costs are sufficiently large, we find that households modify their consumption only when their inflation expectations move between constant inflation and positive inflation.

More precisely, we first show how costly information processing leads to restricting attention to a coarse partition of the information set. Second, we embed this mechanism in a problem where an agent has to decide on consumption based on inflation expectations.

B.1 The inflation process

To this purpose, let us suppose that inflation π_t follows a first-order Markov process taking values in $\Pi = \{\pi_1, ...\pi_,\}$, with n the number of states. The transition matrix is $\{P_{i,j}\}$ and the ergodic distribution is $\{\mu_j\}$. Here we assume that the Markov chain is irreducible and aperiodic, so that the ergodic distribution exists and is unique.

We assume that n can be arbitrarily large.

The entropy rate of this process is:

$$H(\pi_t) = \sum_i \mu_i \left(- \sum_j P_{i,j} \log P_{i,j} \right).$$

Let us define $\mathcal{P}(\Pi)$ that is the partition set of Π. A partition $X_1 \in \mathcal{P}(\Pi)$ is finer than X_2 when every $x \subseteq X_1$ satisfies $x \subseteq X_2$. On the other hand, X_2 is said to be coarser. It is well known that finer/coarser is a partial order on $\mathcal{P}(\Pi)$.

Let us define $\pi(X)$ the process generated by the partition X, that is, for any set $x \in X$, $\pi(X)$ defines a first-order Markov process with states X, a transition matrix $P(X)$ and an ergodic distribution $\mu(X)$ satisfying for all $x \in X$ and $x' \in X$:

$$\mu(x) = \sum_{i \in x} \mu_i \text{ and } P_{x,x'} = \sum_{i \in x, j \in x'} P_{i,j}.$$

In particular, $\pi(\Pi) = \pi$.

Lemma B.1 (Monotonicity)**.** *Let us consider a sequence X_1, X_2, ... X_m with X_j finer than $X_{j'}$ for any j and j' such that $j \geq j'$. $H(\pi(X_j))$ is increasing with j.*

Proof. Without loss of generality, let us focus on a process with three states. The coarsest partition is the set of three states. Then, an intermediate partition is when two states are bundled together and the finest partition is the set of singletons. First, the entropy rate of the set of three states is 0. Second, the entropy rate of an intermediate partition is:

$$\begin{aligned} H_{int} = \mu_1 \left(P_{1,1} \log P_{1,1} + (1 - P_{1,1}) \log(1 - P_{1,1})\right) + \cdots \\ \cdots (\mu_2 + \mu_3) \left(1 - \frac{\mu_2 P_{2,1} + \mu_3 P_{3,1}}{\mu_2 + \mu_3}\right) \log \left(1 - \frac{\mu_2 P_{2,1} + \mu_3 P_{3,1}}{\mu_2 + \mu_3}\right) + \\ \cdots (\mu_2 + \mu_3) \frac{\mu_2 P_{2,1} + \mu_3 P_{3,1}}{\mu_2 + \mu_3} \log \left(\frac{\mu_2 P_{2,1} + \mu_3 P_{3,1}}{\mu_2 + \mu_3}\right) \end{aligned}$$

which is strictly positive. The entropy rate of the set of singletons is:

$$\begin{aligned} H_{singletons} = \mu_1 \left(P_{1,1} \log P_{1,1} + P_{1,2} \log P_{1,2} + P_{1,3} \log P_{1,3}\right) + \cdots \\ \mu_2 \left(P_{2,1} \log P_{2,1} + P_{2,2} \log P_{2,2} + P_{2,3} \log P_{2,3}\right) + \cdots \\ \mu_3 \left(P_{3,1} \log P_{3,1} + P_{3,2} \log P_{3,2} + P_{3,3} \log P_{3,3}\right) \end{aligned}$$

Let us show that this is larger than the entropy rate of the intermediate partition. First,

let us note that, due to the convexity of $x \log x$, we have:

$$\frac{\mu_2 P_{2,1} + \mu_3 P_{3,1}}{\mu_2 + \mu_3} \log \left(\frac{\mu_2 P_{2,1} + \mu_3 P_{3,1}}{\mu_2 + \mu_3} \right) \geq \cdots$$
$$\cdots \frac{\mu_2}{\mu_2 + \mu_3} P_{2,1} \log P_{2,1} + \frac{\mu_3}{\mu_2 + \mu_3} P_{3,1} \log P_{3,1}$$

and:

$$\frac{\mu_2(1 - P_{2,1} - + \mu_3(1 - P_{3,1})}{\mu_2 + \mu_3} \log \left(\frac{\mu_2(1 - P_{2,1}) + \mu_3(1 - P_{3,1})}{\mu_2 + \mu_3} \right) \geq \cdots$$
$$\cdots \frac{\mu_2}{\mu_2 + \mu_3} (1 - P_{2,1}) \log(1 - P_{2,1}) + \frac{\mu_3}{\mu_2 + \mu_3} (1 - P_{3,1}) \log(1 - P_{3,1}).$$

Using these inequalities as well as the fact that

$$(P_{1,2} + P_{1,3}) \log(P_{1,2} + P_{1,3}) \geq P_{1,2} \log P_{1,2} + P_{1,3} \log P_{1,3}$$

we find that $H_{int} \leq H_{singletons}$.

Iterating on the number of states would give the result for N states. □

Let us consider the set of partitions $X_{\pi_j} = \{\{\pi_j\}, \Pi \setminus \{\pi_j\}\}$ for all $\pi_j \in \Pi$.

The entropy rate of the corresponding process $\pi(X_{\pi_j})$ is:

$$H(\pi(X_{\pi_j})) = -\mu_j \left(P_{j,j} \log P_{j,j} + P_{j,-j} \log P_{j,-j} \right) - \mu_{-j} \left(P_{-j,j} \log P_{-j,j} + P_{-j,-j} \log P_{-j,-j} \right).$$

In the case where the process is i.i.d. so that $P_{ij} = P_j = \mu_j$. Under this assumption, the entropy rate simplifies into:

$$H(\pi(X_{\pi_j})) = -\mu_j \log \mu_j - (1 - \mu_j) \log(1 - \mu_j).$$

Note that

$$\lim_{\mu_j \to 1} H(\pi(X_{\pi_j})) = 0.$$

With a first-order Markov process, we have that $\mu_j = P_{-j,j}/(P_{-j,j} + P_{j,-j})$. $\mu_j \to 1$ if and only if $P_{-j,j} \to 1$ and $P_{j,-j} \to 0$. As a result, we also find that $H(\pi(X_{\pi_j})) \to 0$ when $\mu_j \to 1$.

As a result, we obtain the following lemma:

Lemma B.2. *Suppose that there is a state that is sufficiently likely, μ_j close to 1, the entropy rate $H(\pi(X_{\pi_j}))$ is arbitrarily close to 0.*

B.2 Optimal consumption decision

Let us suppose that households have to choose the information structure that they use to make decisions. A finer information structure comes at the cost of a higher information-processing cost.

At each date t, a household has to make a decision on consumption based on their inflation expectation $E_t\pi_{t+1}$. This inflation expectation takes value in Π and follows a Markov process as described above with a transition matrix $\{P_{i,j}\}$ and an ergodic distribution $\{\mu_j\}$.

We denote the ideal decision for consumption by $d^*(E_t\pi_{t+1})$. We denote the decision based on a partition $X \in \mathcal{P}(\Pi)$ by $d^*(E_t\pi_{t+1}(X))$. Of course, when the partition $X = \Pi$, we have $d^*(E_t\pi_{t+1}(\Pi)) = d^*(E_t\pi_{t+1})$.

$$\min_{X \in \mathcal{P}(\Pi)} Ea \left(d^*(E_t\pi_{t+1}(X)) - d^*(E_t\pi_{t+1})\right)^2$$
$$\text{s.t. } \lim_{T\to\infty} \frac{1}{T} I(E_0\pi_1(X), \cdots, E_T\pi_{T+1}(X)) \leq \kappa$$

with κ and a strictly positive constants. κ can be interpreted as the cognitive cost. The constraint is then a constraint on processing information on inflation expectation to decide on consumption.

By definition, $\lim_{T\to\infty} \frac{1}{T} I(E_0\pi_1(X), \cdots, E_T\pi_{T+1}(X))$ is the entropy rate. Based on the previous subsection's results, we find:

Proposition B.1. *Suppose that information-processing ability is sufficiently limited (κ sufficiently low) and that there exists a state π_j that is sufficiently likely, then the optimal information structure is the partition $X_{\pi_j} = \{\{\pi_j\}, \Pi \setminus \{\pi_j\}\}$.*

Proof. In the steady state, for a partition X, let us compute $Ea \left(d^*(E_t\pi_{t+1}(X)) - d^*(E_t\pi_{t+1})\right)^2$:

$$Ea \left(d^*(E_t\pi_{t+1}(X)) - d^*(E_t\pi_{t+1})\right)^2 = a \sum_{X_i \in X} \sum_{\pi_j \in X_i} \mu_j \left(d^*(X_i) - d^*(\pi_j)\right)^2$$

Suppose there exists a state π_j so that μ_j is arbitrarily low and κ is arbitrarily close to 0. By considering a partition X_{π_j}, one can find that $Ea \left(d^*(E_t\pi_{t+1}(X)) - d^*(E_t\pi_{t+1})\right)^2$ is arbitrarily close to 0, which is the minimum of this expression and, given Lemma B.2, this choice of partition satisfies the information-processing constraint.

□

C Questionnaire

We here provide a translation of the full questionnaire of the survey. All socio-demographic questions are asked only during the first interview and are pretty standard (age, occupation, diploma, income, number of members in the household, marital status, region, city size, etc .); the wording is not reported here. Since the wording of the questionnaire is harmonized across European Union countries, for the questions that are common to all countries, we use the wording of the UK survey (see https://ec.europa.eu/info/sites/info/files/questionnaires_uk_cons_en.pdf); the French version is highly similar. We have grouped questions by general topics (general economic situation, prices, consumption/saving, and own financial situation), and this order does not follow

the actual order in which questions are asked to households.

General Economic Situation

Q1. How do you think the general economic situation in France has changed over the past 12 months? It has...

1. Got a lot better, **2.** Got a little better, **3.** Stayed the same, **4.** Got a little worse, **5.** Got a lot worse, **6.** Don't know.

Q2. How do you expect the general economic situation in France to develop over the next 12 months? It will...

1. Get a lot better, **2.** Get a little better, **3.** Stay the same, **4.** Get a little worse, **5.** Get a lot worse, **6.** Don't know.

Q3. How do you think the quality of life in France, as a whole, has changed over the past 12 months? It has...

1. Got a lot better, **2.** Got a little better, **3.** Stayed the same, **4.** Got a little worse, **5.** Got a lot worse, **6.** Don't know.

Q4. How do you expect the quality of life in France to develop over the next 12 months? It will...

1. Get a lot better, **2.** Get a little better, **3.** Stay the same, **4.** Get a little worse, **5.** Get a lot worse, **6.** Don't know.

Q5. How do you expect the number of people unemployed in this country will change over the next 12 months? The number will...

1. Increase sharply, **2.** Increase slightly, **3.** Remain the same, **4.** Fall slightly, **5.** Fall sharply, **6.** Don't know.

Prices

Q6. How do you think consumer prices have developed over the last 12 months? They have...

1. Risen a lot, **2.** Risen moderately, **3.** Risen slightly, **4.** Stayed about the same, **5.** Fallen, **6.** Don't know.

(If answer different from "stayed about the same" at Q6, ask:)

Q7. By what percentage do you think consumer prices have gone up/down over the past 12 months? Please give an estimate. Record up to one decimal place.
Consumer prices have increased/decreased by XX.X%

Q8. In comparison with the past 12 months, how do you expect consumer prices will develop in the next 12 months? They will...

1. Increase more rapidly, **2.** Increase at the same rate, **3.** Increase at a slower rate, **4.** Stay about the same, **5.** Fall, **6.** Don't know.

(If answer different from "stayed about the same" at Q8, ask:)

Q9. By what percentage do you think consumer prices will go up/down over the next 12 months? Please give an estimate. Record up to one decimal place.
Consumer prices will increase/decrease by XX.X%

Consumption / Savings

Q10. In view of the current general economic situation, do you think now is the right time for people to make major purchases (such as furniture, washing machines, electronic or computer equipment, etc.)?

1. Yes, now is the right time, **2.** It is neither the right time nor the wrong time, **3.** No, it is the wrong time, **4.** Don't know.

Q11. In view of the general economic situation, do you think that now is?

1. A very good time to save, **2.** A fairly good time to save, **3.** Not a good time to save, **4.** A very bad time to save, **5.** Don't know.

Q12. Over the next 12 months, how likely will you be to save any money?

1. Very likely, **2.** Fairly likely, **3.** Not likely, **4.** Not at all likely, **5.** Don't know.

Q13. Have you made any major purchases over the last 12 months (washing machine, refrigerator, furniture, dishwasher, etc.)?

1. Yes, **2.** No, **3.** Don't know.

Q14. How likely are you to make major purchases over the next 12 months?

1. Very likely, **2.** Fairly likely, **3.** Not likely, **4.** Not at all likely, **5.** Don't know.

Q15. How likely are you to buy a car over the next 12 months?

1. Very likely, **2.** Fairly likely, **3.** Not likely, **4.** Not at all likely, **5.** Don't know.

Q16. Are you planning to buy or build a home over the next 12 months (to live in yourself, for a member of your family, as a holiday home, to let, etc.)?

1. Very likely, **2.** Fairly likely, **3.** Not likely, **4.** Not at all likely, **5.** Don't know.

Q17. How likely are you to spend any large sums of money on home improvements or renovations over the next 12 months?

1. Very likely, **2.** Fairly likely, **3.** Not likely, **4.** Not at all likely, **5.** Don't know.

Own Financial Situation

Q19. Which of these statements best describes the current financial situation of your household?

1. We are saving a lot, **2.** We are saving a little, **3.** We are just managing to make ends meet on our income, **4.** We are having to draw on our savings, **5.** We are running into debt, **6.** Don't know.

Q20. How has the financial situation of your household changed over the last 12 months? It has...

1. Got a lot better, **2.** Got a little better, **3.** Stayed the same, **4.** Got a little worse, **5.** Got a lot worse, **6.** Don't know.

Q21. How do you expect the financial position of your household to change over the next 12 months? It will...

1. Get a lot better, **2.** Get a little better, **3.** Stay the same, **4.** Get a little worse, **5.** Get a lot worse, **6.** Don't know.

D Further descriptive statistics of the survey

D.1 Statistics on response rates

As illustrated by Table D.1, non-response rates are very low for the questions regarding households' own consumption (less than 1 percent in general). Answers to the questions on the right time to make purchases of durable goods are in general also less frequent (the non-response rate is about 5 percent).

Table D.2 provides estimates of a qualitative model of the main determinants of the non-response probability for the quantitative questions on inflation expectations (as well as perceptions). Households that have a higher income and are better educated are more likely to respond. Older people and women are more likely not to respond.

Table D.1: Non-Response Rates (in %) to Price and Consumption Questions

	Non-Response		
	Quali.	Quanti.	Outlier ($\geq 10\%$)
Perceived Inflation	0.96	52.21	29.60
Expected Inflation	5.22	59.83	21.88
Right Time to Purchase	4.05	-	-
Own Major Purchase			
Past 12 Months	0.07	-	-
Next 12 Months	0.75	-	-

Note: this table reports the percentage of non-response calculated as the ratio between the number of households that answer "do not know" to a question. We also report the percentage of outliers or implausible values for quantitative inflation expectations. We set a threshold at 10 percent of inflation, and the percentage is calculated as the number of answers above or equal to 10 percent over the total number of answers (among households answering the question).

Table D.2: Determinants of Non-Response/Outliers to Quantitative Price Questions—Marginal Effects

		Non-Response		Outlier (more than 10%)	
		Perception	Expectation	Perception	Expectation
HH Income	$[Q1; Q2]$	-1.460***	-0.786***	-5.242***	-5.452***
(Ref: $< Q1$)		(0.214)	(0.210)	(0.424)	(0.488)
	$[Q2; Q3]$	-3.182***	-1.328***	-8.922***	-9.292***
		(0.242)	(0.228)	(0.452)	(0.514)
	$> Q3$	-5.390***	-1.750***	-15.629***	-14.969***
		(0.272)	(0.250)	(0.472)	(0.529)
Education	Secondary	-5.255***	-2.230***	0.631	0.356
(Ref: Primary)		(0.224)	(0.228)	(0.428)	(0.486)
	Further	-6.833***	-2.904***	-3.158***	-3.171***
		(0.226)	(0.228)	(0.420)	(0.474)
Age	30-49	1.162***	-0.015	-0.422	-1.908***
(Ref: 16-29)		(0.373)	(0.312)	(0.594)	(0.646)
	50-64	2.579***	1.049***	-2.407***	-3.233***
		(0.377)	(0.318)	(0.607)	(0.663)
	65+	8.782***	2.676***	-6.646***	-7.708***
		(0.447)	(0.392)	(0.732)	(0.789)
Gender	Female	5.643***	1.750***	10.441***	8.988***
(Ref: Male)		(0.180)	(0.165)	(0.317)	(0.350)
Occupation	No, Unemployed	-1.726***	0.211	3.567***	2.963***
(Ref: Yes)		(0.610)	(0.568)	(1.030)	(1.094)
	No Retired	-0.367	0.076	-1.996**	-0.862
		(0.450)	(0.440)	(0.790)	(0.869)
	No Inactive	3.217***	0.908**	3.249***	1.805**
		(0.414)	(0.407)	(0.732)	(0.782)
HH Size	2	-1.224***	-0.384	3.997***	3.774***
(Ref = 1)		(0.317)	(0.292)	(0.515)	(0.533)
	3	-1.595***	0.050	6.459***	5.150***
		(0.358)	(0.326)	(0.584)	(0.604)
	> 3	-1.499***	0.532	8.407***	7.585***
		(0.376)	(0.343)	(0.617)	(0.645)
Survey Wave	2	0.196	-0.763***	-4.398***	-3.520***
(Ref: 1)		(0.281)	(0.263)	(0.499)	(0.545)
	3	0.240	1.279***	-6.057***	-4.376***
		(0.342)	(0.316)	(0.597)	(0.649)
Controls		Yes	Yes	Yes	Yes
Obs		262,113	211,674	126,378	211,674

Note: this table reports marginal effects (in percentage points) from probit regressions where the endogenous variable is a dummy variable taking the value 1 in cases of non-response to the quantitative price question. Control variables include date dummies, household characteristics (age, location [city, region], diploma, job, income, survey wave (1, 2, or 3). *p<0.1; **p<0.05; ***p<0.01.

D.2 Descriptive statistics on qualitative and quantitative inflation expectations

Table D.3: Inflation Expectations: Qualitative vs. Quantitative Answers

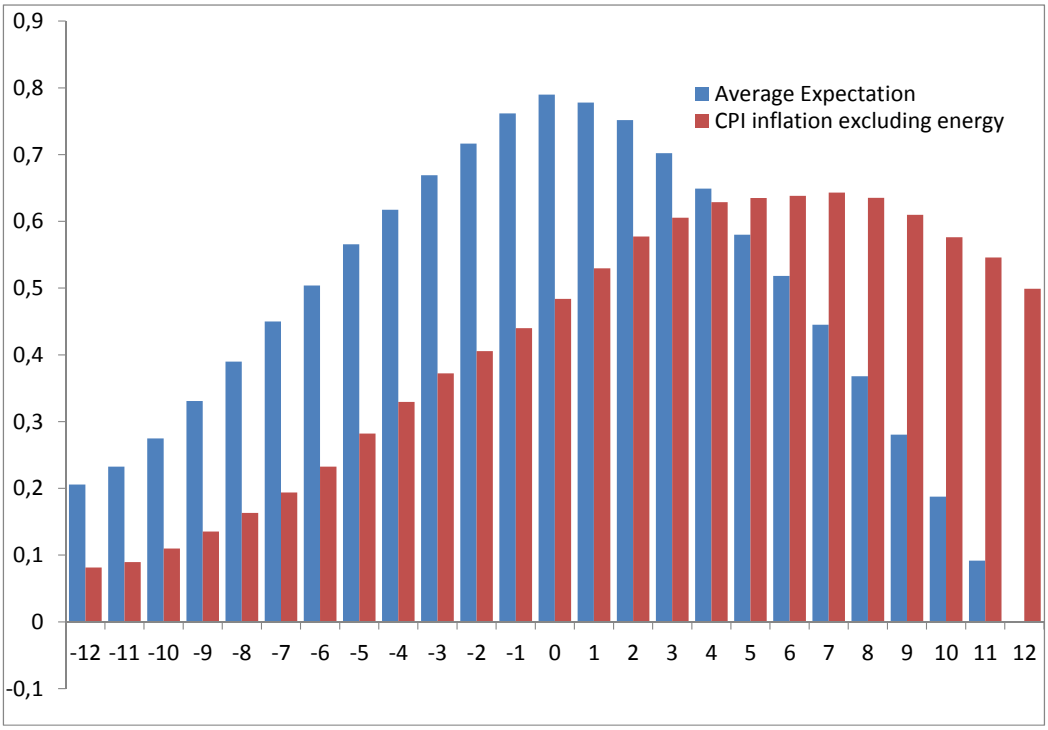
		Quantitative answers			
	%	Mean	Q1	Q2	Q3
Qualitative answers					
Increase more rapidly	9.1	4.93	3	4.5	7
Increase at the same rate	44.6	4.35	2	3.5	5
Increase at a slower rate	13.8	3.15	2	2.5	4.5
Stayed about the same	26.1	0	0	0	0
Fall	1.2	-3.59	-5	-2	-1
Don't know	5.2	-	-	-	

Note: this table reports the main statistics on quantitative inflation expectations according to the answer given to the qualitative question on inflation expectation (we here use the whole cross section of the data set). The first column reports the share of households answering to the different qualitative categories. The second through fifth columns report the moments of the distribution of quantitative inflation expectations conditional on providing a given answer to the qualitative question.

D.3 Dynamic correlations

Inflation expectations Figure D.1 shows the dynamic correlations between the average expected rate of inflation with the actual headline or core inflation rates. The maximum correlation of average expectation with inflation is obtained for dates t - $t+1$. Part of this correlation comes from large fluctuations of energy prices, but even when we exclude energy prices, this correlation is still quite strong (about 0.6). In terms of dynamic correlations, the largest correlation is obtained for dates between $t+3$ and $t+6$.

Figure D.1: Dynamic Correlation between Inflation and Average Inflation Expectation

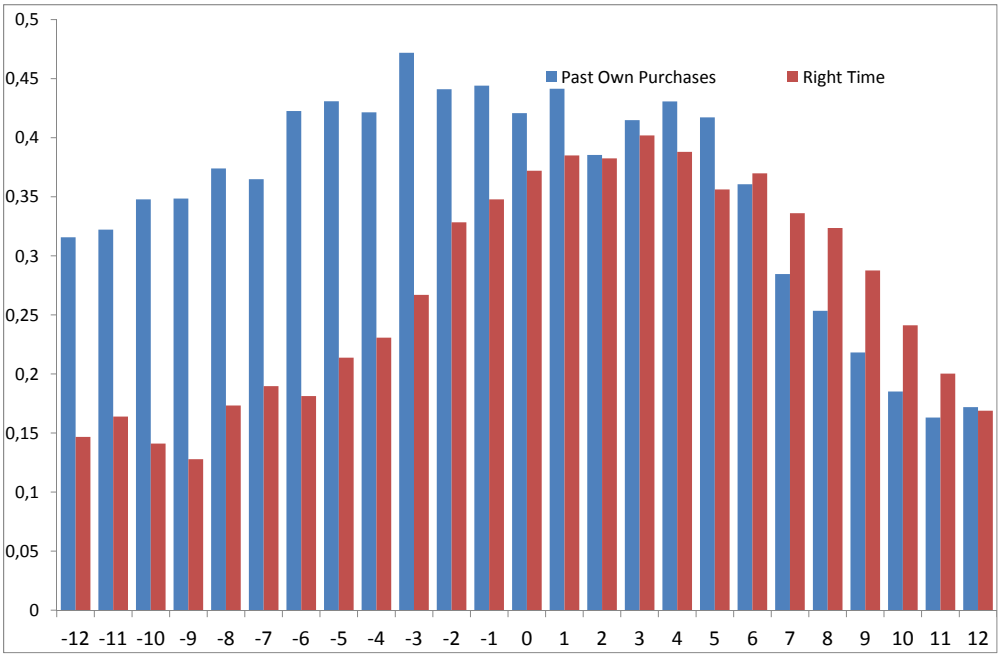


Note: we have first computed date by date the simple average answer to the quantitative questions on inflation expectations. This figure plots the dynamic correlation between the average expected rate of inflation and actual headline CPI inflation/CPI inflation excluding energy. Dynamic correlations are calculated using lagged and forwarded values of actual inflation (from t-12 months through t+12 months).

Durable consumption Figures D.2 and D.3 plot the dynamic correlation between actual durable consumption growth rate and the share of individuals answering positively to survey questions on consumption. The correlation between aggregate durable consumption growth is a little higher for the lagged series of past own purchase decisions, whereas for the question "right time to purchase," the maximum correlation with aggregate consumption growth is obtained at $t+6$, suggesting that the question "right time to purchase" captures better intentions of future purchases. The main conclusions are

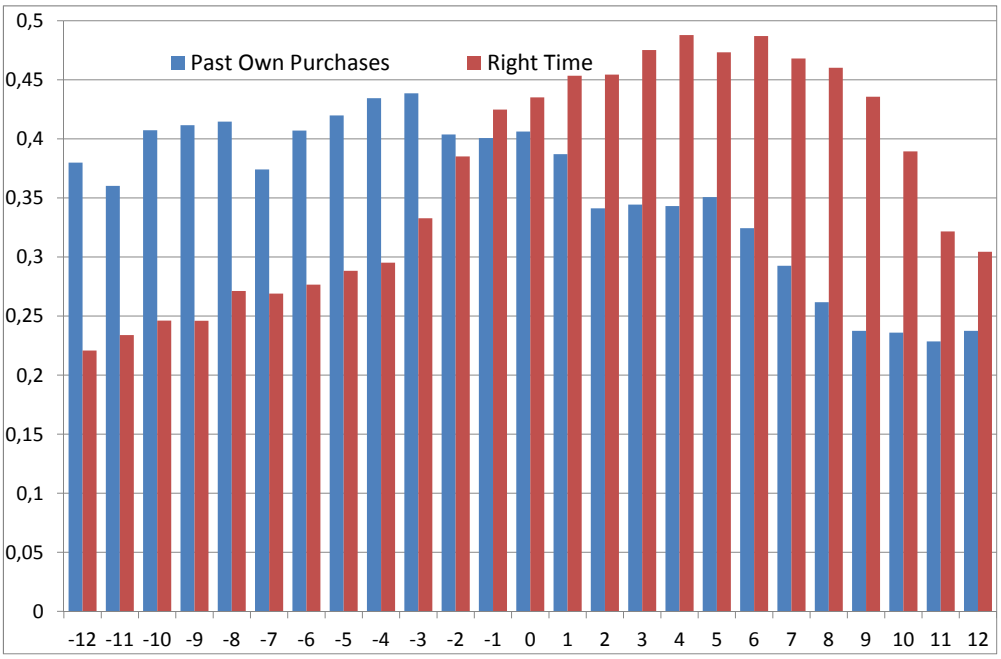
quite similar if we look at the correlation with aggregate consumption growth excluding transport equipment.

Figure D.2: Dynamic Correlation between Aggregate Actual Durable Expenditures and Aggregate Answers on Durable Expenditure in the Survey



Note: we first calculate date by date the proportion of individuals answering "yes" to the question, "Over the last 12 months, have you made durable expenditures?" and "yes" to the question, "Is it the right time to make large purchases?" Then we calculate the correlation between these time series of the share of individuals answering "yes" to questions on durable consumption and the annual growth rate of monthly durable expenditures (source INSEE). Dynamic correlations are calculated using lagged and forwarded values of the actual growth rate of durable consumption from t-12 months through t+12 months.

Figure D.3: Dynamic Correlation between Aggregate Actual Durable Consumption (excluding Cars) and Aggregate Answers on Durable Expenditure in the Survey



Note: we first calculate date by date the proportion of individuals answering "yes" to the question, "Over the last 12 months, have you made durable expenditures?" and "yes" to the question, "Is it the right time to make large expenditures?" Then we calculate the correlation between these time series of share of individuals answering "yes" to questions on durable consumption and the annual growth rate of monthly durable expenditures (source INSEE). Dynamic correlations are calculated using lagged and forwarded values of the actual growth rate of durable consumption from t-12 months through t+12 months.

E Extensive margin: robustness

E.1 The contribution of implausible values to the intensive margin

The fluctuations of the intensive margin are positively correlated with average inflation expectations and explain 25 percent of the variance. To provide further understanding of this contribution, we decompose the fluctuations of the intensive margin between the inflation expectations that are multiples of 5 and the rest. As noted from Figure 2, positive inflation expectations are mainly between 0 percent and 8 percent except for multiples of 5. These rounded expectations correspond to implausible values for inflation, and, arguably, they indicate some form of inattention or cognitive limits from these households.

We find that an important driver of the intensive margin is precisely the evolution of the share of households reporting multiples of 5 as inflation expectations. As Figure E.1 illustrates, the share of households with inflation expectations that are multiples of 5 is an important part of the contribution of the intensive margin to the overall time variation of aggregate inflation expectation.

E.2 Who answers, "[prices] stay about the same"?

We now investigate who answers that they believe prices will remain stable. The short answer is that it can possibly be everyone, no matter age, education, gender or income.

In Table E.1, we report evidence on inflation expectations and their connection with realized inflation across different groups for the whole time period under consideration. More precisely, we report the average inflation expectation, the share of households expecting stable prices, the level of non-zero inflation expectation, and the correlation with realized inflation. This correlation with realized inflation corresponds to the coefficient of an OLS regression where we take realized inflation as an explanatory variable.

For all the groups, we find that (1) a substantial share of households expect stable prices—roughly one-third—and (2) non-zero expectations are around 4 percent and that average inflation expectation as well as the extensive margin move with realized inflation.

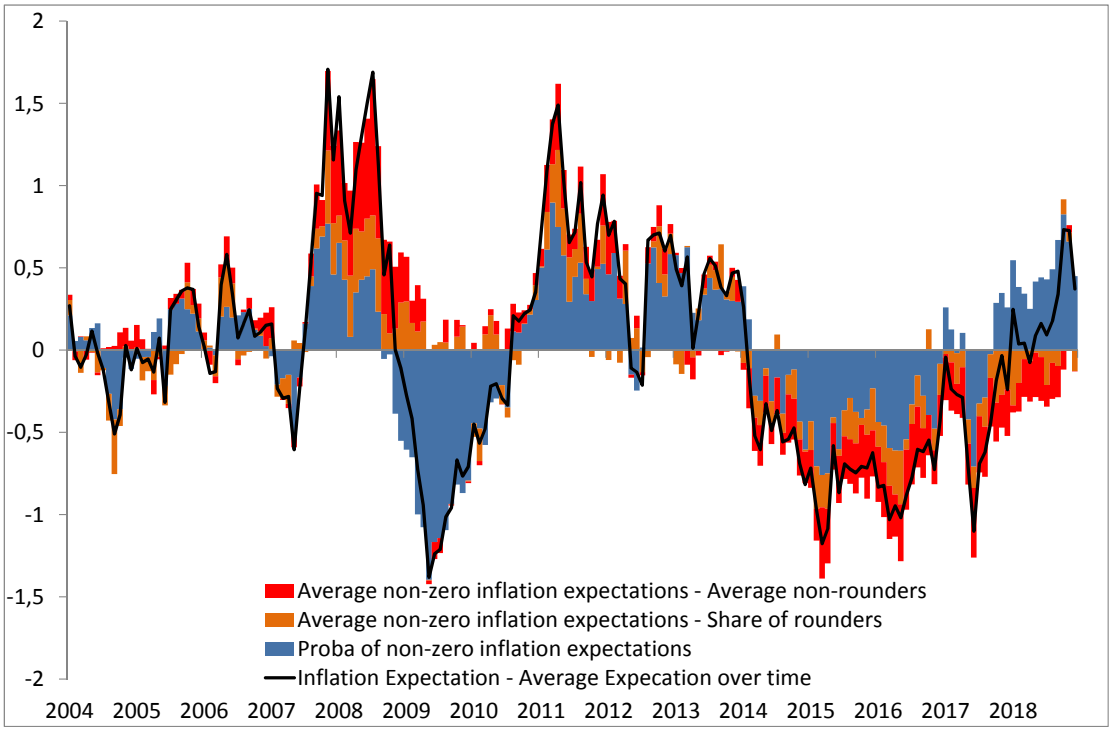
If anything differs across groups, the differences are only quantitative and small. In particular, we find that higher-income, more educated households are in some way more accurate. We find that these households tend to respond more to realized inflation (both the intensive and the extensive margins); they report fewer expectations of "[prices] stay about the same," but their non-zero expectations are lower than less educated/lower-income households. This last point suggests that higher-income/more educated households have more accurate inflation expectations, as in, for example, Vellekoop and Wiederholt (2019).

Table E.1: Drivers of Answering "Increase of Prices"

		Average statistics			Correlation with HICP infl.		
		All	Freq. zero	Av. non-zero π^e	All	Extensive	Intensive
All		2.97	32.0	4.48	0.388***	3.05***	0.405***
	High inflation	3.44	26.6	4.79	0.406***	0.71***	0.537***
	Low inflation	2.56	36.9	4.16	0.519***	6.16***	0.485***
Gender	Female	3.03	35.4	4.87	0.353***	2.63***	0.377***
	Male	2.97	30.2	4.34	0.456***	3.26***	0.420***
Age	16-29	3.23	29.9	4.75	0.222***	2.54***	0.202***
	30-49	3.29	27.9	4.69	0.409***	2.80***	0.417***
	50-64	3.15	28.6	4.51	0.458***	2.99***	0.474***
	65+	2.40	40.6	4.11	0.314***	2.81***	0.337***
Education	Primary	2.66	40.2	4.63	0.275***	2.73***	0.263***
	Secondary	3.03	32.8	4.65	0.420***	2.55***	0.470***
	Further	3.04	29.1	4.37	0.402***	3.51***	0.395***
Income	$< Q1$	2.94	36.6	4.84	0.318***	2.53***	0.335***
	$]Q1 - Q2]$	3.01	34.0	4.70	0.366***	2.77***	0.385***
	$]Q2 - Q3]$	3.12	30.4	4.58	0.407***	3.13***	0.417***
	$> Q3$	2.88	28.2	4.06	0.437***	3.70***	0.445***

Note: the three first columns report average statistics on expected inflation by categories of households. "All" refers to the average calculated using all values of expected inflation collected by the survey including zeros. "Freq. zeros" refers to the proportion of households reporting "stable prices" or zero expected inflation. "Av. non-zero π^e" is the average of expected inflation calculated only on non-zero values. The last three columns report results of simple regressions where the endogenous variable corresponds to (1) all expected inflation values (OLS model), (2) a dummy variable equal to 1 if a given household expects a non-zero inflation (probit model), and (3) non-zero inflation expectations marginal effect (OLS model). In all equations, we report the coefficient or marginal effect associated with the exogenous variable HICP inflation. Each cell corresponds to the result of a model where the sample is restricted to a given household category. Control variables include year and month dummies, household characteristics (age, location [city, region] education, job, income), survey wave (1, 2, or 3), answers to other questions on French economic conditions (standard of living, unemployment, etc.), answers to the question about future plans for major purchases, and a dummy variable for perceived inflation. Regressions also include random household effects, and standard errors are corrected for possible heteroscedasticity. *p<0.1; **p<0.05; ***p<0.01.

Figure E.1: Aggregate Inflation Expectations Decomposition—Contribution of Implausible Values



Note: this figure plots contributions to aggregate inflation expectations. Black line: aggregate average expected inflation—mean aggregate average expected inflation; blue histogram: contribution of time variations of the probability of non-zero answers; light orange histogram: contributions of time variations of the probability of answers multiple of 5; dark orange histogram: contribution of time variations in the average expected inflation for answers not multiple of 5. The contributions of the share of non-multiple of 5 or the average size of answers multiple of 5 are very small and not reported on this graph.

E.3 Aggregate inflation expectation: variance decomposition

Baseline variance decomposition As described in Section 3, the average of individual expectations, $\pi^e_{t|t+1} = \frac{1}{n_t}\sum_{i=1}^{n_t} \pi^e_{i,t|t+1}$, can be decomposed into two components:

$$\pi^e_{t|t+1} = fr_t \times dp^e_{t|t+1},$$

with $fr_t = \left(\frac{1}{n_t}\sum_{i=1}^{n_t} I_{it}\right)$ being the fraction of households with positive inflation expectations, and with $dp^e_{t|t+1} = \left(\sum_{i=1}^{n_t} I_{it}\right)^{-1}\left(\sum_{i=1}^{n_t} \pi^e_{i,t|t+1}\right)$ being the average among households having non-zero inflation expectations.

We can then decompose fluctuations in the average inflation expectations of households into changes in both the extensive and the intensive margins:

$$\pi^e_{t|t+1} - \overline{\pi}^e = \underbrace{\left(fr_t - \overline{fr}\right)\overline{dp}^e}_{extensive} + \underbrace{\left(dp^e_{t|t+1} - \overline{dp}^e\right)\overline{fr}}_{intensive} + O(t).$$

Following Klenow and Kryvtsov (2008), we can thus write the variance of $\pi^e_{t|t+1}$ as:

$$V\left(\pi^e_{t|t+1}\right) = \underbrace{V\left(dp^e_{t|t+1}\right)\overline{fr}^2}_{intensive} + \underbrace{V\left(fr_t\right)\overline{dp^e}^2 + 2cov\left(fr_t, dp^e_{t|t+1}\right)\overline{dp^e fr}}_{extensive}$$

Alternative imputation assumptions As discussed in subsection 3.2, the average inflation expectation and its variance, as well as the contribution of the extensive margin to inflation variations, depend on the value imputed to answers of "[prices] will stay about the same." If we assume a non-zero inflation expectation for households answering "[prices] will stay about the same," the average of individual expectations can be decomposed into two components:

$$\pi^e_{t|t+1} = (1 - fr_t) \times s^e_{t|t+1} + fr_t \times dp^e_{t|t+1},$$

with $fr_t = \left(\frac{1}{n_t}\sum_{i=1}^{n_t} I_{it}\right)$ being the fraction of households with positive inflation expectations, $dp^e_{t|t+1} = \left(\sum_{i=1}^{n_t} I_{it}\right)^{-1}\left(\sum_{i=1}^{n_t} I_{it}\pi^e_{i,t|t+1}\right)$ being the average among households having non-zero inflation expectations, and $s^e_{t|t+1} = \left(\sum_{i=1}^{n_t}(1 - I_{it})\right)^{-1}\left(\sum_{i=1}^{n_t}(1 - I_{it})\pi^e_{i,t|t+1}\right)$ being the average among households expecting prices to "stay about the same."

We can then decompose fluctuations in the average inflation expectations of households into changes in both the extensive and the intensive margins:

$$\pi^e_{t|t+1} - \overline{\pi}^e = \underbrace{\left(fr_t - \overline{fr}\right)\left(\overline{dp}^e - \overline{s}^e\right)}_{extensive} + \underbrace{\left(dp^e_{t|t+1} - \overline{dp}^e\right)\overline{fr} + \left(s^e_{t|t+1} - \overline{s}^e\right)\left(1 - \overline{fr}\right)}_{intensive} + O(t).$$

In a first approach, we consider no time variation in the average expectation for

households expecting prices to remain about the same (that is, we assume a constant average answer equal to $\overline{s}^e$). In that case, the average inflation can be decomposed as the following:

$$\pi^e_{t|t+1} - \overline{\pi}^e = \underbrace{\left(fr_t - \overline{fr}\right)\left(\overline{dp}^e - \overline{s}^e\right)}_{extensive} + \underbrace{\left(dp^e_{t|t+1} - \overline{dp}^e\right)\overline{fr}}_{intensive} + O(t),$$

and the variance decomposition is the following:

$$V\left(\pi^e_{t|t+1}\right) = \underbrace{V\left(dp^e_{t|t+1}\right)\overline{fr}^2}_{intensive} + \underbrace{V\left(fr_t\right)\left(\overline{dp^e} - \overline{s}^e\right)^2 + 2cov\left(fr_t, dp^e_{t|t+1}\right)\left(\overline{dp^e} - \overline{s}^e\right)\overline{fr}}_{extensive}$$

When we compare this expression with our baseline variance decomposition, the contribution of the intensive margin to overall variance does not depend on $\overline{s}^e$ and is the same as the one in our baseline case. However, the contribution of the extensive margin (and thus the overall variance) will decrease with $\overline{s}^e$ (in particular through the term $V\left(fr_t\right)\left(\overline{dp^e} - \overline{s}^e\right)^2$).

We can relax the assumption of no time variation in the average expectation for households expecting prices to remain about the same. For instance, we can assume that the time variance of the average expectation for households expecting prices "to remain about the same" is the same as the one observed for households expecting prices to increase. In that case, one additional covariance term will add to the contribution of the extensive margin to the overall inflation variance (increasing both the contribution of the extensive margin and the overall variance of inflation):

$$V\left(fr_t\right)\left(\overline{dp^e} - \overline{s}^e\right)^2 + 2cov\left(fr_t, dp^e_{t|t+1}\right)\left(\overline{dp^e} - \overline{s}^e\right)\overline{fr} + 2cov\left(fr_t, s^e_{t|t+1}\right)\left(\overline{dp^e} - \overline{s}^e\right)\left(1 - \overline{fr}\right)$$

Similarly, two terms will add to the contribution of the intensive margin; one is the variance of the answers imputed to households expecting prices to remain the same (here, both are equal), and the other is a covariance term between the two average answers:

$$V\left(dp^e_{t|t+1}\right)\overline{fr}^2 + V\left(s^e_{t|t+1}\right)\left(1 - \overline{fr}\right)^2 + 2cov\left(dp^e_{t|t+1}, s^e_{t|t+1}\right)\left(\overline{fr}\right)\left(1 - \overline{fr}\right)$$

We report results associated with these variance decomposition exercises in Table 3 in the main text and Table E.2 in this Appendix. In the first table, we assume different average values for the answer imputed to households expecting prices to "stay about the same" (but we assume no time variation in this average answer). In the second table, we relax the assumption of no time variations in the average answer and assume that the time variance of the average answer imputed to households expecting prices to "stay about the same" is the same as the one observed for households expecting prices to "increase."

In our first exercise (Table 3 in the main text), when we increase the average answer imputed to households answering "stay about the same," as expected, it increases the average aggregate inflation expectation and reduces its variance over time, because the contribution of the extensive margin decreases (in particular because of the term: $V\left(fr_t\right)\left(\overline{dp^e} - \overline{s}^e\right)^2$, whereas the intensive margin remains unchanged.

In our second exercise, we assume some time variation in the average imputed answer has a large positive effect on the overall variance of inflation (relative to the previous exercise). In our baseline scenario with 0 percent imputed answer, the overall variance is now 0.56, compared with 0.41 in the case without time variation. This additional variance comes mainly from the intensive margin (that is, the term $V\left(s^{e}_{t|t+1}\right)\left(1-\overline{fr}\right)^{2}$). This leads to a smaller contribution of the extensive margin (62 percent in the 0 percent scenario versus 76 percent in our baseline scenario). When we increase the average answer imputed to households answering that they expect prices to "stay about the same," results are quite similar to the one described above; the overall variance decreases since the contribution of the extensive margin decreases.

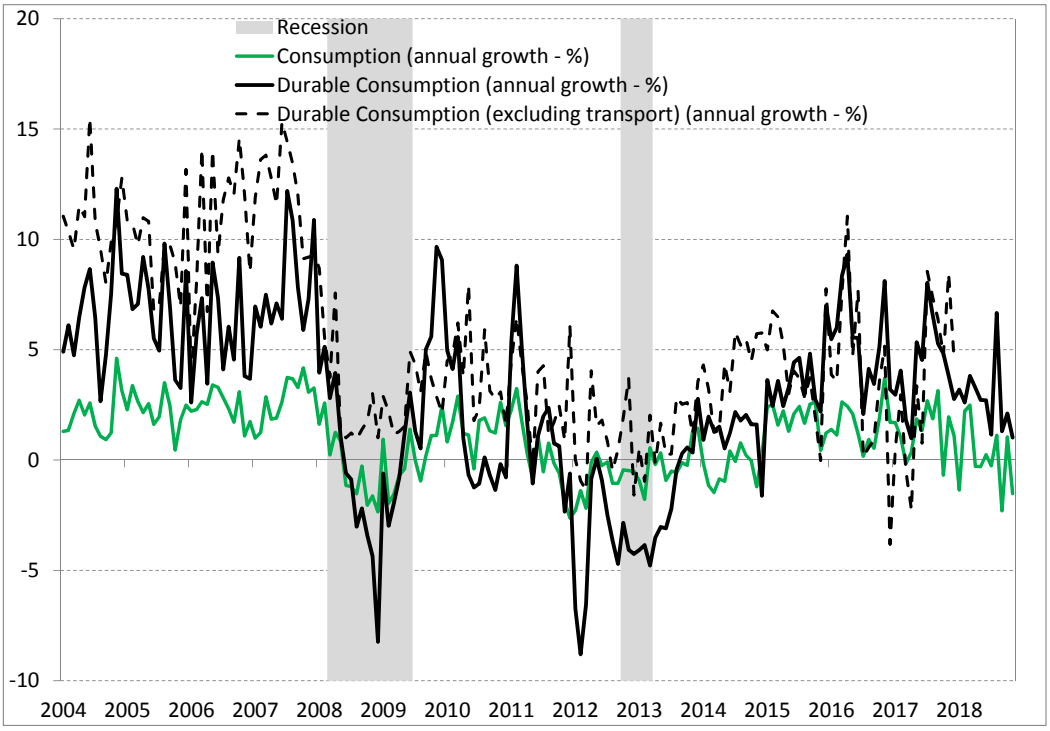
Table E.2: Variance Decomposition—Imputation with Time Variations

Average Imputed Value	Average Agg. Expectation	Variance of Agg. Expectation	Contrib. Intensive	% of Total Variance Intensive	Extensive
0	2.80	0.56	0.21	38.0	62.0
0.5	2.96	0.50	0.21	42.9	57.1
1	3.12	0.44	0.21	48.5	51.5
1.5	3.29	0.39	0.21	55.0	45.0
2	3.45	0.34	0.21	62.3	37.7
2.5	3.61	0.30	0.21	70.5	29.5

Note: this table reports simple statistics on the mean and variance of aggregate inflation expectations depending on the average value imputed to households answering that prices will stay about the same (col. 1) and assuming that the time variation in the average expectations of these households' answers is the same as the one observed for households with no imputed answers. Col. 2 is the average aggregate expectation over time (over all types of answers to the quantitative question, imputed or not). Col. 3 reports the time variance of this average aggregate expectation. Col. 4 reports the contribution of the intensive margin to the overall variance of inflation. Cols. 5 and 6 report the relative contribution of intensive and extensive margins to the overall variance.

F Statistics on durable consumption

Figure F.1: Aggregate Consumption Growth in France—Total and Durables



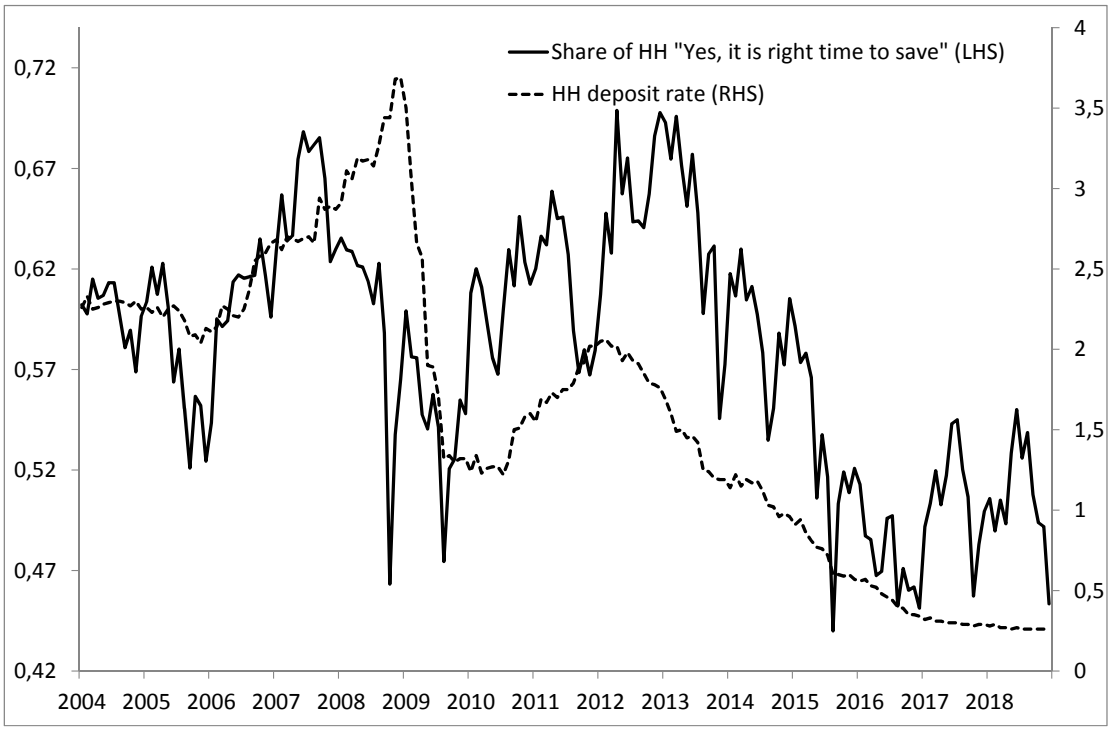
Note: Annual growth rate of household consumption of goods (including, food, manufactured goods, and energy), durables (including transport equipment, housing equipment, and other durables), durables excluding transport equipment (source INSEE)

Table F.1: Distribution of Durable Consumption 2005–2011

	Year	Freq.	Moments—in euros			
			Q1	Q2	Q3	P90
Overall						
	2005	0.59	340	740	1559	2941
	2011	0.62	400	749	1450	2605
Home Appliances	2005	0.27	270	458	744	1213
	2011	0.30	280	422	700	1103
TV, computers, phones...	2005	0.35	200	416	990	1600
	2011	0.41	269	500	850	1370
Furniture	2005	0.30	240	531	1260	2846
	2011	0.28	270	549	1200	2570

Note: this table reports some moments of the distribution of durable spending over a year. Individual data come from the survey Enquete Budget des Familles. Every five years INSEE collects individual data on consumption for more than 10,000 households; households report their durable spending over the preceding 12 months, product by product. We drop individual product spending that is less than 100 euros. We calculate for every household in the survey the total durable spending. Freq. reports the share of households reporting durable spending over the preceding 12 months. The four last columns report moments of the distribution conditional on having reported positive durable consumption.

Figure F.2: Right Time to Save and the Deposit Interest Rate

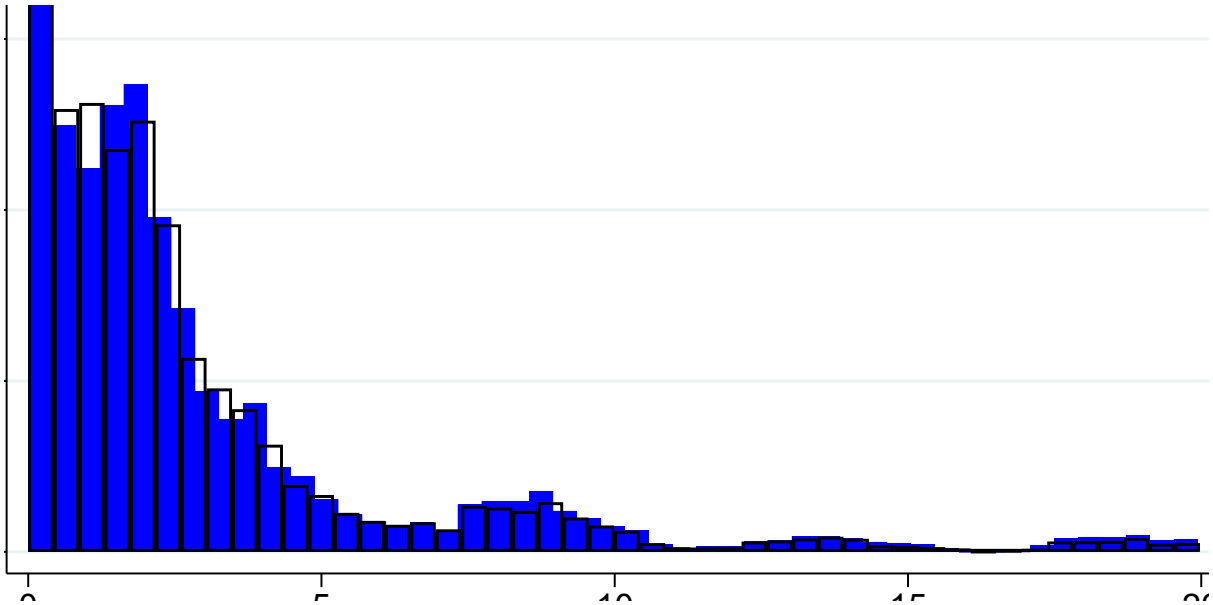


Note: we calculate date by date the share of households answering "yes," that this is the right time for people to save, using individual answers in the survey, and we plot the monthly nominal interest on households' short-term deposits over the same period (source: Banque de France)

G Additional regressions

G.1 Additional Regressions—Forecast Error and Purchases

Figure G.1: Distribution of Forecast Errors by Answer to the Question on Own Durable Purchases



Note: we calculate the difference in absolute value between the quantitative expectation of inflation (over the next 12 months) and the actual value of inflation 12 months after the date of the survey. This figure plots the distribution of this error forecast according to the answer to the question, "Did you make major purchases over the last 12 months?" (Yes/No).

Table G.1: Effect of Durable Consumption Decisions on Forecast Errors

	All	Less than p99	All
	(1)	(2)	(3)
Yes, Durable Purchase	0.013	0.014	0.018
	(0.012)	(0.012)	(0.012)
Perception error	-	-	0.320***
			(0.004)
Controls	Yes	Yes	Yes
Obs.	141,123	134,093	136,574

Note: this table reports fixed effect panel regressions where the endogenous variable is the log difference between household level inflation expectation at date t for the horizon t+12 and the actual inflation at date t+12. Exogenous variables include a dummy variable equal to 1 if the household answers "yes" to the question, "Did you make major purchases over the last 12 months?"; the error in perceived inflation (the log difference between perceived inflation at date t and actual inflation at date t); as well as time and household fixed effects. Standard errors are clustered at the date level. *p<0.1; **p<0.05; ***p<0.01.

G.2 Additional regression: heterogeneity across households

Table G.2: Marginal Effects of Inflation Expectations on Consumption—Household Heterogeneity

		All	Only $\pi^e \neq 0$	Extensive
Gender	Female	0.355***	0.137	1.317**
		(0.103)	(0.159)	(0.550)
	Male	0.122*	-0.152	0.725**
		(0.074)	(0.107)	(0.368)
Age	16-29	-0.187	-0.237	-0.719
		(0.232)	(0.344)	(1.190)
	30-49	0.219**	0.140	0.512
		(0.100)	(0.155)	(0.539)
	50-64	0.297***	-0.081	1.831***
		(0.098)	(0.168)	(0.518)
	65+	0.113	-0.291	0.944*
		(0.122)	(0.187)	(0.543)
Education	Primary	-0.008	-0.471**	0.200
		(0.153)	(0.236)	(0.702)
	Secondary	0.334***	0.156	1.689***
		(0.096)	(0.132)	(0.527)
	Further	0.192**	-0.052	0.832*
		(0.085)	(0.124)	(0.443)

Note: the two first columns report marginal effects (in percentage points) from probit models where the endogenous variable is a dummy variable equal to 1 if the household answers "yes" to the question, "Did you make major purchases over the last 12 months?" Each cell corresponds to the results from model where the sample is restricted to a given household category. in col. 1, "All," we include quantitative answers to the question on inflation expectations; in col. 2 we consider only non-zero answers to the question on inflation expectations; in col. 3 we use a dummy variable equal to 1 if the household answers 0 to the quantitative question on inflation expectations. Control variables include year and month dummies, household characteristics (age, location [city, region] education, job, income), survey wave (1, 2, or 3), answers to other questions on French economic conditions (standard of living, unemployment, etc.), and answers to the questions about future plans for major purchases and perceived inflation. Standard errors are clustered at the date level. *p<0.1; **p<0.05; ***p<0.01.

Table G.3: Marginal Effects of Inflation Expectations on Consumption—Household Heterogeneity—Continued

		All	Only $\pi^e \neq 0$	Extensive
Income	$< Q1$	0.176*	-0.173	0.508
		(0.103)	(0.154)	(0.556)
	$]Q1 - Q2]$	0.153	-0.255	1.039*
		(0.116)	(0.172)	(0.622)
	$]Q2 - Q3]$	0.262**	0.188	0.973
		(0.110)	(0.171)	(0.624)
	$> Q3$	0.200*	0.021	1.154**
		(0.120)	(0.184)	(0.584)
HH Financial Situation	2	0.108	-0.225	-0.536
		(0.115)	(0.165)	(0.554)
	1	0.367***	0.180	1.569***
		(0.089)	(0.130)	(0.486)
	0	0.046	-0.169	0.615
		(0.099)	(0.158)	(0.560)

Note: In the two first columns, we report marginal effects from probit models where the endogenous variable is a dummy variable equal to 1 if the household answers "yes" to the question, "Did you make major purchases over the last 12 months?" Each cell corresponds to the results from the model where the sample is restricted to a given category. In col. 1, "All," we include quantitative answer to the question on inflation expectations; in col. 2 we consider only non-zero answers to the question on inflation expectations; in col. 3 we use a dummy variable equal to 1 if the household answers 0 to the quantitative question on inflation expectations. Control variables include year and month dummies, household characteristics (age, location [city, region] education, job, income0, survey wave (1, 2, or 3), answers to other questions on French economic conditions (standard of living, unemployment, etc.), and answers to the questions about future plans for major purchases and perceived inflation. Standard errors are clustered at the date level. *p<0.1; **p<0.05; ***p<0.01.

G.3 Additional regressions—panel dimension

Panel construction—methodology Each household is surveyed in three consecutive months at most, but the survey does not contain any household identifier provided by the statistical office before 2014—after 2014, we use the variable NUMFA.

To construct the unique household identifier for the period before 2014, we use all the variables describing the characteristics of the head of household (location [region, size of the city], gender, year of birth, education], the characteristics of the partner, and the variables describing the composition of the household. We consider that three observations are associated with the same household over time if all these variables characterizing the household are the same over the period.

This identification of household through time might be quite conservative, in particular if over the three-month period some characteristics changed. Overall, we find that our sample contains about 159,000 different households; 66,475 are surveyed three times, 39,492 twice, and 52,771 only once.

Table G.4: Marginal Effects of Inflation Expectations on Own Major Purchases over the Preceding 12 Months: Qualitative Answer—Panel Regressions

	Fixed Effect Logit		Random Effect Probit	
	(1)	(2)	(3)	(4)
$\pi^e \neq 0$	0.551		0.584***	
	(0.383)		(0.179)	
Increase more rapidly		0.744		1.040***
		(0.648)		(0.294)
Increase at the same rate		0.556		0.531***
		(0.448)		(0.198
Increase at a slower rate		0.937*		0.951***
		(0.553)		(0.245)
Stay about the same		Ref.		Ref.
Fall		-0.033		0.578
		(1.430)		(0.670)
DK		-0.552		-0.775*
		(0.926)		(0.412)
Controls	Yes	Yes	Yes	Yes
Obs.	71,099	71,099	312,921	312,921

Note: this table reports marginal effects (in percentage points) from panel probit regressions with random household effects and conditional logit where the endogenous variable is a dummy variable equal to 1 if the household answers "yes" to the question, "Have you made major purchases during the last 12 months?" Control variables include year and month dummies, (when including random effects: household characteristics [age, location (city, region) diploma, job, income], survey wave (1, 2, or 3), answers to other questions on French economic conditions (standard of living, unemployment, etc.), and answers to the questions about future plans for major purchases, right time to save, and perceived inflation. *p<0.1; **p<0.05; ***p<0.01.

Table G.5: Marginal Effects of Inflation Expectations on Consumption—Past Purchases—by Interview

	1	2	3
π^e Quantitative	0.182**	0.278***	0.138
	(0.084)	(0.107)	(0.126)
π^e Quanti. by intervals:			
$[10\%; +\infty[$	0.267	0.514	-1.393
	(0.759)	(1.072)	(1.181)
$[5\%; 10\%[$	1.237*	2.204***	1.073
	(0.699)	(0.818)	(0.983)
$[3\%; 5[$	1.304**	1.955**	-0.016
	(0.655)	(0.795)	(0.973)
$]0\%; 3\%[$	1.623**	1.413*	0.208
	(0.632)	(0.741)	(0.838)
0%	Ref.		
$< 0\%$	0.862	-0.429	-2.831
	(1.801)	(2.513)	(2.766)
π^e Quali. - Increase	1.166**	1.421**	0.053
	(0.466)	(0.567)	(0.641)
π^e Quali - by intervals:			
Increase more rapidly	1.271**	2.303***	1.813**
	(0.494)	(0.614)	(0.754)
Increase at the same rate	0.456	1.326***	0.386
	(0.321)	(0.396)	(0.461)
Increase at a slower rate	1.294***	1.195***	1.285**
	(0.438)	(0.458)	(0.558)
Stay about the same	Ref.		
Fall	0.556	1.231	0.940
	(1.094)	(1.408	(1.968)
Controls	Yes	Yes	Yes
Obs.	149,203	100,407	63,311
Obs.	62,839	44,814	28,921

Note: this table reports marginal effects from ordered probit regressions. The dependent variable is a dummy variable equal to 1 if the household answers "yes" to the question, "Did you make major purchases over the last 12 months?" Marginal effects are calculated for the value "yes, definitely." Control variables include year and month dummies, household characteristics (age, location [city, region] diploma, job, income), survey wave (1, 2, or 3), answers to other questions on French economic conditions (standard of living, unemployment, etc.), and answers to the questions about future plans for major purchases and perceived inflation. Standard errors are clustered at the date level. *p<0.1; **p<0.05; ***p<0.01.

Table G.6: Marginal Effects of Inflation Expectations on Consumption—Right Time to Purchase—by Interview

	1	2	3
π^e Quantitative	0.056	0.032	0.141*
	(0.053)	(0.059)	(0.077)
π^e Quanti. by intervals:			
$[10\%; +\infty[$	0.006	-0.628	0.400
	(0.429)	(0.552)	(0.679)
$[5\%; 10\%[$	0.794**	0.206	1.764***
	(0.402)	(0.433)	(0.561)
$[3\%; 5[$	1.227***	0.581	1.969***
	(0.409)	(0.492)	(0.557)
$]0\%; 3\%[$	0.974**	0.666*	0.878*
	(0.417)	(0.386)	(0.521)
0%	Ref.		
$< 0\%$	0.043	-0.920	0.824
	(1.222)	(1.565)	(1.647)
π^e Quali. - increase	0.718**	0.183	1.104***
	(0.277)	(0.314)	(0.374)
π^e Quali - by intervals:			
Increase more rapidly	0.036	-0.313	0.259
	(0.301)	(0.348)	(0.402)
Increase at the same rate	0.327*	0.194	0.355
	(0.194)	(0.222)	(0.267)
Increase at a slower rate	1.010***	0.658**	0.445
	(0.243)	(0.274)	(0.360)
Stay about the same	Ref.		
Fall	0.152	-0.142	1.049
	(0.723)	(0.863)	(1.181)
Controls	Yes	Yes	Yes
Obs.	143,320	97,313	61,643
Obs.	61,505	44,086	28,526

Note: In this table, we report marginal effects from ordered probit regressions where the endogenous variable is a variable taking one of three different values depending on the answer to the question, "Do you think now is the right time for people to make major purchases?": 0 if the household answers, "No, it is the wrong time"; 1 if "It is neither the right time nor the wrong time"; and 2 if "Yes, now is the right time." Marginal effects are calculated for the value "yes." Control variables include year and month dummies, household characteristics (age, location [city, region], diploma, job, income) survey wave (1, 2, or 3), answers to other questions on French economic conditions (standard of living, unemployment, etc.), answers to the questions about future plans for major purchases and perceived inflation. Standard errors are clustered at the date level. *p<0.1; **p<0.05; ***p<0.01.

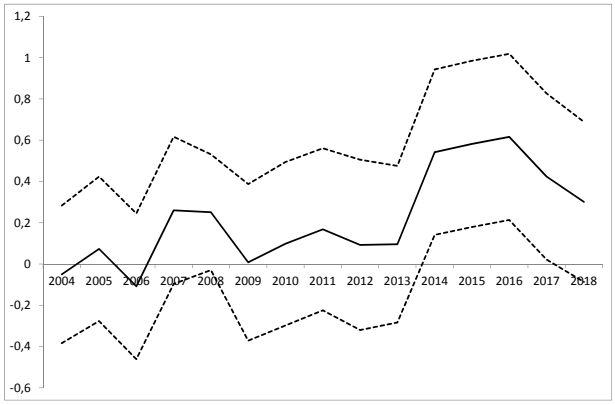
G.4 The response to inflation expectations across years

In this subsection, we investigate whether the connection between inflation expectations and consumption decisions is stable across years. Our sample covers years both before and after the 2008 financial crisis, periods when the effective lower bound (ELB) arguably bind as well as periods when the European Central Bank (ECB) made forward guidance (FG) announcements.

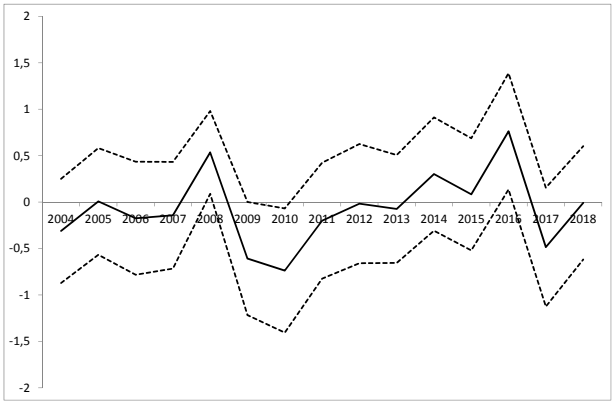
For this purpose, we run regressions by year to test whether the effect of inflation expectations on consumption decisions moved over the sample period. In particular, we would like to test whether the effect of inflation expectations is stronger during the period when the ECB signaled it was at the ELB and gave explicit forward guidance on future rates. Figure G.2 reports the evolution of the coefficient in the regression for inflation expectations. As can be observed, the patterns that we identified in Table 4 are relatively stable across our sample.

If anything, we find, the effect of quantitative inflation expectations on the decision to make large purchases has increased, especially since 2014, which corresponds to the ELB/FG period.

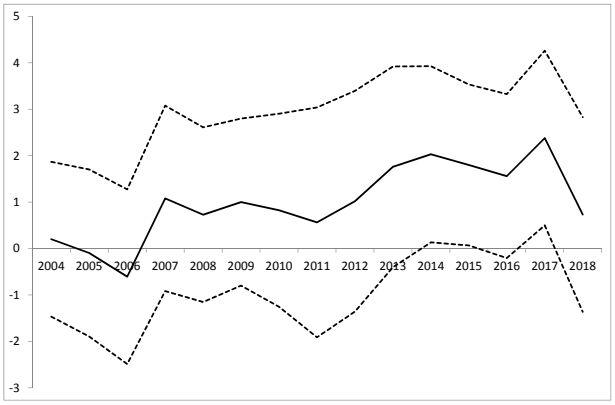
Figure G.2: Marginal Effects of Inflation Expectations over Time



(a) All



(b) Intensive margin



(c) Extensive margin

Note: black solid lines report marginal effects from probit models estimated year by year where the endogenous variable is a dummy variable equal to 1 if the household answers “yes” to the question, “Did you make major purchases over the last 12 months?”; "All" we include all quantitative answers to the question on inflation expectations; "Intensive margin" we use only non-zero answers; "Extensive margin" we use a dummy variable equal to 1 if the answer is different from 0, and 0 otherwise. Control variables include year and month dummies, household characteristics (age, location [city, region] education, job, income), survey wave (1, 2, or 3), answers to other questions on French economic conditions (standard of living, unemployment, etc.), and answers to the questions about future plans for major purchases, right time to save, and perceived inflation. Regressions also include random household effects, and standard errors are corrected for possible heteroscedasticity. Dashed black lines correspond to the 90 percent confidence intervals.

H Germany

DATA SET

We use the underlying individual data from the monthly consumer confidence survey conducted by GFK in Germany. This survey is part of the harmonized European household confidence indicators released by the European Commission for all countries in the European Union. The microdata are collected at a monthly frequency over the period January 2004 through December 2018.[35] Every month about 2,000 interviews are carried out via phone calls. The sample contains a little more than 360,000 individual observations over the 15-year period, that is, about 2,000 observations per month on average. The questionnaire is very similar to the French questionnaire except that the German questionnaire does not include any question on the houshold's own consumption of durables.

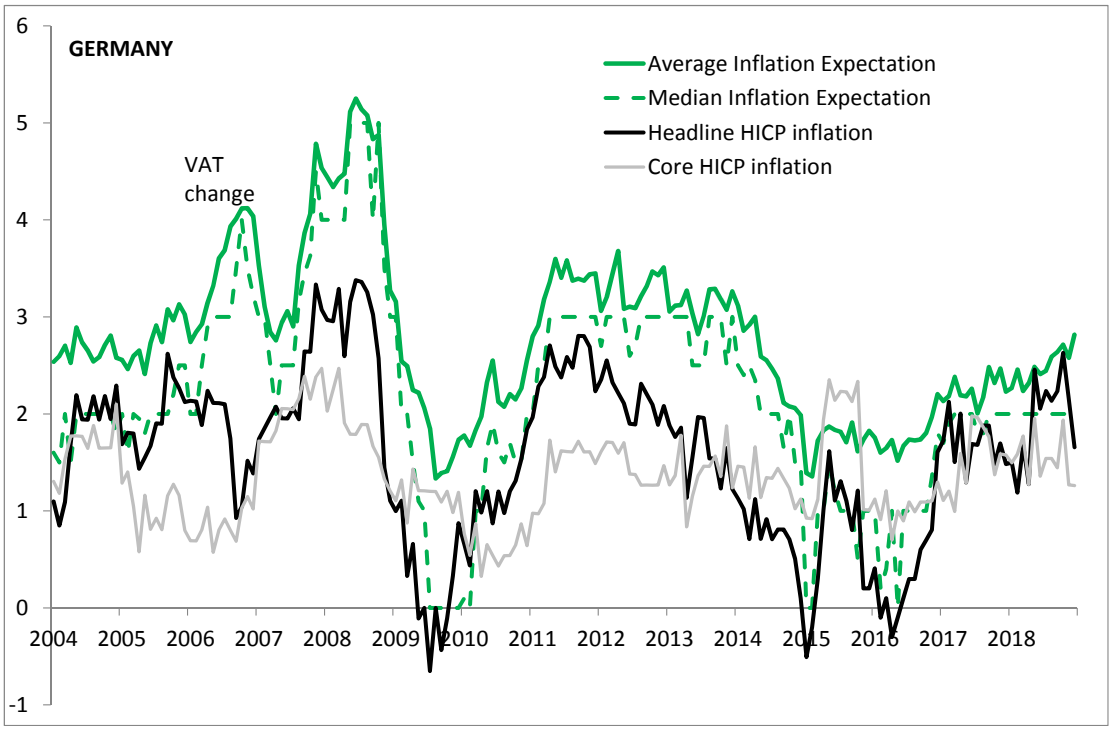
Table H.1: Simple Statistics on Inflation Expectations

	Aggregate Moments	Correlation with Headline π	Correlation with π excl. Energy
Average Expectation	2.76	0.75	0.30
	(0.84)		
% of Stable Prices	0.31	-0.76	-0.31
	(0.10		
Average of non-zero inflation	3.91	0.72	0.25
	(0.65)		

Note: In this table, we report simple statistics calculated using individual answers to the quantitative question on inflation expectations. We first calculate statistics date by date and then compute the average of this time series. The first column reports the simple average of the time series. The second and third columns report correlation coefficients of the aggregate moment calculated date by date and the headline HICP inflation (source Eurostat) and HICP inflation excluding energy and unprocessed food (source Eurostat). "Average" is the simple average of all answers (including zeros) to the quantitative question. "% of Stable Prices" is the average proportion of answers exactly equal to 0. "Average of Non-Zero Inflation" is the average of inflation expectations when not equal to 0.

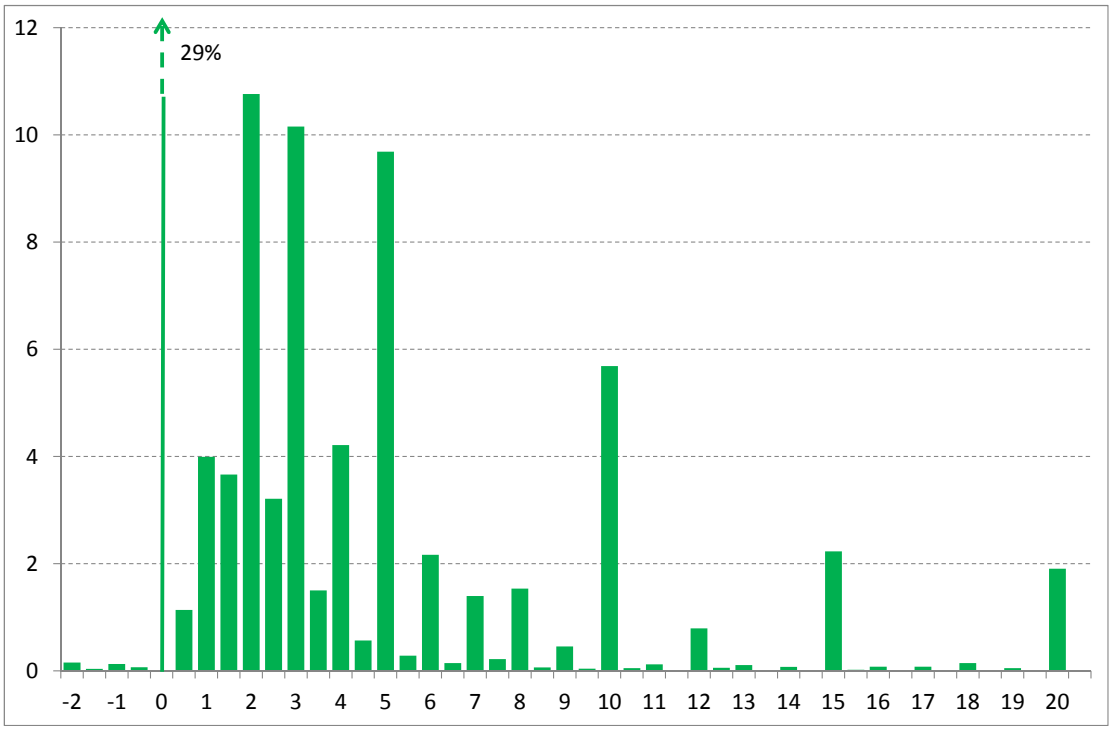
[35] Between August and October 2007, quantitative answers to inflation are not available.

Figure H.1: Expected Inflation and Headline HICP inflation



Note: using answers to the quantitative questions on inflation expectations (we drop quantitative inflation perceptions larger than 20 percent), we compute the simple average/median of all answers date by date. Between August and October 2007, quantitative answers are not available; we have replaced aggregate statistics by a simple interpolation. We have also plotted as benchmarks headline HICP inflation (source Eurostat) and HICP inflation excluding energy (source Eurostat).

Figure H.2: Cross Distribution of Inflation Expectations



Note: we here represent the distribution of inflation expectations across households computed over the period January 2004 through December 2017. The proportion of answers above 20 percent is not reported. The distribution is unweighted.

Table H.2: Aggregate Expectation Time Variations: Extensive vs. Intensive Margins

	Variance	Intensive margin	Extensive margin	
			Freq.	Cov.
All	0.69	0.20	0.16	0.33
Low inflation	0.64	0.17	0.20	0.27
High inflation	0.75	0.23	0.11	0.41

Note: Variance decomposition exercise; col. (1) time variance of aggregate inflation expectation; col. (2) contribution of the intensive margin (that is, non-zero average inflation expectation) ; cols. (3) and (4) contribution of the extensive margin decomposed into variance of the frequency of positive inflation expectations and into the covariance between the average non-zero inflation expectation and the frequency of positive inflation expectations. Low inflation: HICP (headline) below the median inflation over the period; high inflation: headline inflation above the median inflation

Table H.3: Stylised Facts on Durable Consumption

	Frequency	Corr. with consumption	
		Overall	Durables
Right Time to Purchase			
Yes	0.25	0.46	0.28
Neutral	0.58	0.06	0.16
No	0.17	-0.45	-0.16

Note: in this table we report simple aggregate statistics using the answers to the questions on durable consumption. We first compute the average proportion of answers in every answer category date by date and then compute the average of these time series. The first column reports the average proportion of answers in a given category. The other columns report correlation over time of the proportion of answers in a given category and annual growth rate of: col. 2 overall quarterly consumption; col. 3, durable expenditures.

Table H.4: Marginal Effects of Inflation Expectations on Right Time to Purchase: Germany

	All	Intensive (Excl. 0)	Extensive	All Quali.	All Excl. outliers
π^e	-0.073***	-0.118***			0.144*
	(0.019)	(0.018)			(0.074)
$\pi^e \neq 0$			0.832***		
			(0.277)		
π^e by intervals:					
$[10\%; +\infty[$				0.128	
				(0.474)	
$[5\%; 10\%[$				1.134***	
				(0.402)	
$[3\%; 5\%[$				1.710***	
				(0.251)	
$]0\%; 3\%[$				2.364***	
				(0.380)	
0%				Ref.	
$< 0\%$				2.620**	
				(1.144)	
Controls	Yes	Yes	Yes	Yes	Yes
Obs.	256,540	182,714	256,540	256,540	217,308

Note: In this table, we report marginal effects (in percentage points) from ordered probit regressions where the endogeneous variable is a variable taking one of three different values depending on the answer to the question, "Do you think now is the right time for people to make major purchases?": 0 if the household answers "No, it is the wrong time"; 1 if "It is neither the right time nor the wrong time"; and 2 if "Yes, now is the right time." Control variables include year and month dummies, household characteristics (age, location [city, region] diploma, job, income0, survey wave (1, 2, or 3), answers to other questions on German economic conditions (standard of living, unemployment, etc.), and answers to the question about future plans for major purchases, right time to save, and perceived inflation. Standard errors are clustered at the date level. *p<0.1; **p<0.05; ***p<0.01.

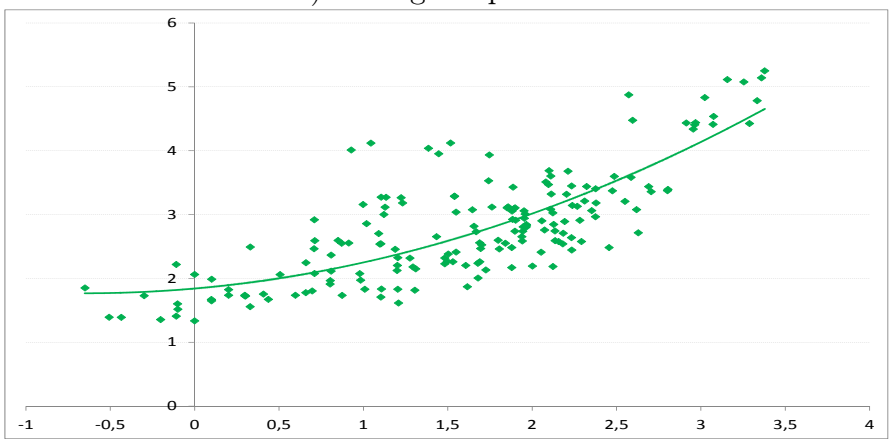
Table H.5: Marginal Effects of Inflation Expectations on Right Time to Purchase: Germany Excluding VAT Change

	All	Intensive (Excl. 0)	Extensive	All Quali.	All Excl. outliers
π^e	-0.101***	-0.140***			-0.032
	(0.017)	(0.017)			(0.054)
$\pi^e \neq 0$			0.377		
			(0.244)		
π^e by intervals:					
$[10\%; +\infty[$				-0.819**	
				(0.372)	
$[5\%; 10\%[$				0.233	
				(0.314)	
$[3\%; 5\%[$				0.950***	
				(0.313)	
$]0\%; 3\%[$				2.530***	
				(0.296)	
0%				Ref.	
$< 0\%$				2.429**	
				(1.136)	
Controls	Yes	Yes	Yes	Yes	Yes
Obs.	241,294	170,269	241,294	241,294	205,053

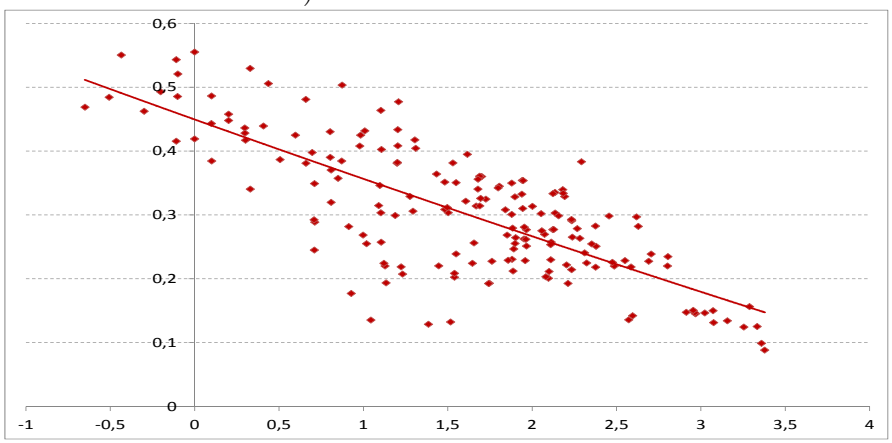
Note: In this table, we report marginal effects (in percentage points) from ordered probit regressions where the endogeneous variable is a variable taking one of three 3 different values depeding on the answer to the question, "Do you think now is the right time for people to make major purchases?": 0 if the household answers "No, it is the wrong time"; 1 if "It is neither the right time nor the wrong time"; and 2 if "Yes, now is the right time." Marginal effects are calculated for the value "Yes." Control variables include year and month dummies, household characteristics (age, location [city, region] diploma, job, income), survey wave (1, 2, or 3), answers to other questions on German economic conditions (standard of living, unemployment, etc.), and answers to the questions about future plans for major purchases, right time to save, and perceived inflation. Standard errors are clustered at the date level. *p<0.1; **p<0.05; ***p<0.01.

Figure H.3: Share of Stable Prices, Average Non-Zero Expected Inflation and Headline CPI Inflation

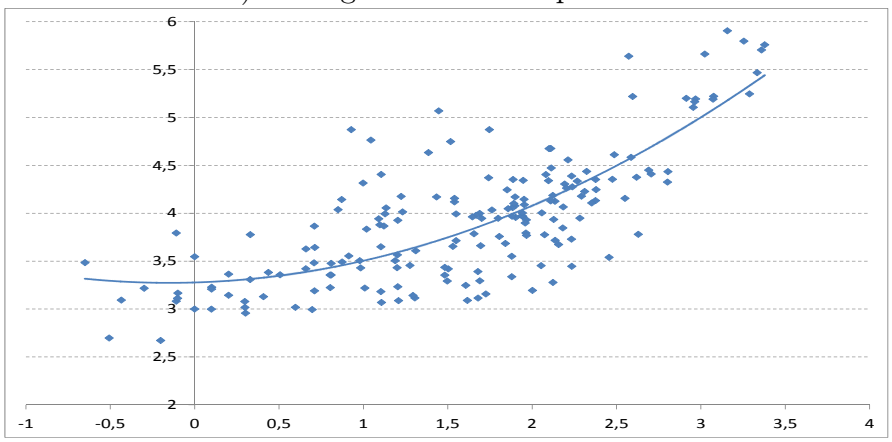
a) Average Expectation



b) Share of Stable Prices

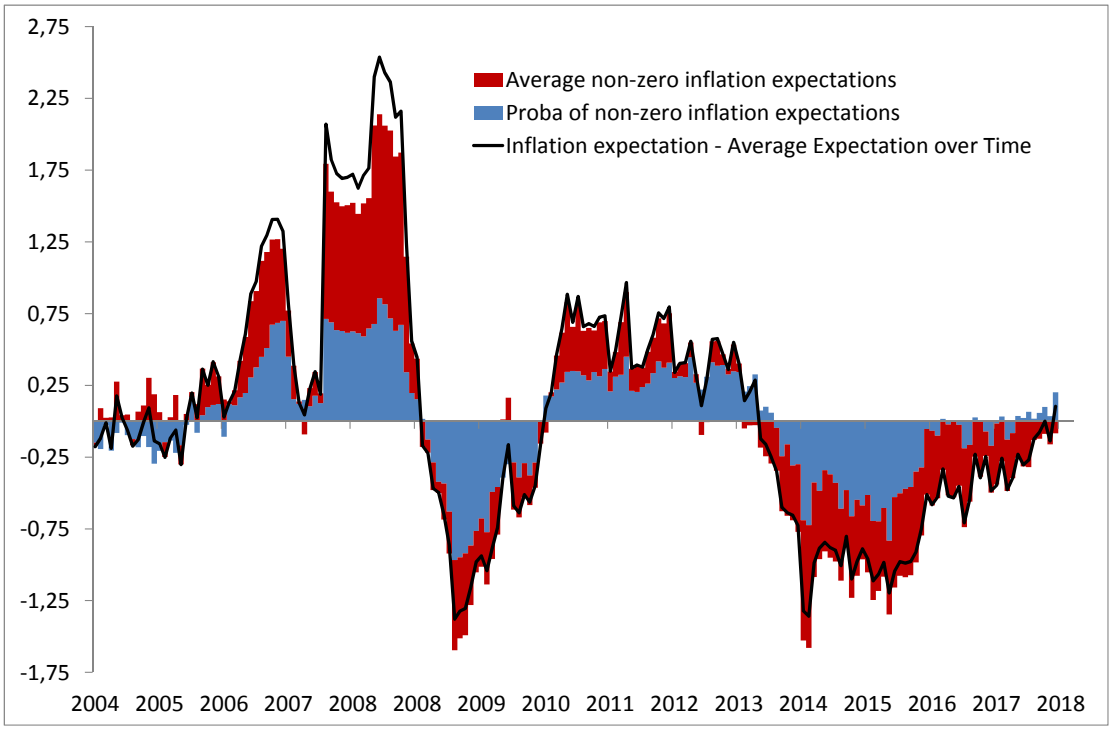


c) Average Non-Zero Expectation



Note: Panel (a) is the scatter plot of average expectation and headline CPI inflation (monthly data). Panel (b): we first compute date by date the proportion of individuals reporting expected stable prices (that is, 0 percent inflation); (b) is the scatter plot of this monthly proportion and headline CPI inflation. In red, each dot represents the share of individuals answering that they expect stable prices over the next 12 months for a given month (and so inflation rate). The red line is a simple polynomial of degree 2 fitting the data. Panel (c): we have computed the average inflation expectation (when individuals do not answer stable prices) date by date. The figure is the scatter plot of this monthly average and headline CPI inflation.

Figure H.4: Aggregate Inflation Expectations Decomposition—Extensive vs. Intensive Margins



Note: Contributions to aggregate inflation expectations. Black line: aggregate average expected inflation—mean aggregate average expected inflation; blue histogram: contribution of time variations of the probability of non-zero answers (extensive margin); red histogram: contributions of time variations in the average expected inflation (intensive margin).

I US Michigan survey

In this appendix, we report some robustness results on the US Michigan survey. We first describe how the survey is designed and the questions that we are using. We then report our results.

Design of the survey and questions. To investigate our point, we look at the different questions related to future (short-term) inflation. As for the euro area survey, we look at both the qualitative and the quantitative variables on inflation expectations.

Question 7 (Question A12)**.** *During the next 12 months, do you think that prices in general will go up, or go down, or stay where they are now?*
1. *Go up,* ***2.*** *Stay the same,* ***3.*** *Go down,* ***4.*** *Don't know.*

If households answer "go up" or "go down," they are then asked the following question:

Question 8 (Question A12b)**.** *By about what percent do you expect prices to go (up/down), on the average, during the next 12 months?*

In the case where a household answers with a number above 5 percent, the questionnaire requires further probing of the answer.

If households answer "stay the same" to the question 7, they are asked the following question:

Question 9 (Question A12a)**.** *Do you mean that prices will go up at the same rate as now, or that prices in general will not go up during the next 12 months?*
1. *Go up,* ***2.*** *Will not go up.*

In the case where households answer "go up" to that question, they are asked Question 8. Otherwise a 0 percent inflation is imputed.

Remark. *It is important to note that the questions on inflation expectations in the Michigan survey share some similarities with those of the euro area surveys, but they also include differences. As with the euro area surveys, households are first asked about their qualitative inflation expectations and then about their quantitative ones. In contrast with the euro area surveys, households are offered a smaller menu of qualitative questions—in the euro area surveys, households can give different answers regarding positive inflation, while in the Michigan survey, they can answer only that prices will go up. On the other hand, households answering that prices will stay the same are asked again about their qualitative inflation expectations. Arguably, both sets of questions allow one to elicit households' inflation expectations but by using different routes in terms of qualitative questions.*

Finally, we consider the following question on the "right time" to purchase as a proxy for durable consumption:

Question 10 (Question A18)**.** *About the big things people buy for their homes—such as furniture, a refrigerator, stove, television, and things like that. Generally speaking, do you think now is a good or a bad time for people to buy major household items?*
1. *Good,* ***2.*** *Pro-con,* ***3.*** *Bad,* ***4.*** *Don't know.*

Controls. We use the same controls as we do for the euro area surveys but with two important differences: As the corresponding variables are not available, we do not control for *perceived inflation* or for *expected own consumption*.

Results. We look at the 1984–2020 period.[36] We report the results in Table I.1, which we confirm with "finer brackets" in Figure I.1.

We are able to identify several inflation regimes and confirm that households actually "discretize."

First, we find that households expecting inflation between 0 percent (excluded) and 3 percent consume more than the households expected no inflation. This result is robust to considering the qualitative answers "go up" to Question 7 or "same" to Question 7 and then "go up" to Question 9. For values between 0 percent and 3 percent, consumption is roughly constant, as can be observed in Figure I.1.

Second, households expecting inflation rates higher than 3 percent do not consume more than households expecting prices to remain stable. A first step starts above 3 percent and goes to almost 7 percent, where the connection between inflation expectations and durable consumption is positive but not significant.[37] Finally, as in the euro area, when inflation becomes sufficiently high, consumption can be even lower.

Third, 3 percent of households expect prices to fall on average in our sample (three times more than in euro area surveys). On average, these households consume strictly less than households expecting no inflation. A closer look at this connection in Table I.1 indicates that the fall in consumption is in fact not statistically different from being constant for all negative inflation expectations.

[36] Focusing on a shorter time period than the one we have for the euro area does not lead to different results.

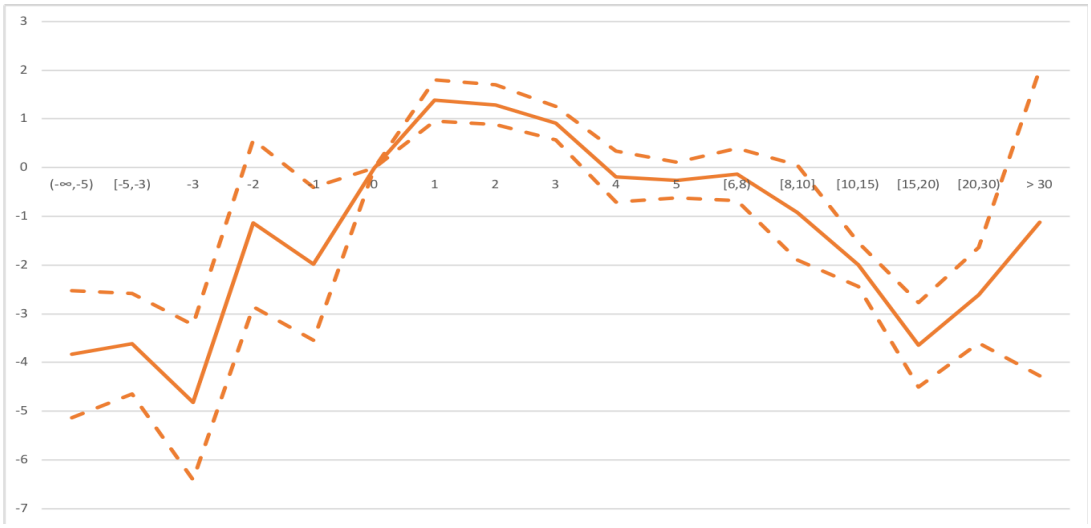
[37] Note that we do not have access to all the controls that we have for the euro area surveys. As put forward in Section 5.1, controls are important for obtaining a positive and significant response of consumption to inflation expectations.

Table I.1: Effects of 12M Inflation Expectations on Durable Consumption Outlook

	(1)	(2)	(3)	(4)	(5)	(6)
π^e **Quantitative**						
By intervals:						
>10%			-2.275***	-3.119***	0.731	-2.700***
			(0.410)	(0.396)	(0.997)	(0.434)
[5%,10%)			-0.265	-0.949***	0.568	-0.465
			(0.342)	(0.317)	(0.599)	(0.365)
[3%,5%)			0.663*	0.053	0.772	0.581
			(0.340)	(0.312)	(0.543)	(0.364)
(0%,3%)			1.333***	0.560*	1.900***	1.114***
			(0.348)	(0.321)	(0.491)	(0.377)
0%			Ref.	Ref.	Ref.	Ref.
[-3%,0%)			-2.799***	-3.314***	-2.625***	-2.825***
			(1.023)	(1.018)	(0.976)	(1.033)
[-5%,-3%)			-3.611***	-4.125***	-3.344***	-3.681***
			(1.025)	(1.023)	(0.980)	(1.035)
< -5 %			-3.823***	-4.331***	-3.548***	-3.892***
			(1.304)	(1.310)	(1.249)	(1.320)
π^e **Qualitative**						
Go up	-0.207					
	(0.303)					
Same/go up	0.943**					
	(0.372)					
Same/infl :	Ref.					
Go down	-3.930***					
	(0.697)					
Extended intervals:						
go up		-0.648***				
		(0.250)				
same		Ref.				
go down		-4.350***				
		(0.696)				
Observations	165,651	165,651	155,911	155,911	50,176	135,645
controls	Yes	Yes	Yes	Yes	Yes	Yes

Note: this table reports marginal effects (in percentage points) from ordered probit regressions where the endogenous variable is a variable taking one of three different values depending on the answer to Question 10: 0 if the household answers "bad," 1 if "pro-con," and 2 if "good." Marginal effects are calculated for the value "good." Control variables include household characteristics (age, location [city, region] diploma, job, income, etc.). Standard errors are clustered at the date level. * p<0.1; ** p<0.05; *** p<0.01. In regression (1), we report the regression with the qualitative inflation expectation. Regression (2): qualitative inflation expectations when households answering "same" at Question 7 are pooled together. Regression (3) with quantitative inflation expectations (Question 8). Regression (4) with households answering "same" at Question 7 and then "go up" at Question 9 are imputed a 0%. Regression (5) on the subsample without households answering "go up" at Question 7. Regression (6) on the subsample without households answering "go up" at Question 9.

Figure I.1: Effects of 12M Inflation Expectations on Durables Consumption Outlook—Finer Brackets



Note: This figure plots our estimates of marginal effects of inflation expectations on decision to buy durables, "right time to consume"). The orange line reports the point estimates. The reference is 0%. Marginal effects are reported in percentage points. Dashed orange lines correspond to the 95% confidence interval.