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## The curious case of the rise in deflation expectations

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# The Curious Case of the Rise in Deflation Expectations

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Giorgio Topa | Wilbert van der Klaauw | John C. Williams

## **The Curious Case of the Rise in Deflation Expectations**

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### **Abstract**

We study the behavior of U.S. consumers' inflation expectations during the high inflation period of 2021-22 using data from the Survey of Consumer Expectations. Short- and, to a lesser extent, medium-term inflation expectations rose as inflation surged in 2021. Disagreement and uncertainty about future inflation increased significantly. Then, in 2022, even as inflation continued to climb, medium- and longer-term inflation expectations unexpectedly fell and medium- and longer-term *deflation* expectations increased. We find that respondents with deflation expectations tend to expect prices to mean revert and are more optimistic about the economic outlook.

Key words: inflation, deflation, expectations, consumer surveys

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This paper presents preliminary findings and is being distributed to economists and other interested readers solely to stimulate discussion and elicit comments. The views expressed in this paper are those of the author(s) and do not necessarily reflect the position of the Federal Reserve Bank of New York, the Federal Open Market Committee, or the Federal Reserve System. Any errors or omissions are the responsibility of the author(s).

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# 1 Introduction

Inflation expectations (IE hereafter) are viewed as important signals of future inflation by economists and monetary policymakers (Reis, 2021; Gopinath, 2022; Mester, 2022). Researchers have long studied how IE are formed (see, for example, Orphanides and Williams 2004, Coibion et al. 2018, Kose et al. 2019, and D’Acunto et al. 2022 for references to the literature). This paper explores households’ formation of IE in the United States during the high inflation episode of 2021–2022 using data from the New York Fed’s Survey of Consumer Expectations (SCE).

We find that the median respondent’s IE rose substantially at the one-year-ahead and, to a much lesser extent, three-year-ahead horizons during 2021, but that three- and five-year-ahead median IE subsequently declined in 2022. In the remainder, we refer to the one-year horizon as “short-term,” the three-year horizon as “medium-term,” and the five-year horizon as “longer-term.”<sup>1</sup> We also find that the distribution of IE across respondents widened at all horizons. While this increase in disagreement among consumers in part reflects a thickening of the right tail of the distribution for short-term IE (i.e., more respondents expecting higher inflation in the short-term), for medium- and longer-term IE it is driven by the growth of the left tail (i.e. more respondents expecting lower inflation in the medium and longer-term). In particular, the share of respondents expecting deflation in the medium-term more than doubled – from 10 percent to 27 percent – between April 2021 and September 2022, a period when realized inflation rose dramatically.

We investigate three plausible hypotheses for this increase in deflation expectations during a period of rising inflation. First, respondents may confuse deflation with a lower, but still positive, rate of inflation. Second, respondents may expect mean reversion in prices. Third, respondents may anticipate that economic conditions will worsen, resulting in deflation.

Overall, we find evidence supporting the first hypothesis (deflation confusion) and the second hypothesis (price mean reversion). Quantitatively, deflation confusion can account for only a very small portion of the share of respondents who expect deflation, while respondents who expect deflation in three years are significantly more likely to believe that commodity prices exhibit mean reversion over a similar horizon. We do not find evidence consistent with the third hypothesis: on the contrary, respondents with medium-term deflation expectations report significantly lower recession probabilities, lower probabilities of higher unemployment, and better economic conditions at the corresponding horizon.

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<sup>1</sup>As discussed in Section 2, we have been eliciting five-year-ahead IE consistently since January 2022 and measured them occasionally a few times before then.

This paper makes three main contributions to the literature. First, while many models of IE formation (such as the adaptive learning model of Evans and Honkapohja 2012, or the learning-from-experience model of Malmendier and Nagel 2016) assume that agents update their beliefs in response to inflation realizations, empirically studying how U.S. consumers’ IE respond to large changes in inflation has been difficult because such episodes have been rare in recent decades. The inflation surge of 2021-2022, combined with the development of modern survey techniques to elicit individual inflation density forecasts, provides a unique opportunity to better understand how consumers update their inflation beliefs during a period of high inflation.

Second, while most of the empirical literature on IE focuses on a single horizon (mostly one-year-ahead), we compare and contrast the evolution of IE at the one-, three- and five-year-ahead horizons. This approach provides insights into how persistent consumers expected the 2021-2022 inflation shock to be. It also highlights the richness of IE dynamics at different horizons (with IE exhibiting different patterns both in the cross-section and over time), providing additional data to test alternative theories.

Third, we identify a puzzling pattern. Contrary to the predictions of some models of IE, the high inflation of 2021-2022 led many respondents to revise their medium- and longer-term IE downward (not upward), including into deflation territory. This suggests that the process consumers use to update inflation expectations is more complex than one based on a univariate model and likely incorporates additional information such as the sources of the rise in inflation and other factors affecting the persistence of inflation.

The remainder of the paper is organized as follows. Section 2 describes the survey data. Section 3 reports the trends in IE at various horizons over the 2021-2022 period. Section 4 evaluates various hypotheses to explain the rise in deflation expectations. Section 5 concludes.

## 2 The Survey of Consumer Expectations

The SCE is a monthly, internet-based survey conducted by the Federal Reserve Bank of New York since June 2013 (Armantier et al., 2017). It uses a rotating panel design, consisting of a nationally representative sample of around 1,300 U.S. household heads, who participate in the survey for up to 12 months.

Since its inception, the SCE has elicited consumers’ IE at the short- and medium-term horizons on a monthly basis. The short-term horizon corresponds to the year ahead (“*Over the next 12 months*”), while the medium-term horizon corresponds to the one-year rate of inflation three years

ahead (“*Over the 12-month period between M+24 and M+36,*” where M is the month in which the respondent takes the survey). So, for instance, a respondent taking the survey in April 2022 is asked about inflation “*Over the 12-month period between April 2024 and April 2025.*” Starting in January 2022, longer-term IE have also been elicited monthly by asking respondents to report their expected one-year rate of inflation five years ahead (“*Over the 12-month period between M+48 and M+60*”).

A unique feature of the SCE is that it elicits both a point and a density forecast from consumers. The former is an expectation expressed as a single number. The latter is obtained by asking respondents to state the percent chance that the rate of inflation will fall within pre-specified bins. The individual density forecasts are used to calculate three measures at each horizon: the *individual inflation expectation* (the mean of a respondent’s density forecast), the *individual inflation uncertainty* (the interquartile range of a respondent’s density forecast) and the *cross-sectional inflation disagreement* (the interquartile range of the individual inflation expectations in a given month). By taking the mean across respondents of the probabilities assigned to each future inflation outcome, we also construct the *aggregate density forecast*.

For the analysis, we combine data from the SCE monthly survey collected between January 2019 and September 2022, with data from a special SCE survey fielded separately between May 24 and June 6, 2022. The special survey included questions aimed at eliciting respondents’ views on factors associated with their inflation expectations.<sup>2</sup>

### 3 The Rise and Fall of IE during 2021-22

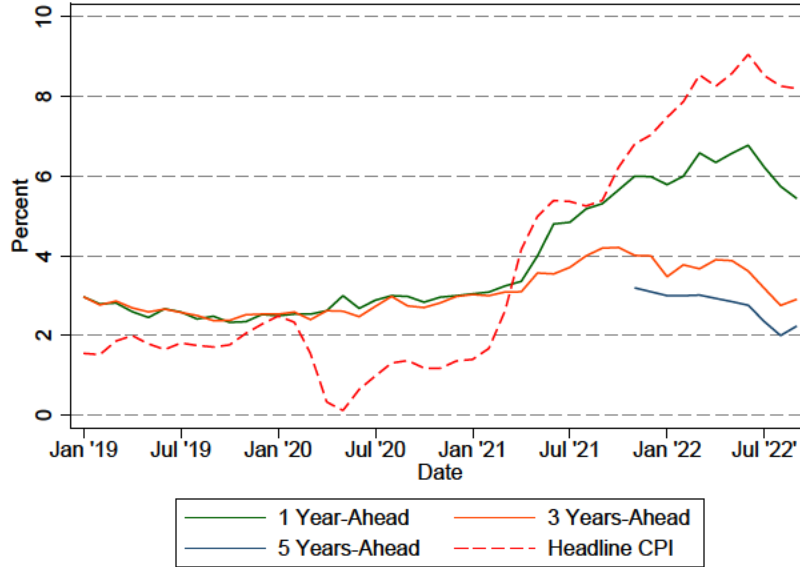
#### 3.1 The divergence in short-term and medium-term IE

IE were relatively stable during the first year of the pandemic but, starting in the spring of 2021, rose significantly following the upturn in realized inflation. Figure 1 plots the median short-, medium-, and longer-term individual IE between January 2019 and September 2022, as well as the realized inflation rate as measured by the contemporaneous twelve-month percent change in the consumer price index (CPI). At the onset of the pandemic, both median short- and medium-term IE averaged around 2.5 percent. With realized inflation rising to levels not seen in several decades, at their respective peaks, short-term IE had risen by over 4 percentage points and medium-term IE had risen by about 1.7 percentage points, both series-high levels in the nearly 10 years since the inception of

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<sup>2</sup>The relevant questions asked in the 2022 special survey are reported in the online Appendix B. We also use data from special survey modules in which longer-term IE were elicited in a density forecast format (July 2021) and in a point forecast format (July 2019 and 2021). In addition, we elicited longer-term IE on a one-off basis in the November 2021 SCE monthly survey.

Figure 1: Median Individual Inflation Expectations



Note: The figure shows the realized 12-month percent change in the headline CPI and median IE (measured as density means) at different horizons in the monthly SCE.

the SCE.

Equally notable as the increase in short- and medium-term IE is the subsequent decline in medium- and longer-term IE during 2022, despite realized inflation continuing to climb during the first half of the year. Medium-term IE peaked at 4.2 percent in October 2021 when realized inflation was 6.8 percent, but then, in spite of inflation rates reaching 9 percent in the summer of 2022, declined to 2.9 percent in September 2022, modestly above the level at the onset of the pandemic. Longer-term IE likewise declined during 2022. We now explore in more detail this unusual decline in medium- and longer-term IE.

### 3.2 The surprising decline in medium- and longer-term inflation expectations

Analyzing changes in the distribution of individual IE across respondents provides insights into the rise and subsequent fall in medium-term IE during the pandemic. Figure 2 plots the distributions of individual IE collected in July of each year between 2019 and 2022. The x-axis in the figure is truncated at -20 and 20 percent. The panels in the left column show distributions of individual density forecast means and the panels in the right column display individual point forecasts.<sup>3</sup> The dot shown on each curve corresponds to the median IE across respondents. In the following, we focus

<sup>3</sup>We focus on the month of July because, for point forecasts, we can go as far back as July 2019 in plotting the distribution of longer-term IE, exploiting data from a one-time special survey fielded at that time.

on the density means shown in the left column but note that the key features that we highlight are shared by the distributions of the point forecasts.

The distributions of short-term IE behave very differently than medium- and longer-term IE over 2020-22. The top row of Figure 2 shows that the distribution of short-term IE shifted notably to the right and widened between July 2020 and July 2021, reflecting higher short-term IE and increased disagreement among consumers about inflation over the next year, respectively. In stark contrast, as shown in the middle and bottom rows, the distributions of medium- and longer-term IE display relatively modest changes in medians (as seen in Figure 1), but a widening in the distributions reflecting large increases in disagreement across respondents.

The increasing disagreement in medium-term IE across respondents is seen clearly by comparing the July 2020 and 2021 surveys, but then takes on a very different character in the July 2022 survey, with the appearance of a sizable shift in probability mass moving from the center of the distribution to the left tail. A similar shift is evident in the distribution of longer-term IE. There is no corresponding movement of probability mass to the right tail between July 2021 and 2022; indeed, the right tails of the distributions are nearly identical in these surveys. Interestingly, this pattern of a leftward shift in the distribution across respondents is not apparent in short-term IE, indicating that respondents distinguish between the characteristics of the near-term inflation outlook and those of the medium- and longer-term outlook.<sup>4</sup>

This leftward shift in the distribution of households' medium- and longer-term IE is illustrated by the growing and sizeable share of households expecting medium- and longer-term inflation of zero or below. The left panel of Figure 3 shows the share of respondents who expect inflation rates to be zero or negative (referred to as “deflation expectations” henceforth) from January 2019 to September 2022. Throughout 2021 and the first half of 2022, the share with near-term *deflation* expectations is low and relatively stable at between 5 and 10 percent, but then rises modestly toward the end of the sample. In sharp contrast, the share expecting deflation in the medium-term more than doubled from 10 percent in April 2021 to 27 percent in September 2022. The share expecting deflation in the longer-term also climbed to 27 percent in September 2022. This rise in deflation expectations is broad-based across demographic groups.<sup>5</sup> A similar pattern is seen in the Michigan Survey of Consumers, where the share of respondents with five-to-ten year-ahead inflation point forecasts at

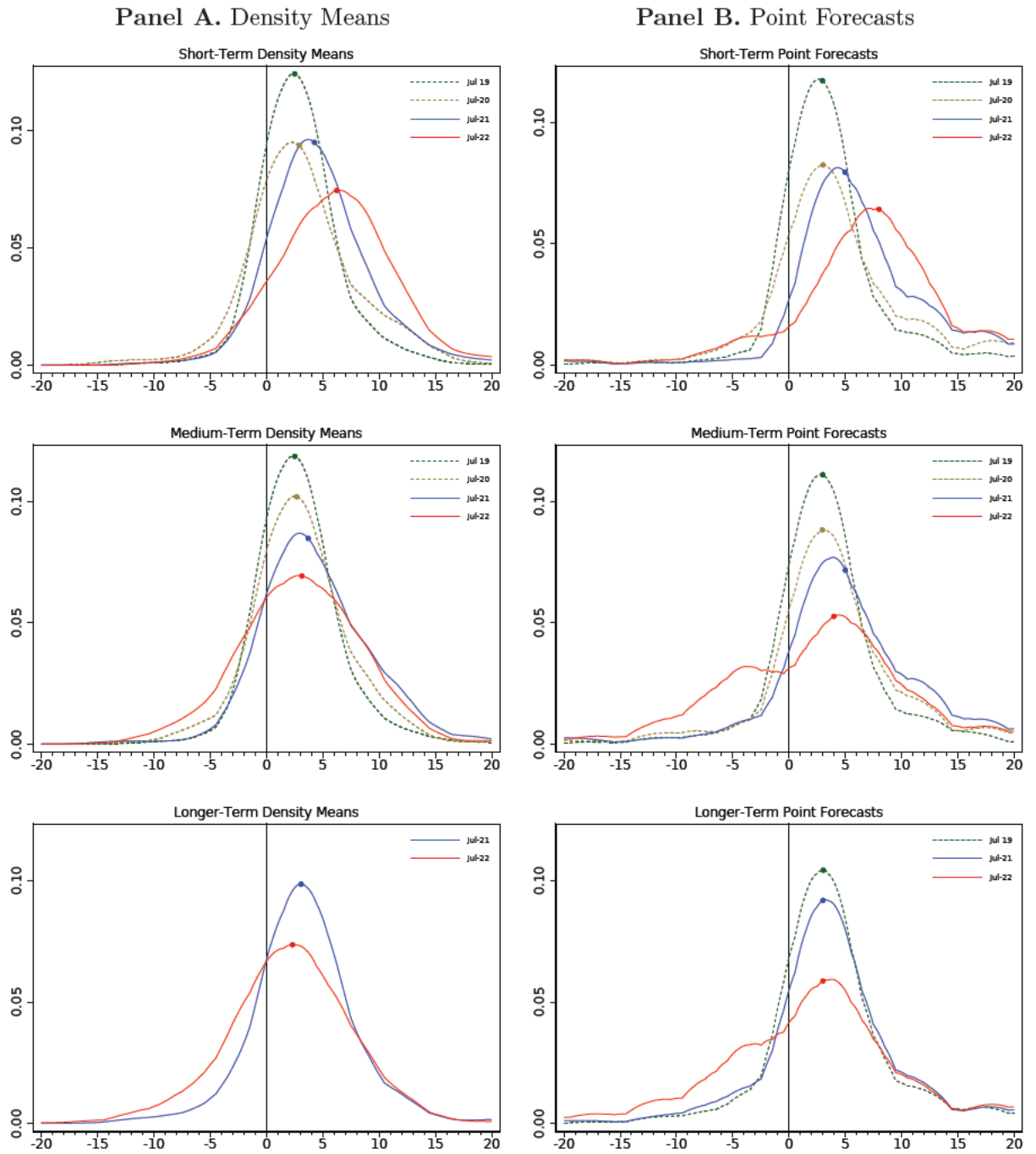
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<sup>4</sup>These patterns are also evident using inflation point forecasts from the Michigan Survey of Consumers, see Figure A.1 in the online Appendix.

<sup>5</sup>The rise in the share expecting deflation in the medium-term over the past year is statistically significant at the 1 percent level both overall and when differentiating by gender, age, household income, college degree attainment, race and Census region.

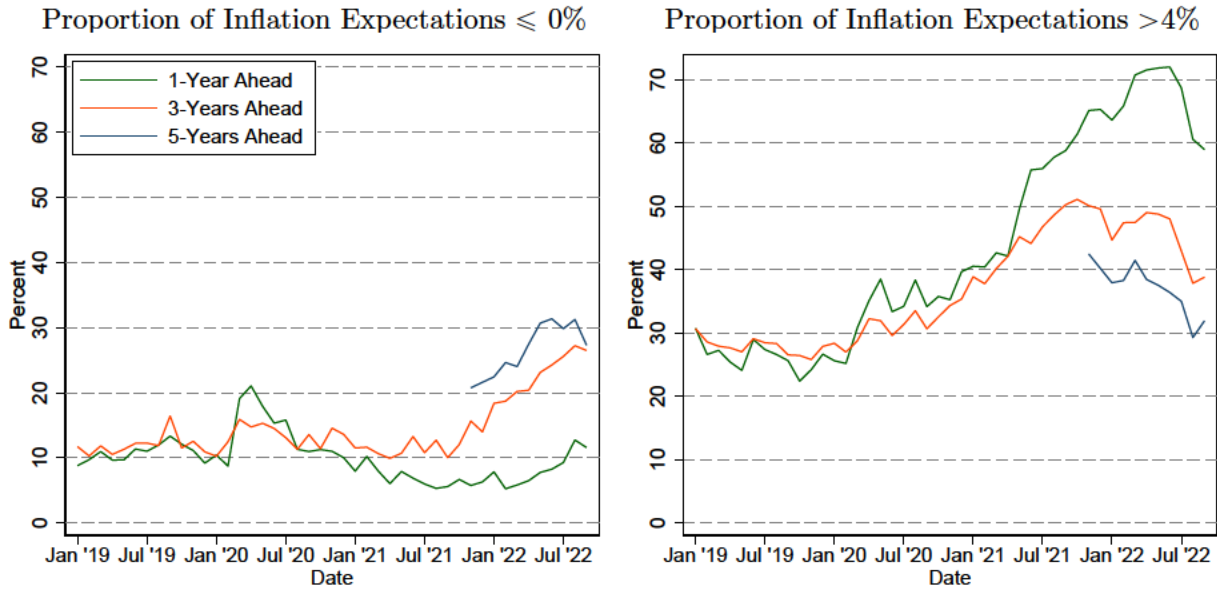


Figure 2: Distribution of Individual Inflation Expectations



Note: The figure shows kernel densities fitted to individual inflation density means (left column) and inflation point forecasts (right column). We use an Epanechnikov kernel with a bandwidth of 2. Circles correspond to median inflation expectations.

Figure 3: Distribution of Individual Inflation Expectations



Note: The leppeft panel shows the share of respondents with deflation expectations (i.e., with density means less or equal to 0%) in the monthly SCE. The right panel shows the share of respondents with IE (density means) above 4% in the monthly SCE.

or below zero reached 24 percent in September 2022.<sup>6</sup>

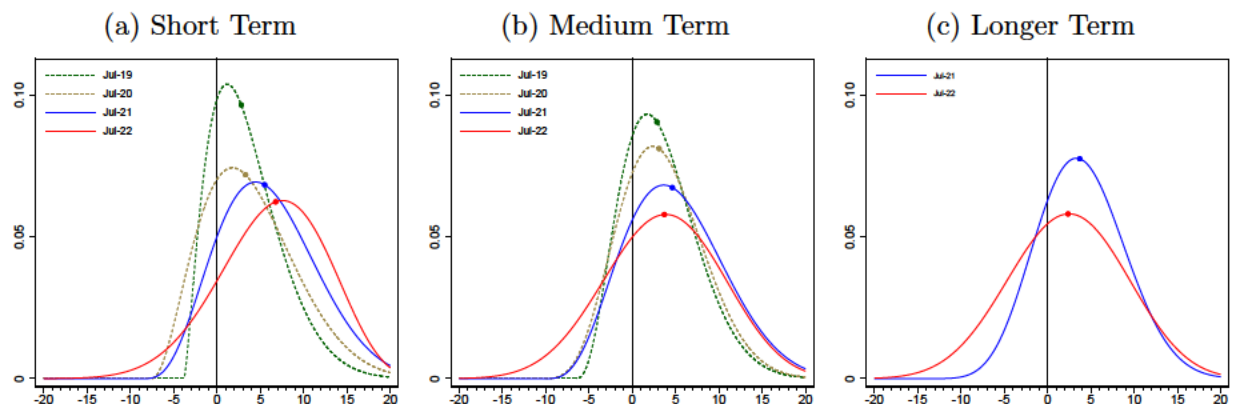
The rise in the share of respondents expecting deflation in the medium- and longer-term is accompanied by a decline in the share expecting inflation above 4 percent. The right panel of Figure 3 shows the corresponding chart of the share of respondents with inflation expectations above 4 percent over time. These patterns are robust to using point forecasts instead of density forecast means as a measure of individual IE (see online Appendix Figure A.2.)

### 3.3 Increased Uncertainty and the Aggregate Density Forecast

Thus far we have focused exclusively on IE disagreement across households; we now incorporate individual forecast uncertainty reported in the SCE. Figure 4 plots the aggregate inflation density forecasts (defined in Section 2) in July of each year between 2019 and 2022. Although, by construction, the aggregate density forecasts are wider than the corresponding distributions showing disagreement alone, the same patterns are evident as in Figure 2. In particular, the densities widen over time and there is a significant increase in the implied probability of medium- and longer-term deflation between July 2021 and 2022. At the same time, while the right tail of the short-term aggregate

<sup>6</sup>The question in the Michigan survey differs from that in the SCE in that it asks for the average annual percent change in prices during the next 5 to 10 years: “By about what percent per year do you expect prices to go (up/down) on the average, during the next 5 to 10 years?” (Emphasis added.)

Figure 4: Aggregate Inflation Density Forecasts



Note: Each chart fits generalized beta distributions to aggregate inflation density forecasts. Circles represent distribution medians.

aggregate density shifted to the right between July 2021 and July 2022, there is no sign of a rightward shift for medium- and longer-term densities. Additional details regarding these patterns and the evolution of disagreement and median uncertainty over this period are provided in the online Appendix.

The majority of the rise in the variance of the aggregate density forecast is due to an increase in disagreement across respondents. We apply the approach of Bassetti et al. (2022) to decompose the aggregate variance into the average of individual variances (a measure of uncertainty) and the variance of individual IE (a measure of disagreement). We find that 66 percent of the overall increase between April 2021 and September 2022 in the variance of the medium-term aggregate density forecast is due to an increase in disagreement across respondents, with the remaining 34 percent due to an increase in individual uncertainty.

## 4 Potential Explanations for the Increase in Deflation Expectations

To understand the surprising increase in deflation expectations during the 2021-2022 high inflation period, we fielded a special SCE module in May 2022 in which we asked questions related to three hypotheses: confusion about the meaning of inflation, an expectation of price reversals for goods that experienced large price run-ups during the pandemic, and expectations of a weak economy or recession.

### 4.1 Confusion about the meaning of inflation

We first consider the explanation that respondents who report that they expect deflation are confused about the meaning of the term “deflation,” and may interpret it as meaning lower inflation or

disinflation. To explore this possibility, in the special survey we asked respondents: “*Imagine that all prices increased by 4% last year, and imagine that all prices increase by 2% this year. In that case, would you say that there is inflation or deflation this year?*”. Overall, the vast majority of respondents (88 percent) do not confuse deflation with a decrease in the rate of inflation. This result is consistent with van der Klaauw et al. (2008) and Bruine de Bruin et al. (2012) who find that most U.S. household heads understand the meaning of the term “inflation.”

The proportion answering the question correctly is slightly, but statistically significantly, lower for those who expect deflation at the three-year horizon (82 percent) than for those who expect inflation between zero and 4 percent (90 percent) and those expecting inflation above 4 percent (89 percent). As shown in column 1 of Table 1, when controlling for other demographic characteristics, those who confuse deflation with a decrease in the inflation rate are 8 percentage points more likely to report expecting deflation three years from now. Given the low overall proportion of respondents answering the question incorrectly, this estimate implies that confusion can explain at most 1 percentage point of the 27 percent of respondents expecting deflation at the end of the sample period.<sup>7</sup> We find similar results when considering the association between confusion and deflation expectations at the five-year-ahead horizon. We also find that confusion likely explains at most a small amount of the 17-percentage-point rise in reported medium-term deflation expectations between April 2021 and September 2022 (see online Appendix).

## 4.2 Price reversals

Since the start of the COVID-19 pandemic, prices of several categories of goods and services, especially those for gasoline and durable goods, have increased dramatically more than the overall CPI. The second hypothesis we consider is whether households expect these sharp price increases to be followed by a decline toward more “normal” prices. Such “mean-reversion” in consumers’ price expectations could help explain why deflation expectations rose when realized inflation surged in 2021-2022. To assess this hypothesis, we asked respondents how much they agree, on a scale from 1 to 7, with the statement: “*In general, when the price of X rises sharply over a short period of time, it usually comes back down over the next 2 to 3 years*” where X refers, in turn, to gasoline, food, durable goods, and homes.

Respondents to the special survey who expect deflation in three years are significantly more likely

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<sup>7</sup>This number (1 percent) is derived by multiplying the share answering incorrectly (0.12) by the marginal effect of answering incorrectly on the likelihood of reporting deflation expectations (0.08).

Table 1: Marginal Effects on the Probability of Expecting Deflation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Deflation Confusion Question	-0.080** (0.035)								-0.072** (0.034)
Gas Price Reversion		0.021*** (0.008)							-0.005 (0.008)
Food Price Reversion			0.029*** (0.008)						0.022** (0.011)
Home Price Reversion				0.026*** (0.007)					0.017** (0.008)
Durables Price Reversion					0.023*** (0.008)				-0.006 (0.011)
Recession in 3 Years						-0.190*** (0.049)			-0.055 (0.055)
Higher Unempl in 3 Years							-0.180*** (0.046)		-0.091* (0.052)
Business Cond in 3 Years								0.069*** (0.012)	0.050*** (0.013)
Mean	0.170	0.170	0.170	0.170	0.170	0.171	0.170	0.170	0.171
Pseudo $R^2$	0.016	0.018	0.026	0.022	0.019	0.025	0.023	0.045	0.068
Observations	2194	2194	2193	2194	2194	2189	2194	2193	2187

Note: Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.010$ . Table reports average marginal effects from estimated Probit models. Demographic controls for gender, age, household income, college degree attainment, race and Census region are included.

to believe that various commodity prices generally exhibit mean reversion over a similar horizon.<sup>8</sup> The estimates reported in columns 2 to 5 of Table 1 indicate that, controlling for demographic characteristics, beliefs about price reversals are positively and statistically significantly related to expecting deflation at the three-year horizon. The effects are economically meaningful: strongly agreeing versus strongly disagreeing about mean-reversion increases the probability of expecting deflation by between 13 and 17 percentage points. Column 9 indicates that strongly agreeing versus strongly disagreeing about mean-reversion on all four items jointly increases the probability of deflation by 17 percentage points.<sup>9</sup> We similarly find economically meaningful effects when relating medium-term deflation expectations to simple binary indicators for agreeing with the price reversal statements (response above 4) or to elicited three-year-ahead commodity price change expectations, and when considering the role of beliefs about mean-reversion in explaining the rise in medium-term deflation expectations between April 2021 and September 2022 (see online Appendix).<sup>10</sup>

<sup>8</sup>The shares of respondents who agree with the price reversal statements (with agreement defined as giving a response above 4) are significantly higher for those expecting deflation than for those expecting inflation (see Appendix Table A.1). Appendix Figure A.7 plots average responses to the mean-reversion question by IE groups for all four goods.

<sup>9</sup>This number is computed by multiplying each coefficient estimate by six (the difference between strongly agreeing and strongly disagreeing) and adding up the four resulting effects.

<sup>10</sup>Conversely, in regressions where the dependent variable is an indicator for expecting inflation above 4 percent instead of deflation, the effects are reversed and larger in magnitude (see Table A.4 in the online Appendix.)

Overall, this evidence suggests that respondents who report deflation expectations tend to expect the large price increases experienced in 2021-2022 to at least partly reverse in the medium-term. The finding of expectations of mean-reversion contrasts with the previous literature, which found that households tend to extrapolate current price movements into the future (see, for example, Kuchler and Zafar 2019 and Armona et al. 2019). Our results suggest that this behavior is not universal.

### 4.3 Expectations of a weak economy or recession

The rise in deflation expectations observed in our survey responses could be associated with an increase in consumers' perceived risk of an economic downturn or recession that leads to expectations of lower inflation or even deflation through a standard Phillips Curve channel. To investigate the extent to which this explanation is empirically relevant, we asked respondents to assess i) the percent chance the U.S. economy will be in a recession in three years, ii) the percent chance the U.S. unemployment rate will be higher in three years than it is now, and iii) how business conditions in three years will compare to the present, on a scale from 1 (much worse) to 5 (much better).

The survey results do not support the hypothesis that deflation expectations are related to a higher perceived risk of a weak economy or recession. In fact, respondents with medium-term deflation expectations are relatively optimistic about economic conditions, reporting significantly lower probabilities of a recession and of higher unemployment and expecting better business conditions at the corresponding horizon than those who expect inflation. The average perceived probability of recession in three years is 28 percent for those expecting deflation vs. 35 percent for those who expect inflation. The corresponding numbers are very similar for the average probability of higher unemployment. The share expecting better or much better business conditions in three years is 81 percent for those reporting deflation expectations compared to 66 percent for those expecting inflation.<sup>11</sup>

Estimates shown in columns 6 to 8 of Table 1 reveal a strong negative perceived association between medium-term deflation expectations and the perceived probability of a recession and higher unemployment three years from now, and a positive association with business conditions three years from now. A 20-percentage-point decline in the likelihood of a recession (or higher unemployment) is associated with about a 4-percentage-point increase in the likelihood of reporting deflation,<sup>12</sup> while

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<sup>11</sup>The differences in responses to these three questions about the economic outlook in three years between those who expect deflation and those who expect inflation are all statistically significant at the 1 percent level (Appendix Table A.1). Appendix Figures A.8 and A.10 show visually the differences in economic expectations between those who expect deflation and their peers. Appendix Figures A.9 and A.11 show equivalent plots for the probability of recession at the short- and longer-term horizons.

<sup>12</sup>While we do not have a time series for the perceived probability of recession and of higher unemployment at the

expecting much better rather than much worse business conditions three years from now increases the likelihood of expecting deflation by 28 percentage points.

Our findings of a negative relationship between expected inflation and economic outcomes are consistent with the findings of Ehrmann et al. (2017) and Kamdar et al. (2019). While we confirm this result, we also find evidence that the relationship between deflation expectations and economic outlook is not constant over time, but rather responds to the economic environment. In particular, we find a modestly positive relationship between short-term IE and expected higher unemployment in the next year during the pre-Covid period, a V-shaped relationship during the early part of the pandemic (March 2020 to April 2021), and a strong positive relationship after the surge in inflation (May 2021 to September 2022).<sup>13</sup> That is, those with deflation expectations are not systematically more optimistic about the economy; in particular, they expected worse economic conditions than a large portion of their peers at the onset of the pandemic.

Finally, estimates in column 9 of Table 1 indicate that our findings are largely robust when we control for all factors jointly. The estimated coefficients on expectations about future economic conditions maintain their signs and are somewhat smaller in magnitude, but for unemployment and business conditions maintain their statistical significance. Similarly, mean-reversion in food and home prices remains positively and statistically significantly associated with deflation expectations, while the estimate on deflation confusion continues to imply that such confusion does not play a meaningful role in explaining the large share of respondents expecting deflation.

## 5 Conclusion

Our results suggest that households with low or even negative medium-term IE see this as occurring in part due to a reversal of the special factors that drove inflation up in 2021 and 2022 and are more likely to be optimistic about the outlook for the economy. Although it is not possible to discern the causal reasoning behind consumers' expectations, one possible explanation is that the increasing number of consumers who have deflationary medium- and longer-term IE consider the high inflation of 2021-22 to be a result of extraordinary circumstances related to the pandemic and the war in Ukraine and expect a reversal of these factors leading to a sharp fall in inflation and a return to a strong economy. These results indicate that the formation of inflation expectations is more nuanced than implied by simple univariate models of adaptive learning and incorporates the influence of

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medium-term, the equivalent series at the short-term in the SCE monthly survey ranges from 31 percent to 51 percent.

<sup>13</sup>See Appendix Figure A.12. Because of data limitation we can only explore the association between short-term IE and expected short-term unemployment over time.

other factors on inflation. Finally, our findings of increased disagreement among consumers about the future path of inflation underscore the importance of introducing agent heterogeneity explicitly into macroeconomic models and models of expectations updating.

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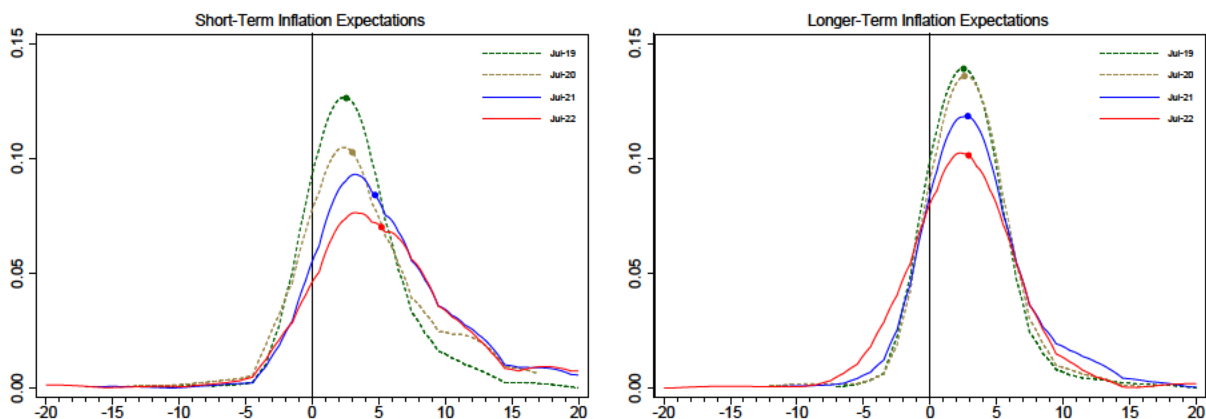


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# Online Appendix

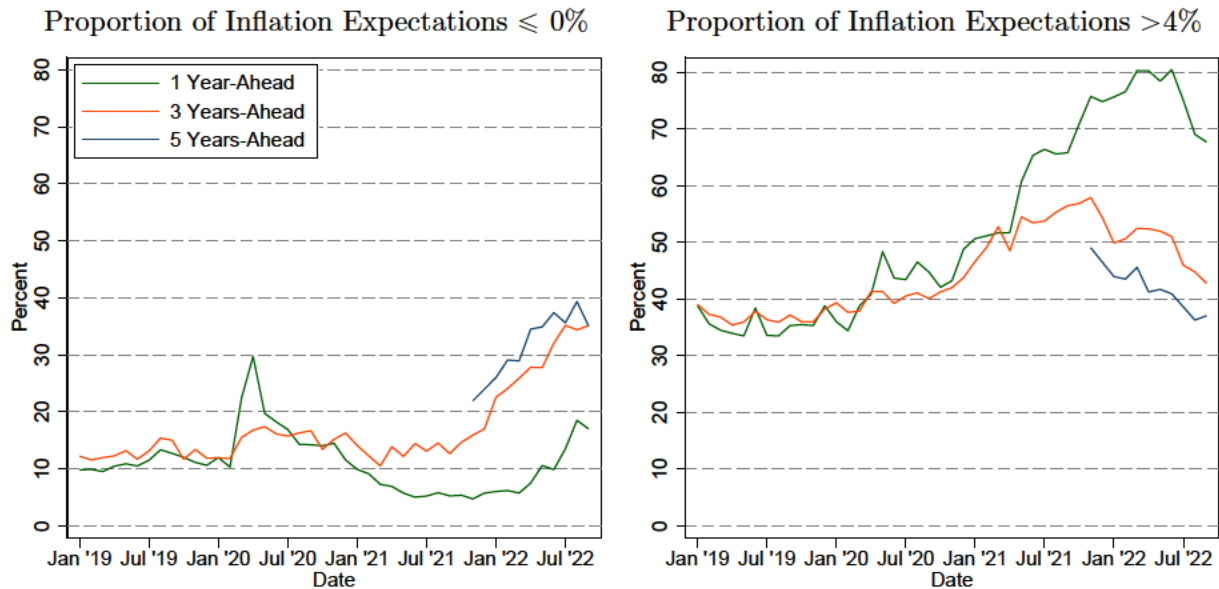
## A Additional Figures and Tables

Figure A.1: Distribution of Individual Point Forecasts (Michigan Survey)



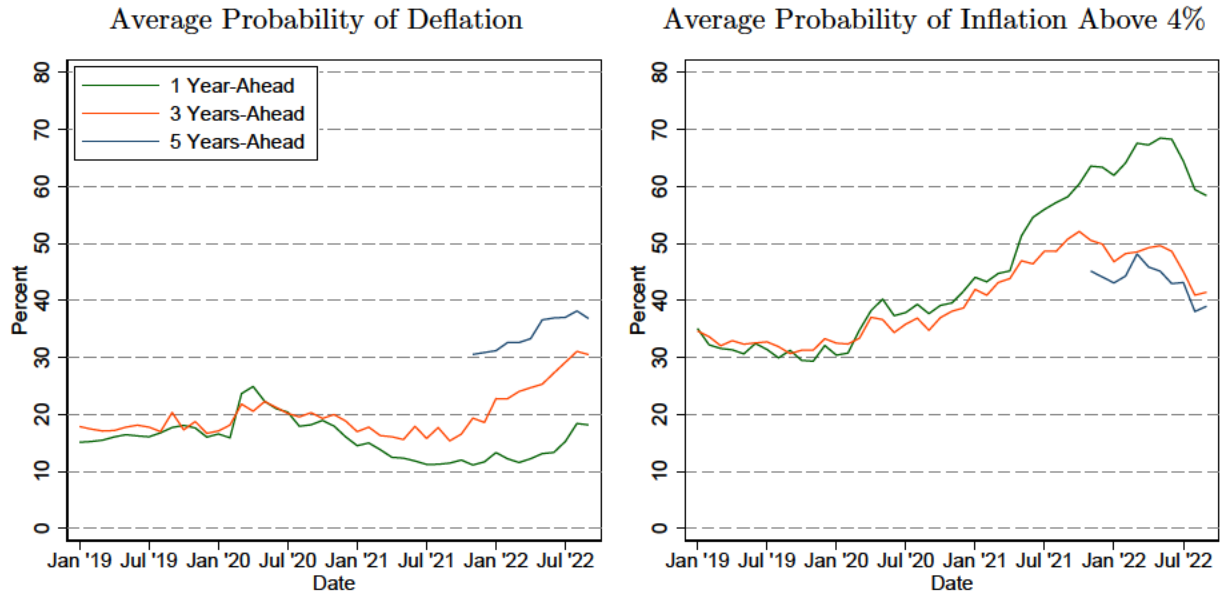
Note: The figure shows kernel densities fitted to individual inflation point forecasts elicited in the Michigan Survey of Consumers. We use an Epanechnikov kernel with a bandwidth of 2. Circles represent the median inflation expectations.

Figure A.2: Distribution of Point Forecasts in the SCE



Note: The left panel shows the share of respondents with point inflation expectations less or equal to 0% in the monthly SCE. The right panel shows the share of respondents with point inflation expectations above 4% in the monthly SCE.

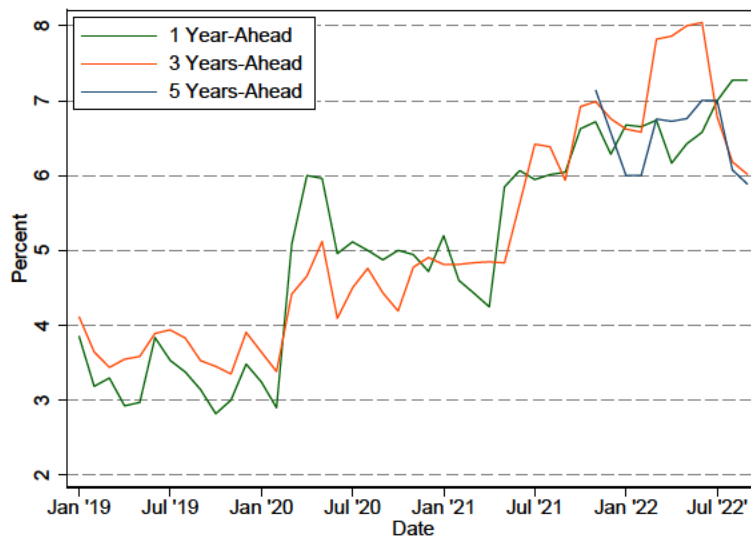
Figure A.3: Average Probabilities Assigned to Deflation and Inflation > 4%



Note: Time series of the probability assigned to deflation outcomes and to inflation above 4 percent in the aggregate density forecast.

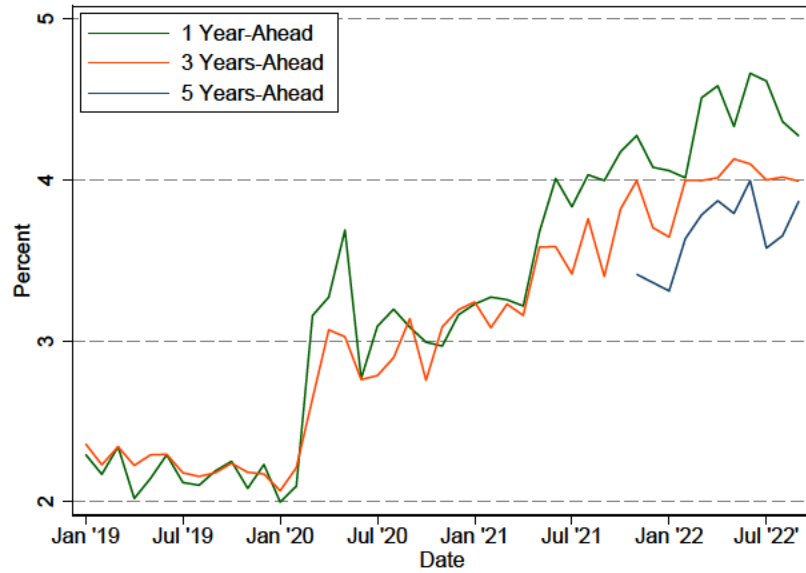
Figure A.3 plots the time series of the probability assigned to deflation outcomes and to inflation above 4 percent in the aggregate density forecast. It highlights the rise in probability assigned to deflation and the recent decline in probability assigned to inflation above 4 percent. In addition, Figures A.4 and A.5 plot the evolution of disagreement and median uncertainty, respectively, highlighting the increase in both measures over time.

Figure A.4: IE Disagreement in the SCE



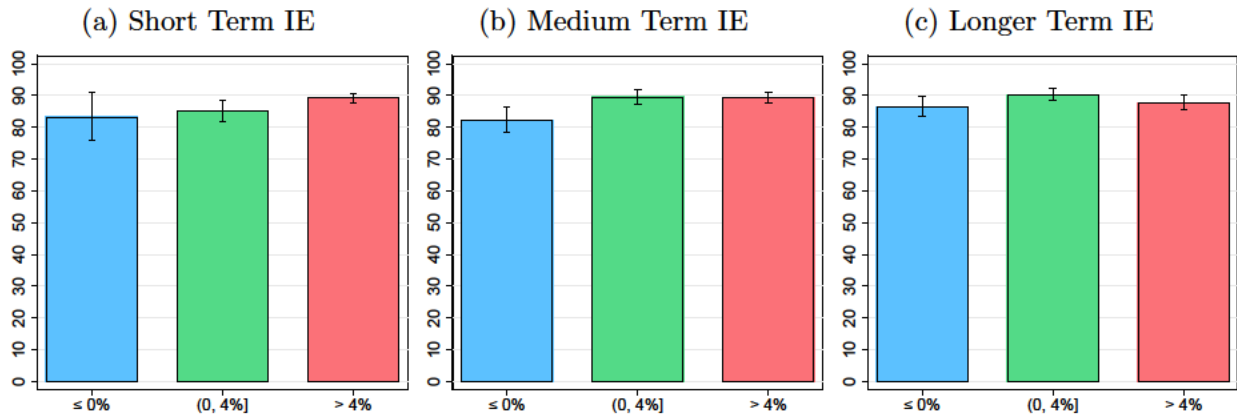
Note: We measure monthly disagreement as the difference between the 75th and 25th percentile of the distribution of inflation density means in a given month.

Figure A.5: Median Inflation Uncertainty in the SCE



Note: We measure uncertainty as the difference between the 75th and 25th percentile of a respondent’s inflation density forecast.

Figure A.6: Deflation Confusion and IE

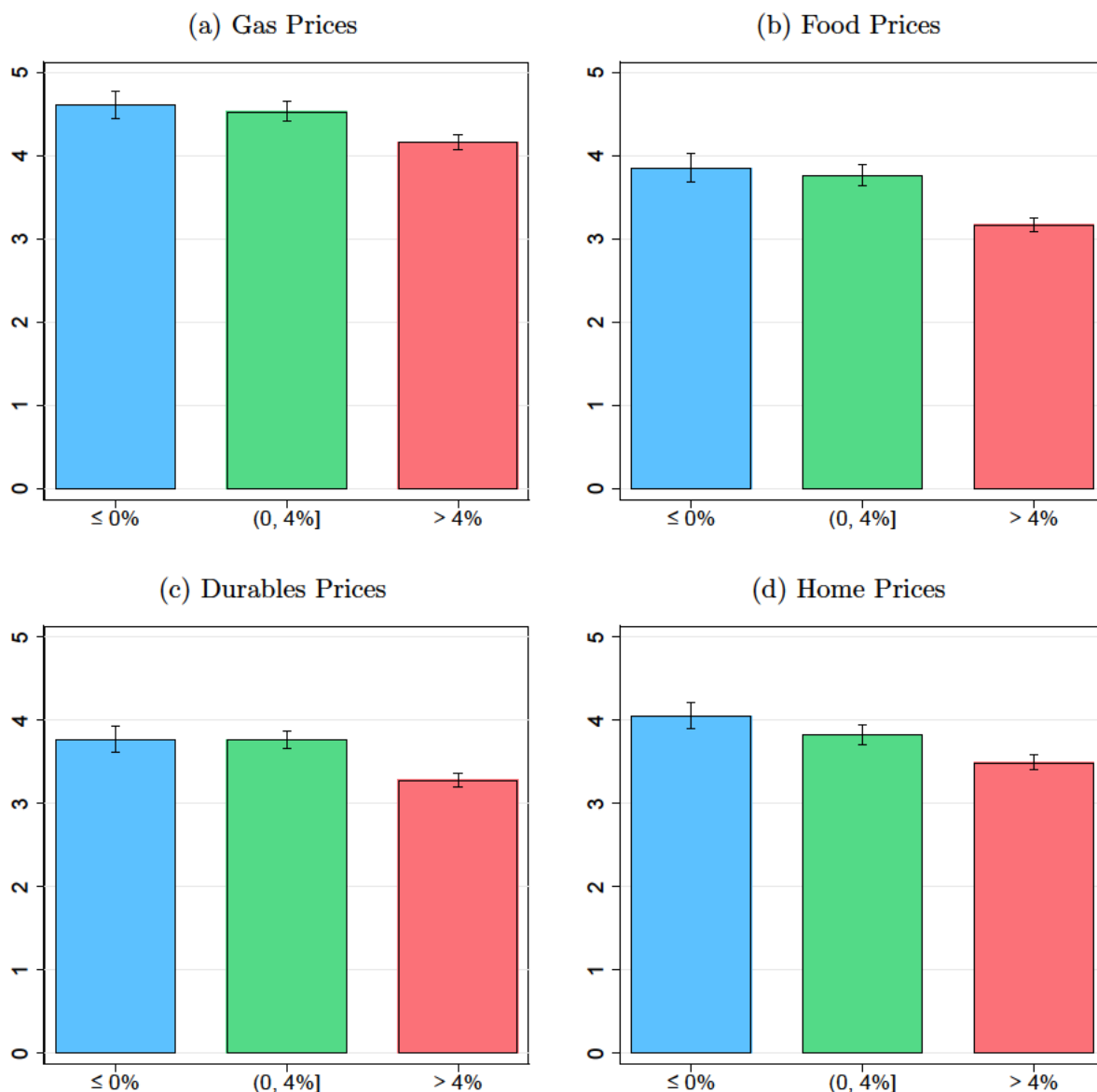


Note: The blue, green and red bars denote the average responses of respondents with IE at the one-year-ahead (left panel), three-year-ahead (middle panel) and five-year-ahead (right panel) horizon less or equal to 0%, in the (0%,4%] interval, strictly greater than 4%, respectively. Respondents are asked “Imagine that all prices increased by 4% last year, and imagine that all prices increase by 2% this year. In that case, would you say that there is inflation or deflation this year?”. Each bar shows the proportion of respondents who responded correctly in that group. Error bars denote the 95% confidence interval around the average.

Figure A.6 shows the proportion of respondents who answer the question correctly by IE group and at all three horizons. At the five-year-ahead horizon the proportions answering correctly are more similar across the three groups (ranging from 87 percent to 90 percent); the difference between those who expect deflation and the two groups of respondents expecting inflation in terms of confusion about the meaning of inflation is negative and significant at the 5 percent level.

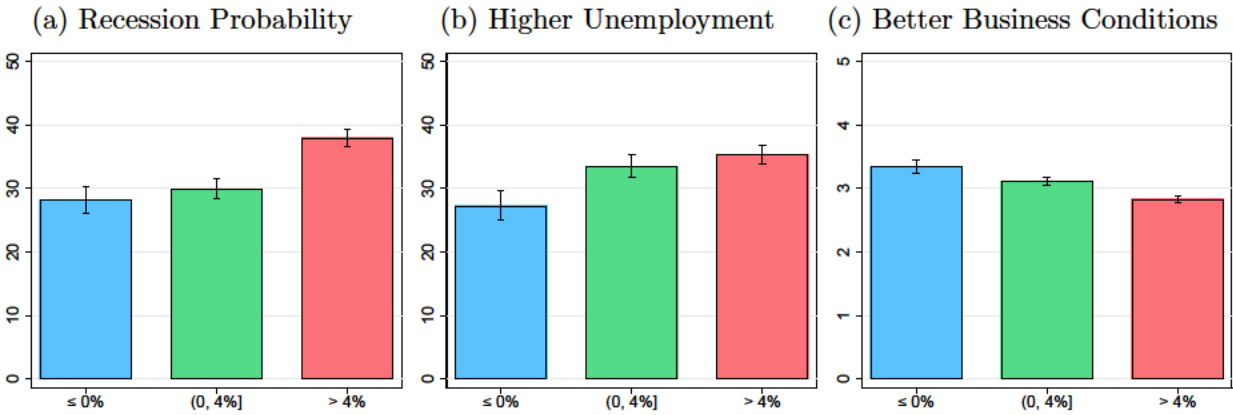
The regression estimate in Table 1 also indicates that confusion plays at most only a small role in explaining the 17-percentage-point rise over time in the share expecting deflation. In fact, thinking in terms of *changes over time*, the regression estimate implies that the effect of confusion can have risen at most from 0 to 8 percent. Assuming a stable 12 percent share in the population, this upper bound on the increase in the effect of confusion would only explain 1 percentage point of the 17-percentage-point rise in reported deflation expectations.

Figure A.7: Three-year-ahead IE and Reversion in Commodities Prices



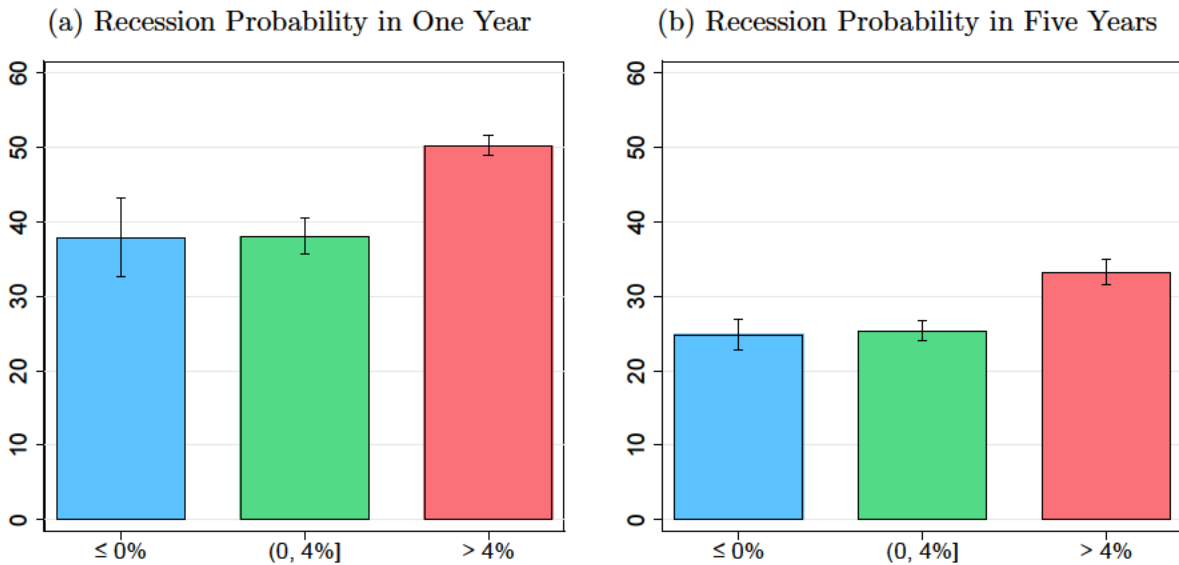
Note: The blue, green and red bars denote the average responses of respondents with three-year-ahead IE less or equal to 0%, in the  $(0, 4\%]$  range, and strictly greater than 4%, respectively. For each commodity X, respondents are asked how much they agree with the statement: “In general, when the price of X rises sharply over a short period of time, it usually comes back down over the next 2 to 3 years”. Responses were coded between 1 (totally disagree) and 7 (totally agree). Error bars denote the 95% confidence interval around the average.

Figure A.8: Three-year-ahead IE and Expected Economic Conditions



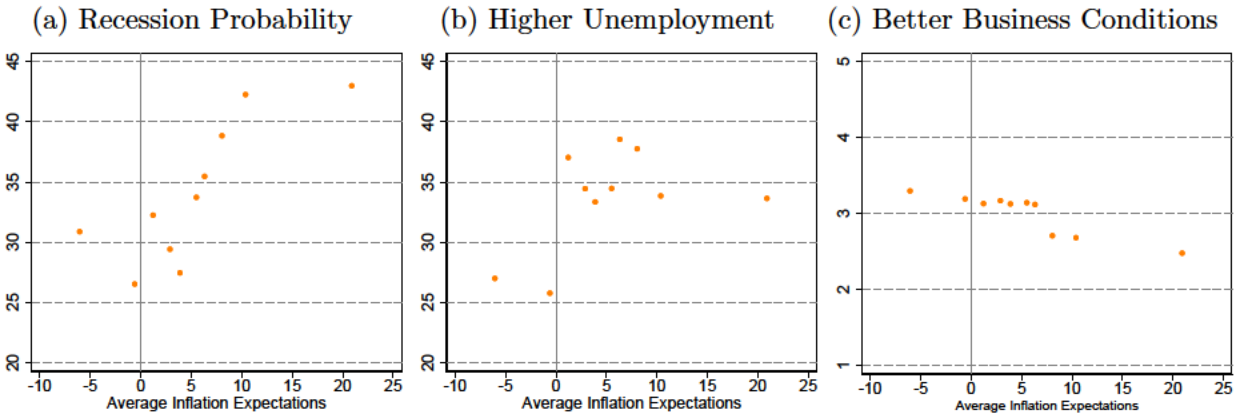
Note: The blue, green and red bars denote the average responses of respondents with three-year-ahead IE less or equal to 0%, in the  $(0\%,4\%]$  range, and strictly greater than 4%, respectively. Respondents are asked to assess to chance the U.S. economy will be in a recession in three years (left panel), the chance the U.S. unemployment rate will be higher in three years than it is now (middle panel), and how business conditions in three years will compare to today's (right panel), with responses ranked from 1 (much worse) to 5 (much better). Error bars denote the 95% confidence interval around the average.

Figure A.9: One- and Five-year-ahead IE and Recession Probabilities



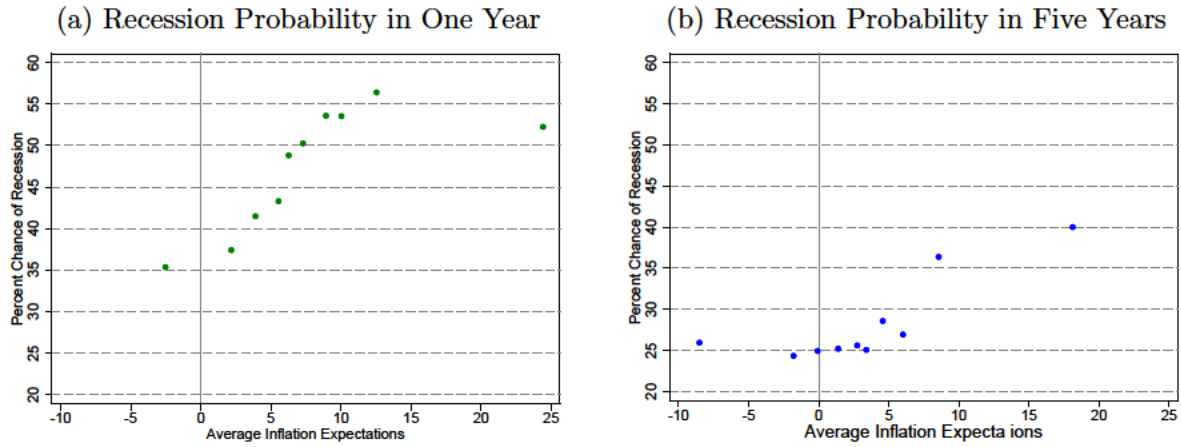
Note: The blue, green and red bars denote the average responses of respondents with one-year-ahead (left panel) and five-year-ahead (right panel) IE less or equal to 0%, in the  $(0\%,4\%]$  range, and strictly greater than 4%, respectively. Respondents are asked to assess the chance that the U.S. economy will be in a recession in one (left panel) and five years (right panel). Error bars denote the 95% confidence interval around the average.

Figure A.10: Three-year-ahead IE and Expected Economic Conditions



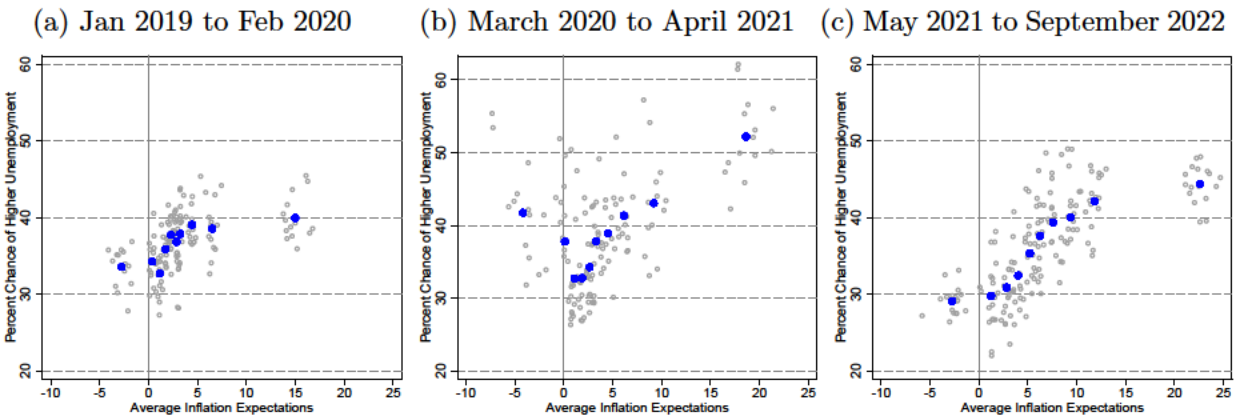
Note: Each dot represents a decile of three-year-ahead IE. Panel (c): 1 = Much Worse and 5 = Much Better.

Figure A.11: One- and Five-year-ahead IE and Recession Probabilities



Note: Each dot represents a decile of IE at the 1-year-ahead (left panel) and 5-year-ahead (right panel) horizon.

Figure A.12: One-Year-Ahead IE and Probability of Higher Unemployment



Note: Each grey dot represents a decile of IE at the 1-year-ahead horizon in a given month. For each grey dot, the X-axis shows the average IE and the Y-axis shows the average probability that the unemployment rate will be higher a year from now than it is today as reported by respondents in that decile, respectively. The blue dots show the average of each decile during the period under consideration.

Table A.1: Price Mean-Reversion and Economic Expectations by Three-Year-Ahead IE

Expectations	Share expecting prices to revert in 2 to 3 years for:				Average Expected Probability of		Share exp. bus. cond. to improve
	Gas	Food	Home Prices	Durables	Recession	↑ Unemploy- ment	
<b>Deflation</b>	0.80	0.61	0.68	0.59	28.22	27.28	0.81
<b>Inflation</b>	0.71	0.48	0.55	0.50	35.04	34.65	0.66
Δ from Exp. Def.	0.09***	0.13***	0.14***	0.09***	-6.82***	-7.37***	0.15***
<b>0-4 % Inf.</b>	0.76	0.57	0.58	0.57	29.98	33.50	0.73
Δ from Exp. Def.	0.04	0.04**	0.10***	0.02**	-1.75	-6.22***	0.07
<b>4+ % Inf</b>	0.69	0.42	0.52	0.47	37.97	35.31	0.61
Δ from Exp. Def.	0.11***	0.18***	0.16***	0.12***	-9.75***	-8.03***	0.20***

Note: Means are calculated using ACS weights. Statistical significance is determined using a T-Test.

Table A.2: IE and Demographic Characteristics

	1-Year Ahead			3-Year Ahead			5-Year Ahead		
	≤ 0%	( 0, 4%]	> 4%	≤ 0%	( 0, 4%]	> 4%	≤ 0%	( 0, 4%]	> 4%
Male	0.31	0.44*	0.51***	0.44	0.51	0.48	0.39	0.54***	0.49**
College	0.23	0.30	0.38***	0.28	0.40***	0.36**	0.28	0.41***	0.35**
Age	50.99	47.26	51.50	50.54	47.69**	52.14	50.95	49.16	51.55
HH Income	46.96	64.08***	73.27***	67.36	75.76*	68.03	61.67	78.64***	67.28
White	0.76	0.77	0.85	0.84	0.81	0.84	0.81	0.84	0.83
Employed	0.49	0.65**	0.56	0.57	0.65*	0.55	0.57	0.62	0.56
High Numeracy	0.48	0.57	0.68***	0.63	0.64	0.65	0.56	0.69***	0.65**
Homeowner	0.61	0.62	0.72	0.70	0.65	0.72	0.72	0.67	0.70

Note: This table reports average demographic characteristics for respondents with deflation vs. inflation expectations. The group of reference for statistical tests is the group of respondents with IE in the ≤0% range at the corresponding horizon. \*, \*\*, and \*\*\* denote statistically significant differences at the 10%, 5% and 1% level, respectively



Table A.3: Three-Year-Ahead IE and Price Change Expectations

	(a) Gas Price Change			(b) Food Price Change		
	$\leq 0\%$	(0, 4%]	$> 4\%$	$\leq 0\%$	(0, 4%]	$> 4\%$
Mean	-1.65	1.26*	7.78***	1.92	5.01*	9.64***
25%	-8.14	-5.16	-2.07	-4.63	1.11	2.82
Median	-2.12	2.27	5.09	1.14	3.83	5.87
75%	4.93	5.75	11.87	5.93	8.73	12.46

	(c) Rent Price Change			(d) Durables Price Change		
	$\leq 0\%$	(0, 4%]	$> 4\%$	$\leq 0\%$	(0, 4%]	$> 4\%$
Mean	4.40	6.61	10.90***	2.77	5.16*	9.75***
25%	-2.35	1.77	4.04	-4.10	1.49	2.98
Median	2.55	4.69	8.93	1.88	4.42	6.04
75%	7.76	9.88	14.54	5.87	9.42	12.71

Note: The group of reference for statistical tests is the group of respondents with three-year-ahead IE less or equal to 0%. \*, \*\*, and \*\*\* denote statistically significant differences at the 10%, 5% and 1% level, respectively.

Table A.3 shows that on average respondents expecting deflation also expect significantly smaller price increases in the medium term than those expecting inflation. In addition, the 25th percentile of the distribution of price change expectations is negative across all four spending items for those expecting deflation.

Table A.4 shows the results of regressions where the dependent variable is an indicator for expecting inflation above 4 percent (instead of deflation). The results are reversed and larger in magnitude relative to those in Table 1 in the main text: Columns 2-5 indicate that higher agreement with the price reversal statement is associated with a significantly lower probability of expecting inflation above 4 percent at the medium-term.

The results reported in columns 6-8 indicate that inflation expectations above 4 percent at the medium-term are significantly associated with worse economic expectations: for example, expecting much worse rather than much better business conditions in three years raises the likelihood of expecting inflation above 4 percent by 38 percentage points.

Table A.5 reports regressions results for specifications with binary variables for whether the respondent agrees with the price reversal statement (response above 4). For instance, for food prices, agreeing with mean-reversion is associated with an 8-percentage-point increase in the likelihood of expecting deflation. While beliefs about price mean-reversion may exert little influence on inflation expectations in periods of low and stable inflation, they can play an important role in times of high and rising inflation. Assuming stable beliefs in the population about price mean-reversion (note the

Table A.4: Marginal Effects on Probability of Expecting Inflation Above 4 Percent

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Deflation Confusion Question	0.076 (0.050)								0.072 (0.050)
Gas Price Reversion		-0.036*** (0.010)							0.011 (0.012)
Food Price Reversion			-0.065*** (0.010)						-0.054*** (0.016)
Home Price Reversion				-0.038*** (0.010)					-0.018 (0.011)
Durables Price Reversion					-0.052*** (0.012)				0.001 (0.017)
Recession in 3 Years						0.435*** (0.068)			0.323*** (0.080)
Higher Unempl in 3 Years							0.213*** (0.064)		0.006 (0.069)
Business Cond in 3 Years								-0.096*** (0.016)	-0.053*** (0.018)
Mean	0.517	0.517	0.517	0.517	0.517	0.516	0.517	0.517	0.516
Pseudo $R^2$	0.011	0.019	0.036	0.019	0.025	0.037	0.017	0.034	0.067
Observations	2194	2194	2193	2194	2194	2189	2194	2193	2187

Note: Table reports average marginal effects from estimated Probit models. Demographic controls for gender, age, household income, college degree attainment, race and Census region are included.

Table A.5: Marginal Effects of Agreeing with Mean-Reversion on Deflation Expectations

	(1)	(2)	(3)	(4)	(5)	(6)
Deflation Confusion Question					-0.080** (0.035)	-0.072** (0.034)
Above 4 Gas Reversion	0.070*** (0.023)				0.045* (0.025)	0.020 (0.024)
Above 4 Food Reversion		0.083*** (0.025)			0.063** (0.030)	0.053* (0.031)
Above 4 Home Reversion			0.073*** (0.024)		0.056** (0.025)	0.055** (0.025)
Above 4 Durables Reversion				0.046* (0.026)	-0.035 (0.030)	-0.035 (0.030)
Recession in 3 Years						-0.060 (0.054)
Higher Unempl in 3 Years						-0.088* (0.051)
Business Cond in 3 Years						0.051*** (0.013)
Mean	0.170	0.170	0.170	0.170	0.170	0.171
Pseudo $R^2$	0.020	0.020	0.019	0.013	0.035	0.067
Observations	2194	2193	2194	2194	2193	2187

Note: Table reports average marginal effects from estimated Probit models. Demographic controls for gender, age, household income, college degree attainment, race and Census region are included.

use of “in general” in the wording of the question), the estimates imply that during the past two years, as inflation surged, the effect of those beliefs on deflation expectations may have risen at most from 0 to about 8 percent. Given the observed distributions of beliefs reported in Table A.1, this implies that mean-reversion *for each* good could potentially explain between 3 and 6 percentage points of the 17 percentage point increase in deflation expectations. *Jointly*, mean-reversion beliefs about all four goods could explain up to 9 percentage points of the increase (using the estimates from Table A.5, column 5).

Table A.6: Marginal Effects of Price Change Expectations on Deflation Expectations

	(1)	(2)	(3)	(4)	(5)
Deflation Confusion Question					-0.055 (0.035)
Gas Price Change in 3 Years	-0.007*** (0.001)				-0.002 (0.002)
Food Price Change in 3 Years		-0.009*** (0.002)			-0.003 (0.003)
Rent Price Change in 3 Years			-0.008*** (0.002)		-0.002 (0.003)
Durables Price Change in 3 Years				-0.010*** (0.002)	-0.002 (0.003)
Recession in 3 Years					-0.026 (0.058)
Higher Unempl in 3 Years					-0.077 (0.054)
Business Cond in 3 Years					0.043*** (0.014)
Mean	0.174	0.164	0.170	0.166	0.167
PseudoR2	0.047	0.050	0.044	0.050	0.080
Observations	1987	2025	2033	2052	1856

Note: Table reports average marginal effects from estimated Probit models. Demographic controls for gender, age, household income, college degree attainment, race and Census region are included.

Table A.6 shows that reporting 10 percentage points lower expected price changes for each of these spending items is associated with a 7 to 10 percentage point increase in the probability of expecting deflation.

## B Questions from the May 2022 SCE Special Survey

### Introduction to Probabilistic Questions

In some of the following questions, we will ask you to think about the percent chance of something happening in the future. Your answers can range from 0 to 100, where 0 means there is absolutely no chance, and 100 means that it is absolutely certain.

For example, numbers like:

- 2 and 5 percent may indicate “almost no chance”
- 18 percent or so may mean “not much chance”
- 47 or 52 percent chance may be a “pretty even chance”
- 83 percent or so may mean a “very good chance”
- 95 or 98 percent chance may be “almost certain”

**Question** For example, what do you think is the percent chance that over the next 12 months you will move to a different primary residence (that is, the place where you usually live)?

*[ruler and slider to select a probability, or box to input a number]*

### Inflation Expectations

#### One-Year-Ahead, Point Forecast

*Part 1*

**Over the next 12 months**, do you think that there will be inflation or deflation? (Note: deflation is the opposite of inflation)

- Inflation
- Deflation (the opposite of inflation)

*Part 2*

What do you expect the rate of [“inflation” (if Part 1==inflation) / “deflation” (if Part 1==deflation)] to be **over the next 12 months**? Please give your best guess.

**Over the next 12 months**, I expect the rate of [inflation/deflation] to be \_\_\_\_\_%

#### One-Year-Ahead, Density Forecast

Now, we would like you to think about the different things that may happen to inflation **over the next 12 months**. In your view, what would you say is the percent chance that, over the next 12 months...

- the rate of inflation will be 12% or higher \_\_\_\_\_ percent chance
- the rate of inflation will be between 8% and 11.99% \_\_\_\_\_ percent chance
- the rate of inflation will be between 4% and 7.99% \_\_\_\_\_ percent chance
- the rate of inflation will be between 2% and 3.99% \_\_\_\_\_ percent chance
- the rate of inflation will be between 0.01% and 1.99% \_\_\_\_\_ percent chance
- the rate of deflation (opposite of inflation) will be between 0% and 1.99% \_\_\_\_\_ percent chance
- the rate of deflation (opposite of inflation) will be between 2% and 3.99% \_\_\_\_\_ percent chance
- the rate of deflation (opposite of inflation) will be between 4% and 7.99% \_\_\_\_\_ percent chance
- the rate of deflation (opposite of inflation) will be between 8% and 11.99% \_\_\_\_\_ percent chance
- the rate of deflation (opposite of inflation) will be 12% or higher \_\_\_\_\_ percent chance

### Three-Year-Ahead, Point Forecast

#### Part 1

Now we would like you to think about inflation further into the future. **Over the next 12-month period between May 2024 and May 2025**, do you think that there will be inflation or deflation?

- Inflation
- Deflation (the opposite of inflation)

#### Part 2

What do you expect the rate of [“inflation” (if Part 1==inflation) / “deflation” (if Part 1==deflation)] to be over that period? Please give your best guess.

**Over the 12-month period between May 2024 and May 2025**, I expect the rate of [inflation/deflation] to be \_\_\_\_\_%

### Three-Year-Ahead, Density Forecast

And in your view, what would you say is the percent chance that **over the 12-month period between May 2024 and May 2025**...

- the rate of inflation will be 12% or higher \_\_\_\_\_ percent chance
- the rate of inflation will be between 8% and 11.99% \_\_\_\_\_ percent chance
- the rate of inflation will be between 4% and 7.99% \_\_\_\_\_ percent chance
- the rate of inflation will be between 2% and 3.99% \_\_\_\_\_ percent chance
- the rate of inflation will be between 0.01% and 1.99% \_\_\_\_\_ percent chance
- the rate of deflation (opposite of inflation) will be between 0% and 1.99% \_\_\_\_\_ percent chance
- the rate of deflation (opposite of inflation) will be between 2% and 3.99% \_\_\_\_\_ percent chance
- the rate of deflation (opposite of inflation) will be between 4% and 7.99% \_\_\_\_\_ percent chance
- the rate of deflation (opposite of inflation) will be between 8% and 11.99% \_\_\_\_\_ percent chance
- the rate of deflation (opposite of inflation) will be 12% or higher \_\_\_\_\_ percent chance

### Five-Year-Ahead, Point Forecast

Now we would like you to think about inflation even further into the future.

#### Part 1

Over the 12-month period between **May 2026 and May 2027**, do you think that there will be inflation or deflation?

- Inflation
- Deflation (the opposite of inflation)

#### Part 2

What do you expect the rate of [“inflation” (if Part 1==inflation) / “deflation” (if Part 1==deflation)] to be over that period? Please give your best guess.

Over the 12-month period between **May 2026 and May 2027**, I expect the rate of [inflation/deflation] to be \_\_\_\_\_%

### Five-Year-Ahead, Density Forecast

And in your view, what would you say is the percent chance that **over the 12-month period between May 2026 and May 2027...**

the rate of inflation will be 12% or higher	_____	percent chance
the rate of inflation will be between 8% and 11.99%	_____	percent chance
the rate of inflation will be between 4% and 7.99%	_____	percent chance
the rate of inflation will be between 2% and 3.99%	_____	percent chance
the rate of inflation will be between 0.01% and 1.99%	_____	percent chance
the rate of deflation (opposite of inflation) will be between 0% and 1.99%	_____	percent chance
the rate of deflation (opposite of inflation) will be between 2% and 3.99%	_____	percent chance
the rate of deflation (opposite of inflation) will be between 4% and 7.99%	_____	percent chance
the rate of deflation (opposite of inflation) will be between 8% and 11.99%	_____	percent chance
the rate of deflation (opposite of inflation) will be 12% or higher	_____	percent chance

### Price Change Expectations for Specific Spending Items

#### One-Year-Ahead

**Twelve months from now**, what do you think will have happened to the price of the following items?

**Twelve months from now, I expect...**

The price of a **gallon of gas** to have increased by \_\_\_\_\_ % OR decreased by \_\_\_\_\_ %

**Food prices** to have increased by \_\_\_\_\_ % OR decreased by \_\_\_\_\_ %

The cost of **renting a typical house/apartment** to have increased by \_\_\_\_\_ % OR decreased by \_\_\_\_\_ %

The price of **home appliances, electronics, furniture, cars or other vehicles** to have increased by \_\_\_\_\_ % OR decreased by \_\_\_\_\_ %

### Three-Year-Ahead

And thinking further into the future, what do you think will have happened to the price of those same items over **the 12-month period between May 2024 and May 2025?**

**Over the 12-month period between May 2024 and May 2025, I expect...**

The price of a **gallon of gas** to have increased by \_\_\_\_\_ % OR decreased by \_\_\_\_\_ %

**Food prices** to have increased by \_\_\_\_\_ % OR decreased by \_\_\_\_\_ %

The cost of **renting a typical house/apartment** to have increased by \_\_\_\_\_ % OR decreased by \_\_\_\_\_ %

The price of **home appliances, electronics, furniture, cars or other vehicles** to have increased by \_\_\_\_\_ % OR decreased by \_\_\_\_\_ %

### Confusion About Inflation

Imagine that all prices increased by 4% **last year**, and imagine that all prices increase by 2% **this year**. In that case, would you say that there is inflation or deflation **this year?**

- Inflation
- Deflation (the opposite of inflation)

### Price Mean-Reversion

To what extent do you agree with the following statements:

#### Gasoline

In general, when **the price of a gallon of gas** rises sharply over a short period of time, it usually comes back down...

over the **next 12 months...**

Totally Disagree						Totally Agree
1	2	3	4	5	6	7

over the **next 2 to 3 years...**

Totally Disagree						Totally Agree
1	2	3	4	5	6	7

### Food

In general, when **food prices** rise sharply over a short period of time, it usually comes back down...

over the **next 12 months...**

Totally Disagree						Totally Agree
1	2	3	4	5	6	7

over the **next 2 to 3 years...**

Totally Disagree						Totally Agree
1	2	3	4	5	6	7

### Durable Goods

In general, when **durable goods prices** rise sharply over a short period of time, it usually comes back down...

over the **next 12 months...**

Totally Disagree						Totally Agree
1	2	3	4	5	6	7

over the **next 2 to 3 years...**

Totally Disagree						Totally Agree
1	2	3	4	5	6	7



## Home Prices

In general, when **home prices** rise sharply over a short period of time, it usually comes back down... over the **next 12 months**...

Totally Disagree						Totally Agree
1	2	3	4	5	6	7

over the **next 2 to 3 years**...

Totally Disagree						Totally Agree
1	2	3	4	5	6	7

## Economic Expectations

### Recession Probability

What do you think is the percent chance that **12 months from now**, the U.S. economy will be in a **recession**?

*[ruler and slider to select a probability, or box to input a number]*

And what about three years from now, what do you think is the percent chance that **three years from now**, the U.S. economy will be in a **recession**?

*[ruler and slider to select a probability, or box to input a number]*

Now think even further into future, what do you think is the percent chance that **five years from now**, the U.S. economy will be in a **recession**?

*[ruler and slider to select a probability, or box to input a number]*

### Unemployment

What do you think is the percent chance that **12 months from now** the unemployment rate in the U.S. will be higher than it is now?

*[ruler and slider to select a probability, or box to input a number]*

What do you think is the percent chance that **3 years from now**, that is in **May 2025**, the unemployment rate in the U.S. will be higher than it is now?

*[ruler and slider to select a probability, or box to input a number]*

### **Business Conditions**

Now turning to **business conditions** in the country as a whole, do you expect that **three years from now**, business conditions will be better, or worse than they are at present, or just about the same?

Much Worse	Somewhat Worse	About the Same	Somewhat Better	Much Better
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>