Highlights

Inflation Disasters and Consumption

Jane M. Ryngaert

- Perceived inflation risks are associated with higher real consumption growth and increased propensity to purchase durables.
- Rare inflation disasters produce greater inflation uncertainty and higher credit costs.
- Inflation expectations affect consumption beyond their direct effect on the Fisher Relation.
- Consumers anticipate other macroeconomic outcomes to accompany inflation with implications for consumption-savings plans.

I thank the editor and anonymous referee, as well as Jeffrey Campbell, Amanda Griffith, Benjamin Pugsley, Eric Sims, seminar participants at the University of Notre Dame and conference participants at the joint European Central Bank - Federal Reserve Bank of New York Conference on Expectations Surveys.

Inflation Disasters and Consumption

Jane M. Ryngaert

[a]*Wake Forest University, Box 7505, Winston-Salem, 27109, NC, USA*

Abstract

Consumers with longer-tailed subjective probability distributions of inflation anticipate lower real consumption growth and are more favorably inclined to purchasing durable goods. I propose a model in which rare inflation disasters increase the cost of future credit by raising debt issuance costs, prompting consumers to stock up on debt and move purchases to the present. Consistent with this theory, consumers with longer-tailed distributions anticipate higher future interest rates. The effects of anticipated tail risks on consumption plans are more pronounced among credit market participants.

Keywords: inflation expectations, expected consumption, issuance costs, tail risk

---

1. Introduction

As expected inflation rises, the expected real interest rate falls, thereby ecouraging consumers to increase their current consumption. With this central macroeconomic relationship as motivation, most surveys of inflation elicit expectations as point forecasts. Some of these surveys include density forecasts that allow researchers to fit subjective probability distributions over a range of inflation outcomes, providing additional information about subjective uncertainty and the weight respondents place in the tails of their distribution. Theory has little to say about how these tails should relate to consumption beyond their implications for the expected real interest rate. This paper examines this relationship empirically.

I use expectations data from the Federal Reserve Bank of New York's Survey of Consumer Expectations to show that the length of the tails of consumers' inflation distributions lower their forecasted real consumption growth. This is true for both perceived upside and downside risk, indicating that inflation expectations prompt intertemporal substitution through more than the expected real interest rate. A longer right tail could reduce real consumption growth by lowering the expected interest rate and encouraging consumption in the present. By the same logic, the left tail should have the opposite effect on consumption growth. However, both tails prompt the household to move consumption from the future to the present.

Households with longer-tailed distributions are also more likely to report positive probabilty of durable purchase in the near term. Increasing the length of the right tail by a percentage point increases the probability of inclination towards spending on durables by 3.2%. The corresponding number for the left tail is 2%. The effect of an increase of one percentage point in the median of the distribution on spending is an order of magnitude lower. While theory suggests that durables consumption should respond to changes in the expected interest rates, this result suggests that the tails of the inflation distribution also drive intertemporal substitution through durable goods.

To match these facts, I introduce a model of *rare inflation disasters* in expectations. These events severely limit consumers' ability to borrow by increasing debt issuance costs. Disasters can cause extreme inflation, disinflation, or deflation. The tails of the expected inflation distribution therefore simultaneously indicate an expectation of disaster and consequently more expensive credit. When consumers anticipate higher debt issuance costs in the future, they want to move borrowing to the present to avoid paying the higher costs. This in turn shifts consumption - inclusive of durable goods - from the future to the present, explaining the reduction in consumption growth for consumers

I thank the editor and anonymous referee, as well as Jeffrey Campbell, Amanda Griffith, Benjamin Pugsley, Eric Sims, seminar participants at the University of Notre Dame and conference participants at the joint European Central Bank - Federal Reserve Bank of New York Conference on Expectations Surveys.

reporting long-tailed distributions. Intuitively, a consumer who is facing higher debt costs in the future should "stock up" on debt and purchases today. Durable goods are a natural way to stock up as they last into the following period and provide a service flow of utility and - barring irreversibilities - the option to sell to finance non-durable consumption when credit is costly.

In support of the proposed model, I provide evidence that the consumption patterns are driven by expectations about future credit costs. Both tails of the subjective probability distribution are correlated with a higher reported probability that *future* nominal interest rates will increase. This means that consumers expect a higher credit costs to accompany *any* failure to maintain price stability, whether inflationary or disinflationary. The results jointly suggest that increasing expected future interest rates increase current consumption, the opposite of what the workhorse New Keynesian model predicts. Assuming sticky or fixed rate borrowing rates produce the same predictions as increased issuance costs. I further use the SCE Credit Access Survey to identify respondents who plan to take out a loan in the near future and then replicate my analyses separately for respondents that are planning to take out a loan and those that are not. The coefficients on the tails are stronger and more significant for the prospective borrowers, indicating that the documented consumption patterns are driven primarily by credit market participants.

This paper contributes to a literature on how expected inflation affects household spending. Much of this literature focuses on the response of readiness to spend on durables: Bachmann et al. (2015), Coibion et al. (2021), Duca-Radu et al. (2019), Burke and Ozdagli (2021), D'Acunto et al. (2016), and D'Acunto et al. (2018). These papers differ from each other in the measured sign of the effect of inflation expectations on durables consumption. All consider the response of durables to point forecast or implied mean forecast and so do not account for the nonlinearities noted in this paper. Ichiue and Nichiguchi (2015) find that consumption increases with expected inflation while planned consumption decreases. Dräger and Nghiem (2021) and Crump et al. (2015) use expected inflation to estimate the consumption Euler equation. Other papers document that higher uncertainty increases savings (Armantier et al. (2021)) and decreases readiness to purchase durables (Binder (2017)). I control for uncertainty using the interquartile range of the subjective inflation distribution and find results consistent with these two findings. This paper considers the tails of the distribution in addition to uncertainty and shows that increased weight in the tails and increased uncertainty produce opposite predictions for expected consumption behavior.

This paper is also relevant to a growing literature considering tail risks in individual's inflation expectations. García and Manzanares (2007), for example, model inflation risks and their assymmetries in density forecasts, showing that these aggregates of these perceived risks vary over the business cycle. Andrade et al. (2012) proposes a measure of the level of left and right tail outcomes, Inflation-at-Risk, and notes that movements in the aggregated assymmetry of these tail risks predicts both inflation itself and the target policy rate. Ryngaert (2021) shows the implications of perceived inflation risks for our understanding of the anchoring of inflation expectations among consumers.

The paper proceeds as follows. Section 2 discusses inflation expectations. Section 3 shows the effect of components of density forecasts of inflation on forecasted real consumption growth and durables purchasing. Section 4 describes utility maximization with disaster-induced debt issuance costs. Section 5 shows that consumers with long-tailed distributions expect higher future interest rates and that the effect of the tails is stronger among credit market participants.

2. Inflation Expectations

I utilize the inflation expectations data from the Federal Reserve Bank of New York's Survey of Consumer Expectations. The survey is conducted monthly over the internet and includes a nationally representative set of rotating household heads who stay in the survey for up to twelve months.[1] Households provide their inflation expectations in two formats, first as a point estimate and then as probabilities that inflation may fall in a set of ranges. They are first asked:

What do you expect the rate of [inflation/deflation][2] *to be* ***over the next 12 months****? Please give your best guess. (Q8v2)*

[1] A household head is defined as the owner or renter of the household home.

[2] This selection is based on the answer to a previous question.

Respondents provide this answer as a percentage. The distribution of point estimates includes many extreme forecasts of inflation, with more than 10% of responses forecasting 15% inflation or higher. The New York Fed accordingly elicits density forecasts of inflation and uses the distribution-implied means to track consumer inflation expectations.[3] The next question asks respondents to consider several possible outcomes for inflation.

Now we would like you to think about the different things that may happen to inflation over the ***next 12 months****. We realize that this question may take a little more effort. (Q9)*

In your view, what would you say is the percent chance that, ***over the next 12 months...***

The respondent is then presented with a set of ranges for the rate of inflation or deflation, where deflation is defined for them as the opposite of inflation. The ranges are a rate of inflation 12% *or higher*, *between* 8% *and* 12%, *between* 4% *and* 8%, *between* 2% *and* 4%, between 0% *and* 2%, and the same set of bins for the rate of deflation.

Measuring the mean and subjective uncertainty implied by the density forecasts requires fitting a probability distribution to the histogram. The SCE (see Armantier et al. (2016b)) uses a modified version of the approach of Engelberg et al. (2009), who fit isoceles triangle distributions to responses filling only one or two bins and a generalized beta distribution to responses filling three or more bins.[4] The mean implied by these distributions is used as the measure of consumers' inflation expectations in many existing studies using SCE data: Armantier et al. (2016b), Armantier et al. (2021), Crump et al. (2015), Armantier et al. (2016a), Ben-David et al. (2018). The subjective distributions in this paper are formed using a modification of this approach that equates the subjective probability's mode to the reported point forecast. For more details on this method, see Ryngaert (2021).

Much of the previous work on the effect of inflation expectations on spending focuses on either the point forecast (Bachmann et al. (2015), Coibion et al. (2021)) or the mean implied by the density forecast (Crump et al. (2015), Armantier et al. (2021)), often controlling for subjective uncertainty (Burke and Ozdagli (2021), Binder (2017)). In all analyses I include the density implied median to control for the central tendency of the subjective inflation distribution and the implied interquartile range as a measure of subjective uncertainty. I include the Bowley (1920) measure of skewness in my main regression analysis. Including this quantile-based measure along with the implied median and interquartile range ensures that the coefficients on other variables recover the effects of those variables holding the 25th, 50th and 75th quantiles of the subjective distribution constant.

I extend the discussion of the effect of inflation expectations on consumer spending by testing the effect of the lengths of the tails of the subjective distribution on spending behavior. The right tail is defined as the difference between the 95th quantile and the 75th quantile. The left tail is the difference between the 25th quantile and the 5th quantile. The tails reflect the consumers' beliefs over extreme outcomes, such as high inflation or deflation.[5] Consumers with longer tails place positive weight on a larger range of extreme realizations of inflation. The longer the tail, the more extreme the potential risk in that direction. Given the subjective distribution controls, the coefficient on the left tail will recover the effect of the 5th percentile moving to the left, holding the distribution at and above the 25th percentile constant. Similarly, the coefficient on the right tail will give the effect of increasing the 95th percentile of the distribution holding the distribution at and below the 75th percentile constant. I transform the data into the tails rather than including the 5th and 95th percentiles themselves for two reasons. First, these variables are highly correlated with the median of the subjective inflation distribution. As the distribution moves up, all three will move. The transformation to right tail and left tail reduces the multicollinearity problem introduced by including the raw 5th and 95th percentiles. Second, this transformation ensures that extreme values - either low or high - result in increases in the tail length. The signs of the coefficients on both tails therefore have the same interpretation for the effect of expected tail risks on spending plans.[6]

The sample runs from from June 2013 to February 2021. There are roughly 1300 observations per period, though not all respondents provide enough information to fit a subjective distribution over their density forecast. I drop

[3] This New York Fed's headline measure of inflation expectations the survey-weighted interpolated median of this series.

[4] The SCE deviates only slightly from the Engelberg et al. (2009) approach, fitting a uniform distribution to one-bin forecasts rather than a triangular distribution.

[5] Scharnagl and Stapf (2015) notes increased concern about such tails in European options-implied inflation expectations.

[6] An increase in the 95th percentile, ceteris paribus, stretches the respondent' distribution over a wider range of upside outcomes. Conversely, an increase in the 5th percentile compresses the downside of the respondents' distribution, signaling a smaller range of downside outcomes. As increases in these two objects have different implications for perceived tail risks, we would expect opposite sign regression coefficients if both upside and downside risk have the same effect on consumption plans.

observations in which the point estimate is inconsistent with the density forecast, that is when the point estimate falls outside the range of the density forecast. To reduce the impact of anomalously dispersed distributions, I drop the observations in the top five percent of interquartile ranges in each period. All subsequent analysis is survey weighted.

Table 1 gives the survey weighted means and standard deviations of the implied mean, implied median, IQR, and tails of the subjective probability distributions over the sample The average implied median is 3.93 % with the mean in a similar range and the correlation between the two high. The average IQR is roughly 3.86 and the the average left and right tails roughly 2.27 and 2.20, respectively. These numbers are large compared to a series that is targeted to 2 % for the entirety of the sample period.[7] However, the remainder of the paper will show that household consumption plans vary with these expectations.

3. Results

This section presents results on the impact of inflation expectations on two components of consumer spending plans: forecasted real consumption growth and readinesss to purchase durable goods. Both anaylses suggest that consumers with longer-tailed distribution transfer consumption from the future to the present.

3.1. Forecasted Real Consumption Growth

The SCE collects information on households' anticipated change in spending in its core survey:

Now think about your total household spending, including groceries, clothing, personal care, housing (such as rent, mortgage payments, utilities, maintenance, home improvements), medical expenses (including health insurance), transportation, recreation and entertainment, education, and any large items (such as home appliances, electronics, furniture, or car payments).

***Over the next 12 months**, by about what percent do you expect your total household spending to [increase/decrease]? Please give your best guess.* (Q26v2)

This variable is meant to track expected nominal spending growth. I put it into real terms by subtracting the implied inflation density median, and regress the resulting forecast of real consumption on the components of the density inflation forecast:[8]

$$F_{i,t}[\Delta c] = \beta_1 Med_{i,t} + \beta_2 IQR_{i,t} + \beta_3(p95_{i,t} - p75_{i,t}) + \beta_4(p25_{i,t} - p5_{i,t}) + \theta \mathbf{x_{i,t}} + u_t + \epsilon_{i,t} \tag{1}$$

I include several variables to control for the households' expectations of other macroeconomic and idiosyncratic outcomes in the analysis of how inflation beliefs influence perceived credit conditions, $\mathbf{x_{it}}$. These include questions about the household's current financial situation as it relates to a year ago (Q1) and its expected future financial situation (Q2) as well as parallel questions about the ease of accessing credit in the present (Q28) and in the future (Q29). I control for the forecasted change in the household's real income, defined as their reported expected change in nominal income (Q25v2) less the median of their subjective inflation distribution. The household reports the probability that unemployment, nominal interest rates, and stock prices will increase in the following year (Q4new, Q5new, and Q6new respectively). I also include date fixed effects and a number of additional demographic controls: household income category, census region, education category, numeracy, indicators for race, gender, marital status, homeownership status, and a full set of controls for the labor force situation of the respondent and spouse. Noting that forecasts in the SCE often improve with length of time in the survey as found in Binder and Kim (2021), I control for forecaster tenure. In addition to the subjective distribution variables presented, I control for the skewness of the distribution.[9] The set of controls is described in detail in Appendix A.

This exercise is similar to that of Crump et al. (2015), who provide an empirical estimate of the intertemporal elasticity of substitution by estimating the response of expected consumption growth on expected inflation. However,

[7]This targeting moved to average inflation targeting in August 2020.

[8]I use the median rather than the mean as the mean of a potentially asymmetric distribution will be sensitive to the lengths of the tails. Including the mean in calculation of the dependent variable may mean that we pick up this sensitivity in the coefficients on the tails.

[9]Controlling for kurtosis is difficult in this particular sample because roughly 30% of the reported distributions are triangular and have the same value of kurtosis. Tables B-4 and B-4 present results with kurtosis as a control.

their paper uses the first-order approximation of the Euler equation to recover structural parameters. I am interested in how different parts of the subjective probability distribution over inflation outcomes, including information about perceived upside and downside risks, predict consumption plans.

Table 2 shows the results of this regression. The coefficient on the median is -0.54, almost identical to the estimate of the intertemporal elasticity of consumption estimated in Crump et al. (2015) after controlling for excess sensitivity. This coefficient is statistically significant and consistent with theory as it implies that a decrease in the real interest rate should causes consumers to increase consumption today. The IQR, a measure of subjective uncertainty, has the opposite sign coefficient as the tails. More uncertain consumers increase their consumption growth, potentially through precautionary savings. Consumers with longer-tailed distributions decrease their consumption growth. The coefficient on the right tail is roughly -0.16, and on the left tail -0.15; both are statistically significant. This means that a one percentage point increase in the right (left) tail decreases consumption growth by 0.16 (0.15) percentage points. The average forecasted real consumption growth is roughly 0.05 %, meaning longer tails can generate a substantial reduction in consumption growth. We may be concerned that tail risks to inflation are picking up perceptions of other risks, such as own job loss. The coefficients on the tails are similar when I limit the sample to employed respondents and control for the expected probability of job loss. These results are presented in the second column of Table 2.

A longer right tail causing a shift of consumption from the future to the present has a Fisherian interpretation. As expected inflation increases, the real interest rate decreases. This should prompt consumers to move consumption from the future to the present, reducing growth. The left tail is harder to explain as left tail inflation beliefs should be associated with a high expected real interest rate. This high interest rate penalizes consumption in the present period and should therefore encourage consumption growth. The result suggests that the tails of the inflation distribution influence spending plans through more than their direct implications for the expected inflation rate. Both perceived upside and downside risk prompt consumers to plan to move consumption from the future into the present. This is consistent with a model in which future borrowing costs are expected to be higher in tail states, prompting consumers to stock up on debt before the cost of initiating new debt increases. I will explain this model in Section 4.

3.2. Buying Attitudes Towards Durables

Durable goods are a natural avenue for moving consumption across time as they provide utility in multiple periods. Durable goods are also more likely to require debt to finance, making them a particularly senisitive to changes in the expected real interest rate as inflation expectations change. There are several papers considering the effect of inflation expectations on durable spendings, providing mixed evidence on the direction of the relationship between expected inflation and purchases. Bachmann et al. (2015) find a negative relationship between inflation expectations and reported readiness to spend on durables in the Michigan Survey of Consumers at the zero lower bound. Coibion et al. (2021) provide experimental evidence that exogenous changes in the inflation expectations of Dutch households cause declines in their plans to spend on durables. Burke and Ozdagli (2021) find a positive impact of inflation on durables consumption among American households, but only for college educated consumers. On the other hand, Duca-Radu et al. (2019) find a positive relationship between inflation expectations and readiness to spend at the zero lower bound for a large survey of European consumers. D'Acunto et al. (2016) and D'Acunto et al. (2018) note an increase in willingness to spend on durables among German and Polish consumers, respectively, following exogenous increases in inflation expectations generated by unexpected tax announcements. I consider the relationship between readiness to purchase durables and the tails of the subjective inflation distribution.

The SCE Household Spending Survey includes questions about the likelihood of buying durable goods. These questions have the respondent report the probability that they will make a purchase in a particular good category in the next four months. I consider the categories: *Appliances*, *Electronics*, *Furniture*, *Cars and Vehicles*, and *House or Apartment*. Table 3 shows the average and median probability assigned to each of these questions. The median response given is 5% or less for each of these categories. To test the effect of subjective inflation distributions on the willingness to purchase larger, interest-sensitive goods, I define a *potential buyer* variable. This is a dummy variable that is equal to 1 if respondents provide positive probability a specific category and 0 otherwise and is similar to the "readiness to spend" variable employed by Bachmann et al. (2015). I combine appliances, electronics, and furniture into one durables category.[10] Potential buyers of durables may assign positive probability to purchasing any of the three goods in the category. Table 3 also provides the proportion of potential buyers in each category.

[10]This provides a parallel to the Michigan Surveys questions asking if now is a good time to buy durables, a car, or a house.

I estimate the following probit regressions separately for each category using the *potential buyer* dummy as the dependent variable:

$$
\begin{aligned}
Potential\ Buyer_{i,t} = &\beta_1 Med_{i,t} + \beta_2 IQR_{i,t} + \beta_3(p95_{i,t} - p75_{i,t}) + \beta_4(p25_{i,t} - p5_{i,t}) \\
&+ \phi\mathbf{1}(Recent\ Purchase) + \theta\mathbf{x_{i,t}} + u_t + \epsilon_{i,t}
\end{aligned} \tag{2}
$$

The main variables of interest are the median and tails of the subject inflation distribution, though I include the full set of controls, $\mathbf{x_{i,t}}$, as well as an indicator equal to 1 if the respondent reports making a purchase in that category in the last four months. Table 4 reports the coefficients and marginal effects. The inflation distribution variables have highly significant effects. The coefficients on both tails are positive and significant for all three goods categories. Holding all other variables at their means, an increase of one percentage point in the right tail leads to a 3.17%, 4.71%, and 3.82% increase in the probability that a consumer reports positive probability of durables, car, and home purchase, respectively. The corresponding increases for an increase of one percentage point in the left tail are 2.02%, 2.80%, and 3.39%. These effects are economically significant. A one standard deviation in the increase of either tail increases the probability of being a potential buyer by roughly 4.5 to 9 percent, depending on the tail and category.

These results should be considered an extension of exisiting results on this topic, rather than a negation. Indeed, the marginal effects on the implied median of the respondents distribution indicate that an increase in the central tendency of the expected inflation distribution either decreases or has no effect on the probability of being a potential buyer for durables, cars and homes. This is consistent with Coibion et al. (2021) and Bachmann et al. (2015) at the ZLB, meaning the inclusion of the tails of the distribution does not bring this particular result in line with theory.

The coefficient on the IQR is negative, consistent with Binder (2017), who finds that the probability of a favorable buying attitude decreases as uncertainty increases. The relationship between uncertainty and buying attitudes is also the opposite of the relationship between the tails and buying attitudes, meaning that the tails of the distribution affect purchasing in ways distinct from the effects of uncertainty. While increased uncertainty about the inflation rate reduces the probability of readiness to buy, potentially due to increased precautionary savings, increasing the lengths of the tails increases the likelihood of purchase. The following section describes a model in which the tails of the distribution are longer due to increased weight on high uncertainty states that also increase future borrowing costs. Anticipating more expensive borrowing in the future, households seek loans earlier than they otherwise would and move up the timing of their large purchases.

4. Theory

To match the empirical facts set forward, I introduce a model of *rare inflation disasters* into expectations and utility maximization. Disaster states lead to an increased likelihood of particularly high or particularly low inflation but, regardless of realized inflation, cause an increase in the cost of obtaining new debt. I model this cost as a period-specific issuance cost (ι) that increases in proportion to the size of a loan. Consumers form expectations such that the probability of a disaster conditional on the inflation rate - and the accompanying increased cost of credit - are higher in tails of the subjective future inflation distribution. As potential disasters occur in the future, they increase the *future* cost of borrowing, encouraging the consumer to move borrowing and consumption to the present period, reducing consumption growth from t to $t+1$. As consumers respond to the incentive to stock up on debt before a disaster occurs and increases the issuance costs for new debt, they are more likely to consume larger, debt-intensive goods.

4.1. Expectations

Assume that the consumer forms expectations of the inflation rate as a Gaussian mixture of two states, one of which is a disaster state (D). The mixture has five parameters: the means and standard deviations of the two normal distributions - μ^D, $\mu^{\neg D}$, σ^D, $\sigma^{\neg D}$- and a mixing probability γ that gives the consumer's unconditional probability of realizing the disaster state. In order to concentrate the conditional probability of a disaster in the tails of the expected inflation distribution, I also assume that uncertainty is higher in the disaster state, that is $\sigma^D > \sigma^{\neg D}$.[11] Given the two

[11] Inflation uncertainty and general macroeconomic uncertainty tend to be higher in recessions: Bloom (2014), Binder (2017), Chan and Song (2018). There is also evidence that crises generate macroeconomic uncertainty (Bloom (2009)), most recently in the Coronavirus crisis, see Leduc and Liu (2020). Binder (2020) notes this uncertainty in inflation expectations in a survey conducted in March 2020.

distributions, the consumer can use Bayes' Rule to find her expected probability of the disaster state conditional on a level of inflation:

$$Pr_t[D|\pi_{t+1}] = \frac{\gamma \times f_\pi^D(\pi_{t+1})}{f_\pi(\pi_{t+1})}. \tag{3}$$

Figure 1 shows an example of inflation expectations with a disaster state. In this case, both distributions have the same mean, but the uncertainty about inflation is higher under D, that is $\sigma_t^D > \sigma_t^{\neg D}$. The first panel of the figure shows the two distributions and a mixture. The second panel shows the consumer's expected probability of the economy being in the disaster state conditional on the realization of inflation. As inflation is further from the mean of the distribution, it becomes more likely that this rate of inflation is occuring under the disaster state.[12]

In addition to producing a wider range of potential inflation outcomes, the cost of obtaining new debt is higher in the disaster state relative to the non disaster state. That is, $\iota^D > \iota^{\neg D}$. Assume, without loss of generality, that $\iota^{\neg D} = 0$, and $\iota^D > 0$. At a given inflation rate, the expected cost of future credit is therefore:

$$E[\iota_{t+1}|\pi_{t+1}] = Pr_t[D|\pi_{t+1}] \times \iota^D. \tag{4}$$

Note that the variation in this cost comes from the expected probability of the disaster rather than the issuance cost realized in the disaster, which is constant. Both μ^D and $\mu^{\neg D}$ may take any value. This allows consumers to have not only biased expectations of inflation (Ehrmann et al. (2015)) that are not accompanied by an increase in expected debt costs but also beliefs centered around low or moderate levels of inflation which carry the possibility of an increased cost of credit. The tails of the subjective distribution are therefore extreme relative to the central tendency of the consumer's own distribution.

4.2. *Utility Maximization and Spending Plans*

The household generates flow utility through consumption and comes into a period with nominal assets A_t. These assets provide a gross return R_{t-1}, which was determined and known in period $t-1$. In order to issue new debt in period t, the household pays the issuance cost, ι_t. Her flow budget constraint is:

$$P_tC_t + A_{t+1} - \iota_t(A_{t+1} - A_t)\mathbf{1}(A_{t+1} - A_t < -A_t) \leq P_tY_t + R_{t-1}A_t \tag{5}$$

The variable describing forecasted real spending growth Section 5.1 includes both durable and non-durable goods. We should therefore consider durable goods to be a part of C_t. I will consider durable goods separately in what follows. The consumer may costlessly dissave up to the limit of her current assets, A_t. After this point, she must intiate new debt and pay the issuance fee. The first order conditions for A_{t+1} and C_t are:

$$\lambda_t[1 - \iota_t\mathbf{1}(A_{t+1} - A_t < -A_t)] = \lambda_{t+1}[R_t - E[\iota_{t+1}|\pi_{t+1}]\mathbf{1}(A_{t+2} - A_{t+1} < -A_{t+1})], \tag{6}$$

and

$$\beta^t u'(C_t) = \lambda_t P_t. \tag{7}$$

where λ_t is the Lagrange multiplier on the time-t budget constraint and the consumer must form expectations over the future issuance cost, ι_{t+1} as its value is unknown. The issuance costs will only impact consumers who plan to take out new debt in a given period. For simplicity of notation, consider the Euler equations for a household planning to borrow in periods t and $t+1$ such that both $\mathbf{1}(A_{t+1} - A_t < -A_t)$ and $\mathbf{1}(A_{t+2} - A_{t+1} < -A_{t+1})$ are equal to 1.

Combining Equations 6 and 7 gives the intertemporal Euler equation for a borrower:

$$u'(C_t)[1 - \iota_t] = \frac{\beta u'(C_{t+1})(R_t - E[\iota_{t+1}|\pi_{t+1}])}{1 + \pi_{t+1}}. \tag{8}$$

[12] The disaster state can also be modeled to have a different mean than the normal state (see Figure B-2).

The left hand side is the marginal utility gained by financing consumption through borrowing in period t. The consumer cannot use the entirety of the loan to finance consumption as she must pay fee ι_t. The right hand side represents the discounted marginal utility that is foregone due to borrowing, namely the gross interest rate to be repaid. Importantly, the future debt issuance cost reduces the cost of borrowing as taking a loan today reduces the future loan amount and its associated fee.

To see the effect of expected inflation disasters on the Euler equation, I set $\iota_t = 0$ and substitute in Equation 4 for $E[\iota_{t+1}|\pi_{t+1}]$. Assuming log utility, Equation 8 gives the following ratio for the borrower:

$$\frac{C_{t+1}}{C_t} = \frac{\beta(R_t - Pr_t[D|\pi_{t+1}] \times \iota^D)}{1 + \pi_{t+1}} \tag{9}$$

Figure 2 shows the above Euler equation plotted against the inflation rate along with the Euler equation in a model without disasters. As the conditional probability of disaster increases, the expected future debt issuance cost increases as well. This drives consumption towards the present and makes the ratio of future to present consumption lower than it would be otherwise. This nonlinearity allows for the result in Section 3.1 that the tails of the distribution are associated with lower consumption growth.

We can further consider the effect of inflation disasters on durables purchases with the following modification of the budget constraint in Equation 5:

$$P_tC_t + P_tI_t^X + A_{t+1} - \iota_t(A_{t+1} - A_t)\mathbf{1}(A_{t+1} - A_t < -A_t) \leq P_tY_t + R_{t-1}A_t \tag{10}$$

Durables depreciate at rate δ and the stock of durables in a period is equal to:

$$X_t = I_t^X + (1 - \delta)X_{t-1} \tag{11}$$

Assuming that the consumer plans to initiate new debt and combining Equations 10 and 11 gives:

$$P_tC_t + P_t(X_t - (1 - \delta)X_{t-1}) + A_{t+1} - \iota_t(A_{t+1} - A_t) \leq P_tY_t + R_{t-1}A_t \tag{12}$$

The first order condition for durables spending is:

$$u_X(C_t, X_t) = \lambda_tP_t - \lambda_{t+1}P_{t+1}(1 - \delta) \tag{13}$$

Combining this with Equations 6 and 7 (and making the appropriate adjustments to the marginal utilities in those equations) gives the tradeoff between durable and future non-durable consumption. To focus on the disaster-induced issuance costs, I set $\iota_t = 0$ and incorporate the expectations of ι_{t+1} as relying on the probability of disaster conditional on a level of inflation, $Pr_t[D|\pi_{t+1}] \times \iota^D$.

$$u_X(C_t, X_t) = \beta u_C(C_{t+1}, X_{t+1})\left[\frac{R_t - Pr_t[D|\pi_{t+1}] \times \iota^D}{(1 + \pi_{t+1})} - (1 - \delta)\right] \tag{14}$$

This condition and the intertemporal Euler equation in Equation 8 imply that the optimal ratio of the marginal utility of durables consumption to non-durable consumption should be:

$$\frac{u_X(C_t, X_t)}{u_C(C_t, X_t)} = 1 - (1 - \delta)\frac{(1 + \pi_{t+1})}{R_t - Pr_t[D|\pi_{t+1}] \times \iota^D} \tag{15}$$

Assuming log-log utility, the optimal ratio of durable to non-durable consumption will be equal to 1 over the above equation. Figure 2 shows the optimal durable to non-durable consumption with and without disasters when $\mu^D = \mu^{\neg D}$.[13] The optimal ratio is increasing in inflation. At inflation rates where the conditional probability of disaster is low, the ratio of durables to non-durables is similar to the optimal ratio from the model without disasters. In the

[13]Figure B-3 shows the same when $\mu^D > \mu^{\neg D}$

tails of the inflation distribution, where the conditional probability of disaster and expected future debt issuance cost is high, the ratio is higher than would be optimal without these costs. The expected issuance costs incentivize borrowers to move borrowing from $t + 1$ to t. The consumer therefore "overaccumulates" durables relative to a model without these costs. The durables provide two benefits to the consumer beyond utility in time-t. Undepreciated durables provide future flow utility and can also be sold to finance non-durable consumption, C_{t+1}, when borrowing is costly. In the tails of a distribution with disasters, consumers shift spending from the future to the present more than they otherwise would and spend more on durables relative to non-durables in time-t than they otherwise would. These two effects combined should make durables purchases particularly sensitive to inflation expectations beliefs about future credit costs.

4.3. Model Relationship to Empirical Results

In the baseline model, inflation expectations affect intertemporal substitution and allocation between good types only through the expected real rate of return. Inflation disasters create deviations in the optimal path of consumption growth and the optimal ratio of durables to non-durables relative to this model. Section 3 shows that longer-tailed distributions predict consumption responses consistent with these deviations.

The tails of the normal mixture distribution can increase due to several factors: increasing either or both standard deviation, increasing γ, or changing μ^D while holding $\mu^{\neg D}$ fixed. Changing any of these adjusts the conditional probability of the disaster across the inflation distribution and therefore the nature of the deviation of the disaster Euler equation from the non-disaster Euler equation. However, expected consumption growth and expected ratio of durables to nondurables are given by the expected value of the Euler equation. Any given part of the Euler equation will therefore be weighted by the probability assigned to that inflation outcome. This means that only increases in γ and $\mu^D - \mu^{\neg D}$ create both increased tail length along with model-implied changes in consumption plans that are consistent with those seen in the data. Increasing γ raises the probability of disaster across the full distribution, increasing the expected future cost of credit. Increasing μ^D while holding $\mu^{\neg D}$ constant skews the inflation distribution towards high inflation outcomes, predominantly increasing the right tail of the distribution and lowering the expected real interest rate.[14] Increasing the standard deviations will change the spread of the underlying distribution, but not the expected issuance cost.

To see how the components of the normal mixture impact consumption plans, I estimate these parameters for each observation. This is done with simulated method of moments, minimizing the difference between the probability distribution generated by the normal mixture and the distribution fitted to the data as explained in Section 2.[15] Consistent with the model, consider the distribution with the larger standard deviation to be the disaster distribution. Table 5 shows the effect of the estimated parameters of the mixture of normals distribution on consumption plans.

Speficially, I estimate the following equations:

$$F_{i,t}[\Delta c] = \beta_1 \mu_{i,t}^{\neg D} + \beta_2(\mu_{i,t}^{D} - \mu_{i,t}^{\neg D}) + \beta_4 \left(\frac{\sigma_{it}^{D}}{\sigma_{it}^{\neg D}} \right) + \beta_5 \gamma_{i,t} + \theta \mathbf{x_{i,t}} + u_t + \epsilon_{i,t} \tag{16}$$

$$\begin{aligned} \textit{Potential Buyer}_{i,t} = {} & \beta_1 \mu_{i,t}^{\neg D} + \beta_2(\mu_{i,t}^{D} - \mu_{i,t}^{\neg D}) + \beta_4 \left(\frac{\sigma_{it}^{D}}{\sigma_{it}^{\neg D}} \right) + \beta_5 \gamma_{i,t} \\ & + \phi \mathbf{1}(\textit{Recent Purchase}) + \theta \mathbf{x_{i,t}} + u_t + \epsilon_{i,t} \end{aligned} \tag{17}$$

The coefficient on $\mu_{i,t}^{\neg D}$ recovers the change as the entire distribution shifts. The coefficient on $\mu_{i,t}^{D} - \mu_{i,t}^{\neg D}$ gives the effect of a change in the disaster state mean while holding the mean of the lower uncertainty distribution constant. As $\sigma_{i,t}^{\neg D}$ increases and $\frac{\sigma_{i,t}^{D}}{\sigma_{i,t}^{\neg D}}$ is held constant, σ_{it}^{D} increases as well proportionally. The coefficient on $\frac{\sigma_{i,t}^{D}}{\sigma_{i,t}^{\neg D}}$ recovers the effect of increasing the standard deviation of the wider distribution, leaving the uncertainty of the other distribution unchanged. Either of these can increase the spread of the distribution, but the model suggests that they should have no bearing on consumption plans.

[14] A lower real interest rate prompts the consumer to move consumption from the future to the present, lowering consumption growth, and to tilt consumption towards durables.

[15] I describe this in detail in Appendix Appendix D.

As the subjective distribution shifts up, consumption growth decreases, consistent with theory and the results presented in Table 2. The corresponding effect of this shift on the probability of being a potential buyer is negative in all catergories. This is counter to theory, but consistent with Bachmann et al. (2015) and Coibion et al. (2021) as well as 4. As γ increases, consumption growth decreases and the probability of readiness to purchase durables and larger goods increases. This is consistent with the key mechanism of the theory outlined above.

The results in Table 5 also suggest that increasing σ^D reduces consumption growth, while increasing the standard deviation of both distributions (while leaving the ratio of the two constant) increases the propensity to purchase durables. While this is not predicted by the model, it suggests that the tails predict the consumption results more in more dispersed distributions and particularly as the disaster state is more dispersed. The mixture model allows for *all* consumers to have a disaster state, even if their entire subjective distribution is closely concentrated around a low level of inflation. This result suggests that the consumption behaviors documented in this paper are more likely among consumers whose inflation distributions spread over a wider range of outcomes - including outcomes far away from the low levels of realized inflation observed for much of the sample period.

5. Evidence for Credit Cost Channel

This section provides empirical support for the credit cost mechanism of the model. I show that consumers with longer-tailed distributions assign a higher probability to the event that that future interest rates will increase and that the effects of the tails on consumption plans are stronger among those who are planning to take out a loan.

5.1. Inflation Expectations and Interest Rate Expectations

The core survey of the SCE includes a question about the probability that future interest rates will increase. While this is not a perfect measure of the cost of issuing new debt in the future, it does provide information about respondent beliefs about future credit costs. This section considers the effects of the subjective distribution variables, especially the tails of the distribution, on this expectation. The question is worded as:

*What do you think is the percent chance that **12 months from now** the average interest rate on saving accounts will be higher than it is now?*[16]

This question is not a perfect proxy for future debt issuance costs, but it is reasonable to believe that consumers expect borrowing rates to follow the the rates on savings accounts. This therefore provides a measure of the belief that the cost of credit will increase in the future. Table 6 gives the coefficients for a regression with the percent chance that interest rates will increase as the dependent variable:

$$Prob_{i,t}[Int.\ rate\ increase] = \beta_1 Med_{i,t} + \beta_2 IQR_{i,t} + \beta_3(p95_{i,t} - p75_{i,t}) + \beta_4(p25_{i,t} - p5_{i,t}) + \theta \mathbf{x_{i,t}} + u_t + \epsilon_{i,t} \tag{18}$$

This value is decreasing as the median and IQR increase, but increases with the lengths of the tails. A one percentage point increase in the right tail increases this probability by 0.55 percent while a one percentage point increase in the left tail increases it by 0.56 percent.[17] Controlling for job loss risk yields similar coefficients.

Section 4 models rare inflation disasters as accompanied by an increase in debt issuance costs. The expectation of these events prompts the consumer to stock up on debt before it gets more expensive; an increase in future interest rates can be interpreted in a similar framework. In the basic New Keynesian model, an increase in expected future interest rates should have a contractionary effect on current consumption. This is the motivation behind forward guidance as a tool for monetary policy makers. When policy rates are at their effective lower bound, commiting to keep future interest rates low for several periods in the future should stimulate consumption by lowering future expected interest

[16]This question is included in the set of controls, yet the regressions still produce significant coefficients on the tails of the inflation distribution. The question is a rough measure of beliefs about future cost of credit. As a dependent variable, it can show us something about the types of consumers who believe future credit will be more expensive. As an independent control variable in estimations of consumption plans, it is an imperfect measure of the anticipated cost of credit.

[17]The coefficient on skewness is positive and significant, meaning household's with perceived risks skewed towards higher outcomes are more likely to believe interest rates will increase.

rates. The results of this paper - that the tails of the inflation distribution predict both an increase in expected future nominal interest rates and intertemporal substitution - suggest the opposite consumption response to a change in future interest rates. I reconcile this by allowing borrowing rates to be sticky.

Suppose that instead of the budget constraint in Equation 5, the flow budget constraint is of the form:

$$P_t C_t + A_{t+1} \leq P_t Y_t + R_{t-1} A_t - \zeta_{t-1} A_{t-1} \mathbf{1}(A_t < 0) \tag{19}$$

where $\zeta_{t-1} = R_{t-1} - R_{t-2}$, or the interest rate differential between periods $t-2$ and $t-1$. This budget constraint means that the consumer can freely save and borrow additional funds at the current known rate R_t. Debt from the previous period is, however, locked in at the previous interest rate for an additional period. This fixed rate debt along with expectations of future interest rates causes consumers to adjust the timing of their borrowing and purchasing. Consumption growth, where C_t is consumption inclusive of durable goods is:

$$\frac{C_{t+1}}{C_t} = \frac{\beta(R_t - \frac{\lambda_{t+2}}{\lambda_{t+1}} E[\zeta_{t+1}|\pi_{t+1}])}{1 + \pi_{t+1}} \tag{20}$$

When a borrower anticipates an increase in the future interest rate, R_{t+1}, ζ_{t+1} increases and she is incentivized to reduce the amount of debt initiated at rate R_{t+1} $(A_{t+2} - A_{t+1})$ by increasing the amount she borrows at the temporarily fixed rate, R_t (A_{t+1}). Suppose that interest rates will increase in the disaster state but not in the non-disaster state such that $\zeta^D > 0$ and $\zeta^{\neg D} = 0$.

$$\frac{C_{t+1}}{C_t} = \frac{\beta(R_t - \frac{\lambda_{t+2}}{\lambda_{t+1}} Pr[D|\pi_{t+1}] \times \zeta^D)}{1 + \pi_{t+1}} \tag{21}$$

This equation is the same as Equation 9 if $\iota^D = \frac{\lambda_{t+2}}{\lambda_{t+1}} \zeta^D$.[18] As λ_{t+1} and λ_{t+2} are the Lagrange multipliers on budget constraints, both will be greater than 0. An increase in future interest rates will therefore have the same effect as an increase in future issuance costs.

The standard New Keynesian model predicts that increases in expected future interest rates should have a similar impact as in increase in current interest rates. The belief that committing to low interest rates in the future should have an expansionary effect on current spending underpins forward guidance as a monetary policy approach. Research has shown that the model predicts an unrealistically high response of consumption to future interest rates (del Negro et al. (2015), Carlstrom et al. (2015)). McKay et al. (2016) predict a smaller effect of future interest rate shocks by introducing uninsurable income risk and borrowing constraints into the model. I argue that - similar to the probability that the borrowing constraint will bind in the future - consumers may face considerations in the credit market other than just the future rate. In this case, the consumer has the opportunity to pay a lower rate by initiating the loan sooner, which actually encourages consumption in anticipation higher future rates. This suggests that current fixed rate loans get more attractive when the expected future interest rate increases. Consistent with this, Badarinza et al. (2018) use panel data to show that the share of fixed rate mortgages - relative to adjustable rate mortgages - in a country increases with the aggregate expectation of year-ahead nominal interest rates. Furthermore, this incentive to move up the timing of fixed rate loans could explain why the effects of the tails are so large in readiness to purchase cars and houses, both of which are predominantly financed through fixed rate loans in the U.S.

5.2. Results by Participation in Credit Markets

I have thus far argued that the link between the tails of consumers' subjective inflation distributions and their consumption plans can be explained by the expected cost of credit at perceived tail outcomes of inflation. Section 4.2 shows that this channel is only relevant in the utility maximization of those planning to borrow. This means that the posited link between the tails of the subjective inflation distribution and consumption-savings plans should be more pronounced among consumers who plan to borrow in the near future. The anticipation of an inflation disaster influences consumption through the increased cost of credit that accompanies a disaster. Households who are dependent

[18] Should the fixed interest rate extend N periods, the $E[\iota_{t+1}] = \sum_{n=1}^{N} E_t[\frac{\lambda_{t+n}}{\lambda_{t+n+1}} \zeta_{t+n}]$.

on credit to finance consumption should be particularly sensitive to this channel. Households who are not planning to borrow should have a smaller consumption response to an expected disaster as they do not need to worry about the cost of credit. I therefore repeat the analyses on the effect of the components of subjective inflation distributions separately for consumers reporting that they plan to borrow in the next twelve months and those that do not.

The SCE Credit Access supplement contains questions asking the likelihood that a respondent will apply for a specific type of loan in the next twelve months. This likelihood is separately elicited for the following: *Apply for a credit card*, *Apply for a mortgage or home-based loan*, *Apply for an auto loan*, *Request an increase in the credit limit of a credit card*, *Request an increase in the credit limit of an existing loan*, *Request to refinance your mortgage*, and *Apply for a student loan* (N17a1 through N17a7). A respondent is termed a potential borrower of a specific loan type if they respond with positive probability for that loan.

Table 7 estimates Equations 1 and 2 separately for those planning to apply for a loan and those not planning to apply for a loan. The first column of Panel A contains presents consumption growth results for credit market participants, or those who report positive probability of taking out a loan in the next twelve months. I use all loan types because the dependent variable in question refer to consumption across all good types. The corresponding column of Panel B presents the same analyses but for respondents who report a probability of 0 for all loan types. Coefficients are presented only for the components of the subjective inflation distribution, but the regressions contain the full set of controls. The coefficients on the right and left tails in Panel B are insignificant while the coefficients in Panel A are significant and and larger in magnitude than those in Table 2, indicating a stronger response effect of these tails among those consumers planning to borrow.

Columns 2 through 7 present the results on purchasing attitudes towards larger goods. The credit categories are specific to the good types so that the potential credit applicants are those likely to finance purchases in that category. For durables, the sample is split by those who plan respond with positive probability to the following: *Apply for a credit card*, *Request an increase in the credit limit of a credit card*, or *Request an increase in the credit limit of an existing loan*. For cars and vehicles, the sample is split by those planning to apply for a car loan and those who are not. For houses and apartments, the sample is split by those obtaining, increasing, or refinancing a mortgage loan. The table shows the coefficients and marginal effects for the probit analysis where the dependent variable is equal to 1 if the respondent is a potential buyer in that category, shown in Equation 1. Panel A presents the results for the regression restricted to respondents planning to apply for a relevant loan type. Panel B includes the results of the regression for those respondents with no such plans. The coefficients on the tails - particularly the left tail - are smaller and less likely to be significant in Panel B, again suggesting that the effect of the tails on consumption plans is a borrower-specific effect.

6. Conclusion

I provide cross-sectional evidence that beliefs in extreme inflation outcomes are a significant predictor of households' consumption plans. Households with long-tailed subjective probability distributions over inflation have lower forecasted growth in real consumption, are more likely to report positive spending attitudes towards durables, and are more likely to plan to spend out of an unexpected increase in future income. They further assign higher probability to the outcome that future interest rates will increase. These results are consistent with *rare inflation disasters* that materialize in the tails of inflation expectations and increase the cost of borrowing.

Jointly, these results suggest that the relationship between inflation expectations and anticipated consumption goes beyond the well-known Fisher relationship. Indeed, households seem to view inflation not only as a component of real interest rates but also as a barometer of other financial market costs. Failures to achieve price stability are correlated with reduced consumer confidence that interest rates will remain steady, with implications for consumption-savings plans. Future research may further explore this new proposed link between inflation expectations and consumption.

Variable	Mean	Stand. Dev.	Corr. with $E[\pi_{t+1}]$	N
$E[\pi_{t+1}]$	3.94	4.40	-	$93,351$
Median	3.92	4.37	0.99	$93,351$
IQR	3.85	3.55	0.18	$93,351$
$p95 - p75$	2.27	1.89	0.22	$93,351$
$p25 - p5$	2.20	2.28	0.10	$93,351$

Table 1: The table provides summary statistics for the variables of households' subjective inflation distribution. These variables are the median, IQR, and the lengths of the right and left tails of these distribution. The length of the right tail is the difference between the 95th and 75th percentiles while the left tail is the difference between the 25th and 5th percentiles.

	Full Sample	Employed Respondents
Median	-0.54***	-0.51***
	(0.01)	(0.01)
IQR	0.27***	0.27***
	(0.04)	(0.05)
$p95 - p75$	-0.16***	-0.15**
	(0.05)	(0.06)
$p25 - p5$	-0.15***	-0.16***
	(0.04)	(0.06)
Prob. job loss, (0-100)		0.01***
		(0.00)
Observations	86,618	52,480
R^2	0.29	0.28

Standard errors in parentheses
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 2: The table provides regression results for Equation 1 or the response of forecasted real consumption growth to variables characterizing the subjective inflation distributions of consumers. Forecasted consumption growth is the difference between the between the consumers reported nominal spending growth over the next twelve months less the median of their subjective distribution over inflation in the next twelve months. The median and interquartile range represent the central tendency and uncertainty of individual subjective inflation distribution while $p95 - p75$ and $p25 - p5$ represent right and left tail risk, respectively. Included in the regression are household demographic controls as well as their expectations over other macroeconomic outcomes. The second column controls for the probability of job loss among employed respondents. The table shows that increasing the length of either tail reduces forecasted consumption growth. Increased uncertainty has the opposite effect.

Category		Mean Response	Median Response	Proportion > 0
Durables	Appliances	11	1	
	Electronics	17	5	0.73
	Furniture	12	0	
Cars or Vehicles		9	0	0.39
House or Apartment		5	0	0.22

Table 3: The Household Spending Survey includes questions about the probability of purchase of various goods. The first and second columns give the average and median probability assigned to the likelihood of purchase in that category in the next four months. The second column reports the proportion of respondents who respond with positive probability.

	Durable Goods		Cars and Vehicles		Houses and Apartments	
	Coeff.	ME	Coeff.	ME	Coeff.	ME
Median	-0.0084	-0.0025	-0.0121**	-0.0043**	-0.0148**	-0.0039**
	(0.0056)	(0.0017)	(0.0051)	(0.0018)	(0.0059)	(0.0015)
IQR	-0.0569***	-0.0168***	-0.0689***	-0.0242***	-0.1000***	-0.0263***
	(0.0208)	(0.0061)	(0.0197)	(0.0069)	(0.0236)	(0.0062)
$p95 - p75$	0.1076***	0.0317***	0.1341***	0.0471***	0.1452***	0.0382***
	(0.0299)	(0.0088)	(0.0262)	(0.0091)	(0.0287)	(0.0075)
$p25 - p5$	0.0684***	0.0202***	0.0797***	0.0280***	0.1287***	0.0339***
	(0.0254)	(0.0075)	(0.0221)	(0.0078)	(0.0249)	(0.0065)
Observations	12,621		12,623		12,565	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4: The table presents the coefficients and marginal effects for inflation distribution variables from the probit regression specified in Equation 2. The dependent variable is equal to 1 if the survey respondent reports a positive probability of buying either “Durable Goods”, “Cars and Vehicles”, or “Houses and Apartments” in the next four months. The durables category combines responses to questions about the probability of purchasing appliances, electronics, and furniture. The median and interquartile range represent the central tendency and uncertainty of individual subjective inflation distribution while $p95 - p75$ and $p25 - p5$ represent right and left tail risk, respectively. Included in the regression are household demographic controls as well as their expectations over other macroeconomic outcomes. The marginal effects are the change in the probability of being a potential buyer for a one percentage point increase in each of the inflation distribution statistics. Increasing the length of either tail increases the likelihood of being a potential buyer while increasing uncertainty reduces this likelihood.

Normal Mixture Parameters							
	F[Δ Cons.]	Durable Goods		Cars and Vehicles		Houses and Apartments	
		Coeff.	ME	Coeff.	ME	Coeff.	ME
$\mu^{\neg D}$	-0.54***	-0.0132**	-0.0039**	-0.0097*	-0.0034*	-0.0127**	-0.0033**
	(0.01)	(0.0059)	(0.0017)	(0.0053)	(0.0019)	(0.0060)	(0.0016)
$\mu^{D} - \mu^{\neg D}$	-0.25***	-0.0060	-0.0018	0.0026	0.0009	-0.0073	-0.0019
	(0.01)	(0.0058)	(0.0017)	(0.0050)	(0.0017)	(0.0054)	(0.0014)
$\sigma^{\neg D}$	-0.03	0.2890***	0.0847***	0.3639***	0.1271***	0.3890***	0.1014***
	(0.04)	(0.0407)	(0.0117)	(0.0310)	(0.0105)	(0.0310)	(0.0078)
$\frac{\sigma^{D}}{\sigma^{\neg D}}$	-0.05***	-0.0001	-0.0000	0.0150	0.0052	0.0185	0.0048
	(0.02)	(0.0101)	(0.0030)	(0.0113)	(0.0039)	(0.0113)	(0.0029)
γ, (0 - 100)	-0.01**	0.0124***	0.0036***	0.0048**	0.0017**	0.0043**	0.0011**
	(0.00)	(0.0021)	(0.0006)	(0.0019)	(0.0007)	(0.0022)	(0.0006)
Observations	86,312	12,585		12,587		12,529	

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: This table shows the response of projected real consumption growth and readiness to purchase durables to estimates of the parameters of the normal mixture described in Section 4. Expectations are assumed to follow a mixture of two normal distributions. One distribution is a non-disaster state ($\neg D$) and the other is a higher uncertainty disaster state (D). The coefficient on $\mu^{\neg D}$ recovers the change as the entire distribution shifts. The coefficient on $\mu^{D} - \mu^{\neg D}$ gives the effect of a change in the disaster state mean while holding the mean of the lower uncertainty distribution constant. As $\sigma^{\neg D}$ increases and $\frac{\sigma^{D}}{\sigma^{\neg D}}$ is held constant, σ^{D} increases as well proportionally. The coefficient on $\frac{\sigma^{D}}{\sigma^{\neg D}}$ recovers the effect of increasing the standard deviation of the wider distribution, leaving the uncertainty of the other distribution unchanged. γ is the weight the consumer's expectations place on the disaster distribution. The first column shows the estimates from Equation 16 and the remaining columns give the coefficients and marginal effects from the probit regression specified by Equation 17. As γ increases, projected consumption growth decreases and the likelihood of durables purchase increases. This means that the expected probability of disaster is linked to consumption patterns as described in Section 4.

Prob. Interest Rate Increase		
Median	-0.23***	-0.23***
	(0.03)	(0.04)
IQR	-0.43***	-0.29**
	(0.10)	(0.13)
$p95 - p75$	0.55***	0.32*
	(0.14)	(0.18)
$p25 - p5$	0.56***	0.55***
	(0.12)	(0.15)
Prob. job loss,		0.05***
(0-100)		(0.01)
Observations	89,915	54,476
R^2	0.29	0.29

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: The table provides the coefficients from a regression with the probability of interest rates being higher 12 months from the survey date (Q5new) as the dependent variable, specified in Equation 18. The median and IQR represent the central tendency and uncertainty of individual subjective inflation distribution while $p95 - p75$ and $p25 - p5$ represent right and left tail risk, respectively. Included in the regression are household demographic controls as well as their expectations over other macroeconomic outcomes. The second column includes the probability of own job loss risk as a control. The table shows that consumers with longer tails in either direction anticipate higher interest rates in the future.

Panel A: Planning to Apply for Loan

	F[Δ Cons.]	Durable Goods		Cars and Vehicles		Houses and Apartments	
		Coeff.	ME	Coeff.	ME	Coeff.	ME
Median	-0.51***	-0.0132	-0.0028	-0.0056	-0.0019	-0.0252**	-0.0087**
	(0.02)	(0.0109)	(0.0023)	(0.0109)	(0.0038)	(0.0125)	(0.0043)
IQR	0.43***	-0.0869**	-0.0181**	-0.0410	-0.0142	-0.1004**	-0.0344**
	(0.06)	(0.0391)	(0.0081)	(0.0363)	(0.0126)	(0.0427)	(0.0146)
$p95 - p75$	-0.28***	0.1020*	0.0213*	0.1016**	0.0352**	0.1861***	0.0639***
	(0.07)	(0.0591)	(0.0123)	(0.0483)	(0.0167)	(0.0561)	(0.0191)
$p25 - p5$	-0.30***	0.1318**	0.0275**	0.1188***	0.0411***	0.1233***	0.0423***
	(0.06)	(0.0530)	(0.0110)	(0.0402)	(0.0139)	(0.0474)	(0.0161)
Observations	37,767	4,783		4,112		3,578	

Panel B: Not Planning to Apply for Loan

	F[Δ Cons.]	Durable Goods		Cars and Vehicles		Houses and Apartments	
		Coeff.	ME	Coeff.	ME	Coeff.	ME
Median	-0.59***	-0.0102	-0.0035	-0.0159**	-0.0045**	-0.0129**	-0.0024**
	(0.02)	(0.0080)	(0.0027)	(0.0080)	(0.0023)	(0.0058)	(0.0011)
IQR	0.14*	-0.0292	-0.0099	-0.0548*	-0.0156*	-0.0439	-0.0082
	(0.08)	(0.0323)	(0.0110)	(0.0318)	(0.0090)	(0.0333)	(0.0062)
$p95 - p75$	-0.02	0.1045**	0.0355**	0.1525***	0.0433***	0.0754*	0.0141*
	(0.10)	(0.0439)	(0.0149)	(0.0420)	(0.0119)	(0.0423)	(0.0079)
$p25 - p5$	-0.07	0.0155	0.0053	0.0272	0.0077	0.0732**	0.0137**
	(0.08)	(0.0373)	(0.0126)	(0.0335)	(0.0095)	(0.0359)	(0.0067)
Observations	16,935	4,791		5,473		6,433	

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: This table shows the estimates from Equations 1 and 2 with the sample split by respondents' plans to apply for credit. Panel A shows the results for respondents who report positive probability of planning to apply a loan in the next 12 months. The first column separates consumers by plans to apply for any type of loan. In the remaining columns, the loan type is specific to the good category - consumer loans for the durables category, auto loans for the cars and vehicles category, and mortgage loans and refinances for the house and apartments category. Panel B shows the results for respondents who do not plan to apply for these loans in the next 12 months. These results show that effects of the tails are more pronounced among credit market participants.

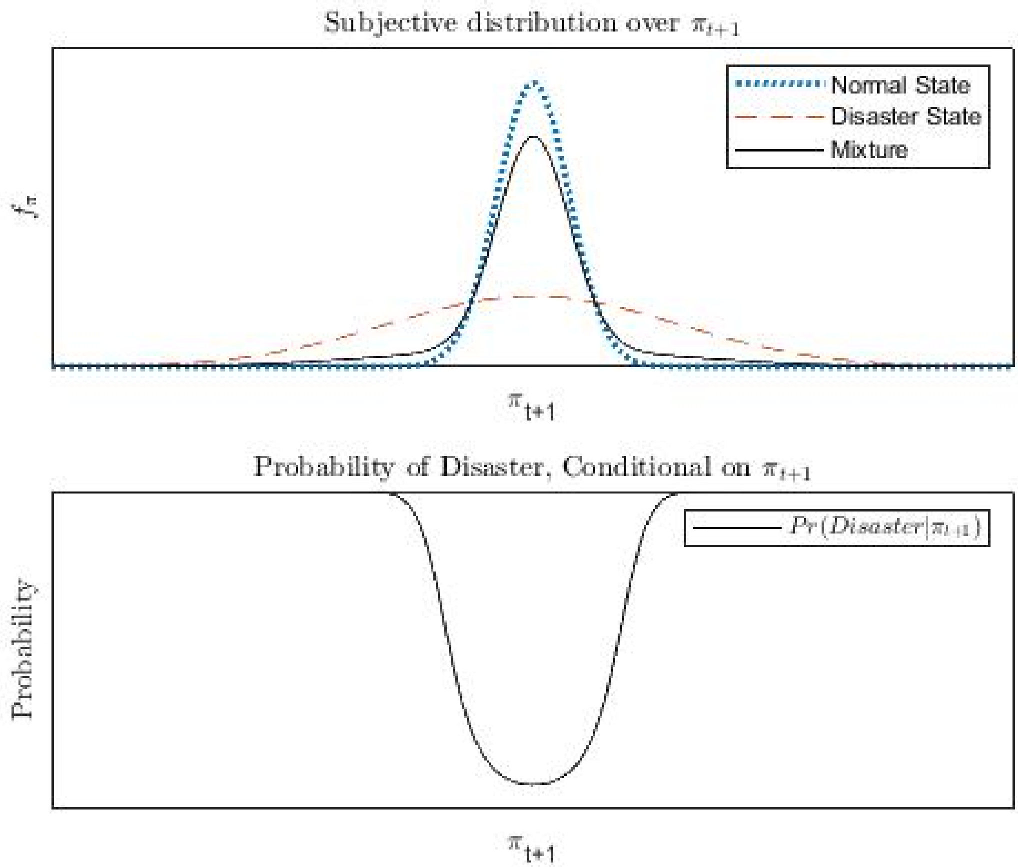

Figure 1: This figure shows the model of inflation expectations as a mixture of two normal distributions over possible inflation outcomes. One of these distributions gives the distributions over inflation in a disaster. Future debt issuance costs increase in the disaster state. The first panel shows the two normals and their mixture. The mixture gives the agent's expectations over possible inflation outcomes. The second panel applies Bayes Rule to find the expected probability of being in the disaster state conditional on a realization of inflation.

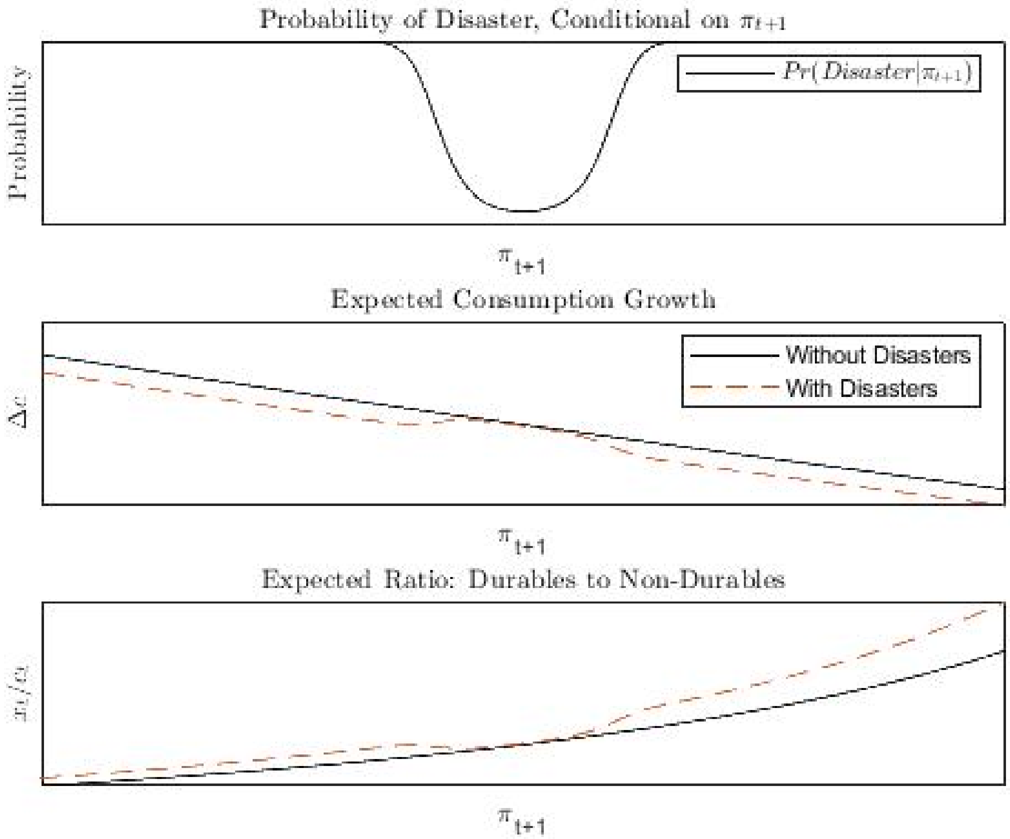

Figure 2: This figure shows the expected probability of disaster conditional on a realization, π_{t+1} as well as the Euler equations from section 4.2 plotted against the inflation rate. The second panel shows optimal consumption growth plotted against the rate of inflation. The solid line shows that consumption growth should decline as inflation increases and the real interest rate decreases, causing the consumer to shift consumption from the future to the present. The dashed shows consumption growth plotted against inflation when anticipated disasters factor into the consumer's behavior. The possibility of a disaster drives up the expected future loan issuance fee, which drives borrowing and consumption towards the present. As the probability of disaster is higher in the tails of the distribution, consumption growth is further from the disaster-free prediction at these inflation rates than it is at inflation rates at the middle of the distribution. The third panel shows the expected ratio of durable to non-durable consumption. In the tails of the distribution, the ratio of durable to non-durable consumption is higher in the model with disasters than in the model without disasters.

References

Andrade, P., Ghysels, E., Idier, J., 2012. Tails of inflation forecasts and tales of monetary policy.

Armantier, O., Koşar, G., Pmerantz, R., Skandalis, D., Smith, K., Topa, G., van der Klaauw, W., 2021. How economic crises affect inflation beliefs: Evidencve from the covid-19 pandemic. Journal of Economic Behavior & Organization .

Armantier, O., Nelson, S., Topa, G., van der Klaauw, W., Zafar, B., 2016a. The price is right: Updating inflation expectations in a randomized price information experiment. Review of Economics and Statistics 98, 506–523.

Armantier, O., Topa, G., van der Klaauw, W., Zafar, B., 2016b. An overview of the survey of consumer expectations. Federal Reserve Bank of New York Staff Report 800.

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

Badarinza, C., Campbell, J.Y., Ramadorai, T., 2018. What calls to arms? international evidence on interest rates and the choice of adjustable-rate mortgages. Management Science 64, 2275–2288.

Ben-David, I., Fermand, E., Kuhnen, C.M., Li, G., 2018. Expectations uncertainty and household economic behavior.

Binder, C., 2017. Measuring uncertainty based on rounding: New method and application to inflation expectations. Journal of Monetary Economics 90, 1 – 12.

Binder, C., 2020. Coronavirus fears and macroeconomic expectations. The Review of Economics and Statistics 102, 721–730.

Binder, C., Kim, G., 2021. Learning-through-survey in inflation expectations.

Bloom, N., 2009. The impact of uncertainty shocks. Econometrica 77, 623 – 685.

Bloom, N., 2014. Fluctuations in uncertainty. Journal of Economic Perspectives 28, 153 – 176.

Bowley, A.L., 1920. Elements of Statistics. Charles Scribner's Sons, New York.

Burke, M., Ozdagli, A., 2021. Household inflation expectations and consumer spending: Evidence from panel data.

Carlstrom, C.T., Fuerst, T.S., Paustian, M., 2015. Inflation and output in new keynesian models with a transient interest rate peg. Journal of Monetary Economics 76, 230–243.

Chan, J., Song, Y., 2018. Measuring inflation expectations uncertainty using high-frequency data. Journal of Money, Credit and Banking 50, 1139 – 1166.

Coibion, O., Georgarakos, D., Gorodnichenko, Y., van Rooij, M., 2021. How does consumption respond to news about inflation? field evidence from a randomized control trial.

Crump, R.K., Eusepi, S., Tambalotti, A., Topa, G., 2015. Subjective intertemporal elasticity. Federal Reserve Bank of New York Staff Report 734.

D'Acunto, F., Hoang, D., Weber, M., 2016. The effect of unconventional fiscal policy on consumption expenditure.

D'Acunto, F., Hoang, D., Weber, M., 2018. Unconventional fiscal policy.

Dräger, L., Nghiem, G., 2021. Are consumers' spending decisions in line with a euler equation? The Review of Economics and Statistics 103, 580–596.

Duca-Radu, I., Kenny, G., Reuter, A., 2019. Inflation expectations, consumption and the lower bound: Micro evidence from a large multi-country survey. American Economic Journal: Economic Policy 11, 130–155.

Ehrmann, M., Pfajfar, D., Santoro, E., 2015. Consumers' attitude and their inflation expectations.

Engelberg, J., Manski, C., Williams, J., 2009. Macroeconomic expectations of households and professional forecasters. Journal of Business and Economic Statistics 27, 30 – 41.

García, J.A., Manzanares, A., 2007. What can probability forecasts tell us about inflation risks? European Central Bank Working Paper Series .

Ichiue, H., Nichiguchi, S., 2015. Inflation expectations and consumer spending at the zero lower bound: Micro evidence. Economic Inquiry 53, 1086 – 1107.

Leduc, S., Liu, Z., 2020. The uncertainty channel of the coronavirus.

McKay, A., Nakamura, E., Steinsson, J., 2016. The power of forward guidance revisited. American Economic Review 106, 3133–3158.

del Negro, M., Giannoni, M., Patterson, C., 2015. The forward guidance puzzle.

Ryngaert, J., 2021. Balance of risks and the anchoring of consumer inflation expectations.

Scharnagl, M., Stapf, J., 2015. Inflation, deflation, and uncertainty: What drives euro-area option-implied inflation expectations, and are they still anchored in the sovereign debt crisis. Economic Modeling 48, 248–269.