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Olivier Armantier | Gizem Koşar | Jason Somerville | Giorgio Topa | Wilbert van der Klaauw | John C. Williams

FEDERAL RESERVE BANK *of* NEW YORK

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Abstract

We study the behavior of U.S. consumers' inflation expectations during the high inflation period of 2021-23 using data from the New York Fed's Survey of Consumer Expectations. Inflation expectations rose and fell as inflation surged and then moderated, but with notable differences across forecast horizons. Inflation uncertainty and disagreement also rose markedly and then abated. Despite the sharp rise in inflation, we see a sizable increase in the left tail of the distribution of medium- and longer-term expectations and increased expectations of *deflation*. Using a pair of special surveys, we find that those who expect deflation are more likely to expect price mean reversion and generally expect better, not worse, economic outcomes. We show that although a standard learning model of inflation expectations formation captures some of the movements in inflation expectations and inflation uncertainty over this period, the model is not able to replicate the timing of the rise in medium-term expectations and inflation uncertainty, some aspects of disagreement, or the rise in deflation expectations.

Key words: inflation, deflation, expectations, consumer surveys

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Armantier, Koşar, Somerville, Topa, van der Klaauw, and Williams: Federal Reserve Bank of New York (emails: olivier.armantier@ny.frb.org, gizem.kosar@ny.frb.org, jason.somerville@ny.frb.org, giorgio.topa@ny.frb.org, wilbert.vanderklaauw@ny.frb.org, john.c.williams@ny.frb.org). The authors thank Felix Aidala, Fatima Boumahdi, Leo Goldman, Devon Lall, Roshie Xing, and Joe Delehanty for excellent research assistance. For helpful comments and suggestions, they thank Jonathan McCarthy and seminar participants at the BoC–ECB–New York Fed Conference on Expectations Surveys, Bank of Canada, and Indiana University.

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). The high inflation period of 2021-23 represents a valuable laboratory for models of inflation expectations formation. In this paper, we use data from the New York Fed's Survey of Consumer Expectations (SCE) through July 2023 to study the behavior of households' IE during this period and analyze it through the lens of a standard learning model of IE formation. While the model broadly captures the movements in survey measures of IE over this period, we also document some noteworthy differences between model-generated IE and the survey data.

In the SCE, the median respondent's IE generally rose and fell as inflation surged and subsequently moderated, but with important nuances. Household expectations moved the most at the one-year-ahead horizon, mirroring the movements in realized inflation. Indeed, the peak of one-year-ahead IE coincided with the peak of actual inflation in June 2022. In contrast, three-year-ahead expectations rose much less and peaked earlier (in October 2021), starting to decline while inflation was still rising. 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."[1]

We also find that both individual uncertainty and cross-sectional disagreement about future inflation increased substantially at the onset of the Covid-19 pandemic and rose further in 2021-22 when inflation spiked. Here too we see important differences by forecast horizon: while the increase in disagreement in part reflects a thickening of the right tail of the distribution for short-term IE (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 (more respondents expecting lower inflation – or even deflation – in the medium and longer-term). Strikingly, the share of respondents expecting *deflation* in the medium-term increased from 10 percent to 27 percent between April 2021 and August 2022 even as inflation surged, and remained elevated through the end of the sample period.

We use a standard learning model of IE formation to analyze to what extent the model implications match the patterns observed in the data.[2] While model-generated IE track the rise and subsequent decline in short-term IE very well, they lag the survey data in terms of the timing of

[1] 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.

[2] The model is a version of the constant gain least squares learning model in Orphanides and Williams (2004, 2005).

the peak in medium-term IE. This discrepancy likely reflects the assumption in the learning model that agents only use information about realized inflation to update their expectations. As a result, the model-based peak in IE occurs at about the same time as the peak inflation rate. The fact that medium-term IE in the data started turning well before inflation peaked suggests that consumers use other information in addition to realized inflation in updating their IE.

Similarly, the learning model tracks the overall movements in inflation uncertainty reasonably well, but misses the timing of the rise in inflation uncertainty at the onset of the pandemic evident in the survey data. In the model, uncertainty only starts rising once inflation surges in 2021. This again suggests that the pandemic represented a special set of circumstances not captured by the model, such that survey respondents use other information to increase their perception of inflation uncertainty.

We also investigate the behavior of IE disagreement across agents using a birth-cohort version of the learning model. The birth-cohort model broadly captures the movements in short- and medium-term IE across age groups and qualitatively matches the increase in cross-sectional disagreement that we observe in the survey data. The model, however, generates a smaller rise and a faster return of disagreement to pre-pandemic levels than seen in the data.

In the final part of the paper we dig deeper into the striking increase in deflation expectations we observe in the data. By construction, the learning model is silent on the issue of asymmetry in the aggregate forecast distribution (and associated rise in expectations of deflation) that we observe in the survey data.[3] Instead, we study this issue using two special surveys of households. Overall, we do not find evidence that respondents confuse deflation with disinflation–a lower, but still positive, rate of inflation. Instead, we find evidence consistent with respondents expecting mean reversion in prices: those who expect deflation in three years are significantly more likely to believe that commodity prices exhibit mean reversion over a similar horizon. These respondents are also more likely to attribute future declines in inflation to improvements in supply chain issues. We can also rule out the possibility that respondents may anticipate a worsening in economic conditions, resulting in deflation: 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.

This paper makes three main contributions to the literature. First, while many models of IE formation (such as the one considered here, the adaptive learning model of Evans and Honkapohja

[3]The model is silent on this feature of the data because it only generates forecast means and variances, and says nothing about the shape of the forecast distributions.

2001, 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 and subsequent reversal, 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 2021-2023 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 few dimensions along which it would be worth enriching current models of IE formation. The high inflation of 2021-2023 led many respondents to revise their medium- and longer-term IE downward (not upward), including into deflation territory. The model considered here is silent about this asymmetry in the distribution of IE. Further, the peak in medium-term IE preceded the peak in actual inflation and in model-generated IE. Finally, while inflation uncertainty rose already at the onset of the pandemic in the data, it increases later in the model. These findings, together with new qualitative survey evidence on the perceived drivers of inflation dynamics and factors behind the increase in deflation expectations, suggest that the process consumers use to update their 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. In addition, the increase in cross-sectional disagreement is quantitatively larger than in the birth-cohort model, underscoring the importance of modeling richer forms of heterogeneity.

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 2021-2023 period. Section 4 introduces the learning model of IE formation and examines its predictions vis-a-vis the data. Section 5 evaluates several potential explanations for the rise in deflation expectations. Section 6 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.

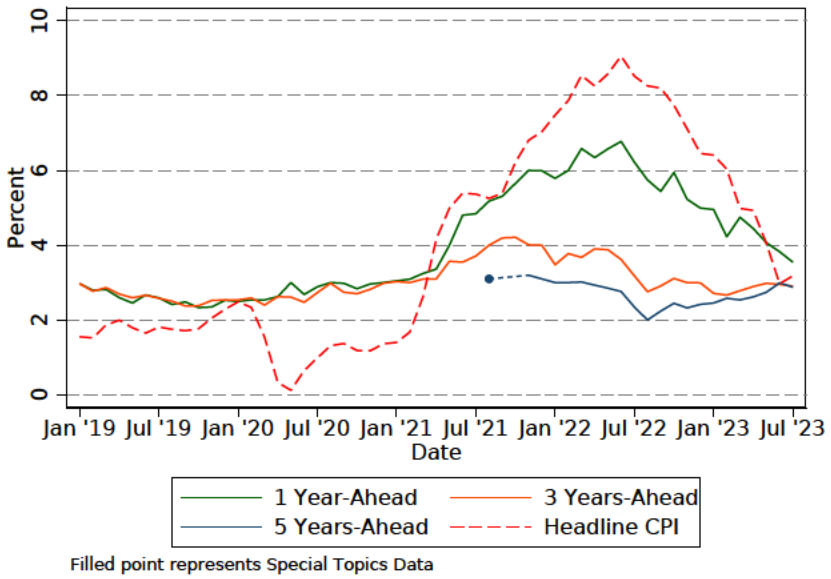
Since its inception, the SCE has elicited consumers' IE at the short- and medium-term horizons on a monthly basis. The short-term horizon corresponds to the year ahead ("*Over the next 12 months*"), while the medium-term horizon corresponds to the one-year rate of inflation three years ahead ("*Over 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 ("O*ver 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 at each horizon. 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 July 2023, with data from two separate special SCE surveys. The first one was fielded between May 24 and June 6, 2022 (we refer to it as the "May 2022" survey); the second one was fielded on June 7 through June 20, 2023 and we refer to it as the "June 2023" survey. The special surveys included questions aimed at eliciting respondents' views on factors associated with their inflation expectations.[4]

[4]We provide more details about the exact survey questions used in the analysis in Section 5. The relevant questions asked in the May 2022 and June 2023 special surveys are reported in Appendix B and C, respectively. We also use data from additional special survey modules in which longer-term IE were elicited in a density forecast format (August 2021) and in a point forecast format (July 2019, April 2021 and August 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 dot represents data from the August 2021 special survey.

3 The Rise and Fall of IE during 2021-23

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

Inflation expectations 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 July 2023, as well as the realized inflation rate as measured by the contemporaneous twelve-month percent change in the consumer price index (CPI). Prior to the surge in inflation, both median short- and medium-term IE averaged around 2.8 percent between 2014 and 2020. 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 10 years since the inception of 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 as well as short-term IE 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 2.8 percent in August 2022, back to their 2014-2020 average. Longer-term IE likewise declined during the first eight months of 2022. In contrast, short-term IE

only peaked in June 2022 at 6.8%. Between August 2022 and July 2023, as short-term IE continued to steadily decline, medium-term IE remained essentially flat and longer-term IE rose slightly. By July 2023 median short-term IE were back to 3.5 percent whereas medium- and longer-term IE were both at 2.9 percent.

3.2 The surprising movements in medium- and longer-term IE

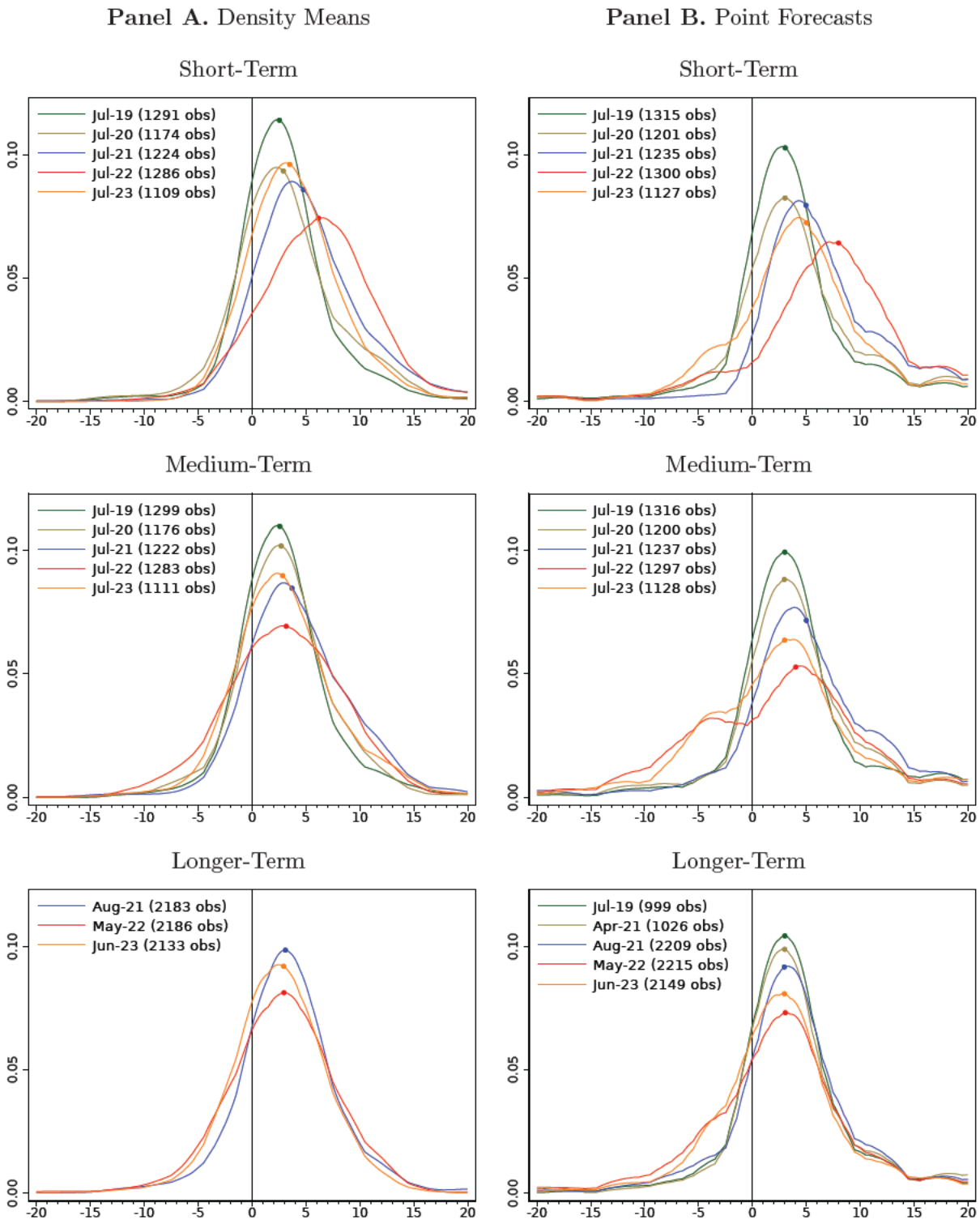
Analyzing changes in the cross-sectional distribution of individual IE provides additional insights into the rise and subsequent fall in short- and medium-term IE during the pandemic. Figure 2 plots the distributions of individual IE collected in the summer of each year between July 2019 and July 2023. 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.[5] The dot shown on each curve corresponds to the median IE across respondents. In the following, we focus 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. While seeing a continuing movement of probability mass to the right tail between July 2021 and 2022 for short-term IE, we see no corresponding shifts at the medium- and longer-term horizons; indeed, the right tails of the latter distributions are nearly identical between these surveys. Interestingly, the 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. By the summer of 2023 IE distributions had partly retraced

[5]For longer-term IE we rely on a set of special surveys fielded roughly once a year over the summer because we can go as far back as July 2019 for point forecasts and August 2021 for density forecasts.

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.

their movements over 2021-22, becoming less dispersed at all horizons. However, the thicker left tail at the medium- and longer-term horizon persisted.[6]

The leftward shift in the distribution of households' medium- and longer-term IE is also 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 July 2023. Throughout this period, the share with near-term *deflation* expectations is low and relatively stable at between 5 and 13 percent, except for a short-lived spike at the onset of the Covid pandemic. In sharp contrast, the share expecting deflation in the medium-term more than doubled from 10 percent in April 2021 to 27 percent in August 2022 and remained elevated at 20 percent by the end of the sample period. The share expecting deflation in the longer-term also climbed to 31 percent in August 2022 – almost one in three respondents! – and remained close to 20 percent by July 2023. This rise in deflation expectations is broad-based across demographic groups.[7] 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 or below zero reached 23 percent in September 2022, falling to 14 percent in July and August 2023, but remaining above its pre-pandemic reading of 6 percent.[8]

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 Appendix Figure A.2.)

3.3 Increased Uncertainty and the Aggregate Density Forecast

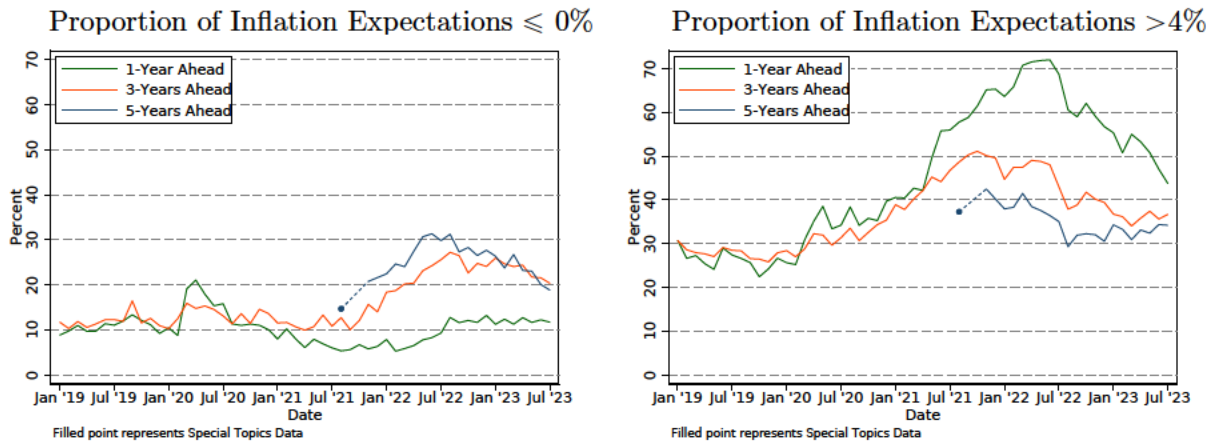
Thus far we have focused on IE disagreement across households; we now incorporate individual forecast uncertainty reported in the SCE. Figure 4 plots the aggregate inflation density forecasts (defined in Section 2) in the summer of each year between July 2019 and July 2023. Although, by construction, the aggregate density forecasts are wider than the corresponding distributions showing

[6]These patterns are also evident using inflation point forecasts from the Michigan Survey of Consumers, see Figure A.1 in the Appendix.

[7]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 for all cuts of the data by gender, age, household income, college degree attainment, race and Census region.

[8]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 3: Distribution of Individual Inflation Expectations



Note: The left 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.

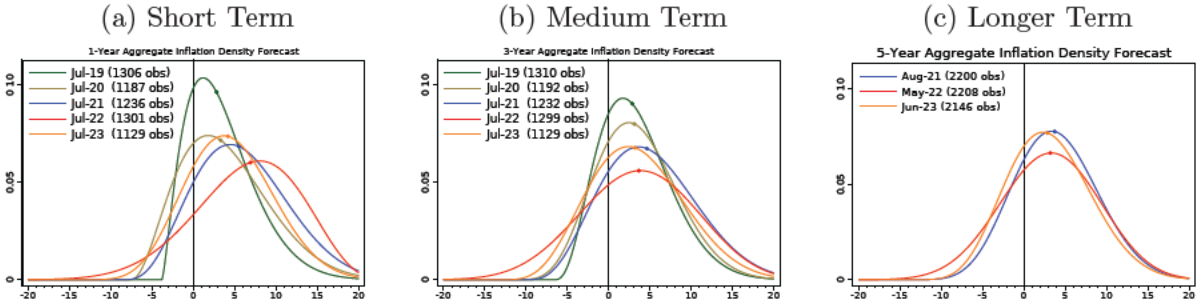
disagreement alone, the same patterns are evident as in Figure 2. In particular, the densities widen over time and there is a significant increase in the implied probability of medium- and longer-term deflation between summer 2021 and summer 2022. At the same time, while the right tail of the short-term aggregate density thickened between July 2021 and July 2022, there is no sign of a rightward shift for medium- and longer-term densities. Between summer 2022 and summer 2023 the aggregate density forecasts partially retraced the widening that occurred over the previous year, but the implied probability of deflation at the medium- and longer-term horizons remained elevated.[9]

The majority of the rise in the variance of the aggregate density forecast between the summers of 2021 and 2022 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 81 percent of the overall increase between April 2021 and August 2022 in the variance of the medium-term aggregate density forecast is due to an increase in disagreement across respondents, with the remaining 19 percent due to an increase in individual uncertainty. This result, together with the asymmetric movements depicted in Figures 2 and 4, suggests that the rise in deflation expectations is not simply a manifestation of greater uncertainty, but reflects a significant increase in the fraction of survey participants expecting deflation as their individual inflation expectation.

To better trace the behavior over time of disagreement and uncertainty, Figures 5 and 6 plot

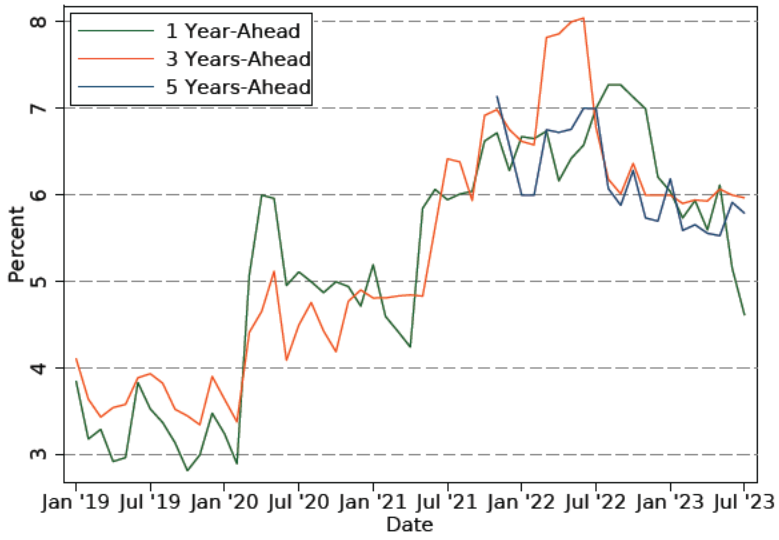
[9]Figure A.3 plots the time series of the probability assigned to deflation outcomes and to inflation above 4 percent in the aggregate density forecast. It highlights the rise in probability assigned to deflation and the recent decline in probability assigned to inflation above 4 percent.

Figure 4: Aggregate Inflation Density Forecasts



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

Figure 5: IE Disagreement in the SCE



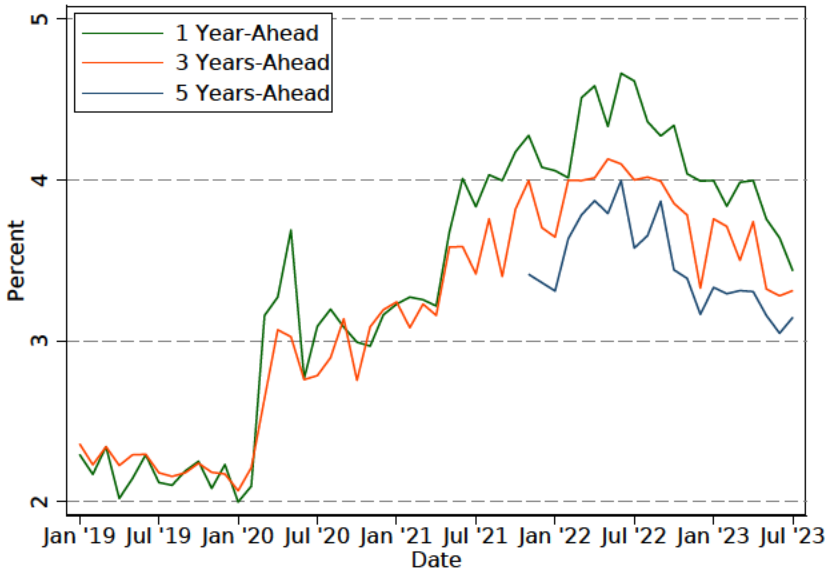
Note: We measure monthly disagreement as the difference between the 75th and 25th percentile of the distribution of inflation density means in a given month.

the time series of IE cross-sectional disagreement and median individual uncertainty. Both disagreement and uncertainty rose sharply at the short- and medium-term horizon at the beginning of the pandemic, and increased further as inflation surged starting in spring 2021. Disagreement and uncertainty peaked around the summer of 2022 and have since declined, although they remained substantially higher than pre-Covid levels as of July 2023.

3.4 Sensitivity of IE revisions to inflation surprises

Another way to illustrate the lower responsiveness of medium-term (versus short-term) IE to inflation shocks at the individual respondent level, is to examine the sensitivity of IE revisions to short-term forecast errors. Table 1 reports estimation results from panel regressions of within-individual

Figure 6: 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.

revisions in short-term and medium-term expectations on individual forecast errors. Revisions are defined as the within-individual difference between IE in survey month 12 and IE in month 2 of their participation in the panel. Forecast errors are defined as realized inflation (measured as the contemporaneous 12-month change in the CPI) in month 12 minus expected one-year-ahead inflation in month 2. We consider three sub-periods: pre-pandemic from June 2014 to February 2020; the initial phase of the pandemic from March 2020 to April 2021; and the more recent period from May 2021 to July 2023.

We find that the estimated sensitivity of IE revisions to inflation surprises is lower at the medium-term than at the short-term horizon across all sub-periods. In addition, the estimates suggest that the response of IE revisions to inflation surprises is broadly similar pre- and post-pandemic. These findings are consistent with the earlier results on a more muted response of medium-term IE to movements in realized inflation.

4 A learning model of inflation expectations formation

In Section 3 we highlighted several findings on the behavior of consumer IE at different horizons during the 2021-23 period, in which realized inflation first surged and then started to moderate. We now examine these patterns through the lens of a standard learning model of IE formation,

Table 1: Sensitivity of IE Revisions to Forecast Errors

	1-Year IE Revisions			3-Year IE Revisions		
	Jun 2014 to Feb 2020 (N=3,874)	Mar 2020 to Apr 2021 (N=818)	May 2021 to Jul 2023 (N=1,821)	Jun 2014 to Feb 2020 (N=3,847)	Mar 2020 to Apr 2021 (N=812)	May 2021 to Jul 2023 (N=1,810)
One-Year Ahead Forecast Error	0.77***	0.82***	0.76***	0.44***	0.44***	0.38***
	(0.04)	(0.09)	(0.07)	(0.05)	(0.10)	(0.08)
Constant	0.020	-0.77	2.95	-0.76	0.54	3.49
	(0.43)	(0.64)	(1.75)	(0.57)	(0.76)	(2.03)
R^2	0.44	0.42	0.37	0.20	0.18	0.12
Mean	-0.071	0.76	0.098	-0.056	0.39	-0.33

Standard errors in parentheses. Sample weights used in the regressions. Monthly dummies included.
Revisions (dep. variable) are defined as 1-year and 3-year inflation expectations in month 12 minus those in month 2.
Errors are defined as realized CPI in month 12 minus expected inflation in month 2.
Period is defined as the month of the respondent's twelfth month in the SCE panel.
All inflation expectations are the respondent's density mean from the SCE core survey.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

and ask whether and to what extent the model implications match what we see in the data. As a reminder, IE generally rose and fell as inflation surged and then moderated, but with notable differences across forecast horizons. Inflation uncertainty and disagreement also rose markedly and then abated. Importantly, we see a pronounced movement in the left tail of the distribution of medium- and longer-term IE starting in summer 2021, accompanied by an increase in deflation expectations that persists through the end of the sample period.

4.1 Model description

We use a learning model of IE formation to provide a benchmark for the survey results. In the model, agents estimate an $AR(3)$ process with data on current and past inflation to forecast future inflation. The agents re-estimate the model via least squares each period as new data become available. This model has been widely used in the literature on IE formation with imperfect information, as it provides a relatively modest departure from rational expectations that nests the latter as a limiting case.[10]

We run two versions of the model: one is an aggregate model with a representative agent who forms expectations at different horizons via a constant gain least squares learning process, using current and past data on realized inflation. The other is a model in which agents from different age

[10]See the discussion in Orphanides and Williams (2004, 2005) and references therein. See also (Sargent, 1999; Cogley and Sargent, 2001; Evans and Honkapohja, 2001; Gaspar and Smets, 2002) for related treatments of learning.

cohorts form inflation expectations based on their lifetime experience of inflation.[11] Each age cohort uses a constant gain least squares learning algorithm but differs in terms of the sample of inflation realizations they consider in forming their expectations, and in terms of the calendar date they start forecasting. This second model is able to generate time-varying dispersion in IE across agents, as different cohorts update their IE differently.

Both models operate at a monthly frequency. Agents observe current month data when forming expectations, and forecast the next three-month annualized headline CPI. With those forecasts, they can also forecast one-year, three-year and five-year-ahead CPI: for example, one-year-ahead CPI is an average of the forecasts for the next 3, 6, 9 and 12 month annualized CPIs. In each period t, agents estimate the coefficients of the following equation:

$$\pi_{i+3} = c_{0,t} + c_{1,t}\pi_i + c_{2,t}\pi_{i\ \ 3} + c_{3,t}\pi_{i\ \ 6} + \nu_i, \tag{1}$$

where π_t is the three-month annualized percent change in headline CPI. Let X_i and c_i be the 4×1 vectors $X_i = (1,\ \pi_i,\ \pi_{i\ \ 3},\ \pi_{i\ \ 6})'$ and $c_i = (c_{0,i},\ c_{1,i},\ c_{2,i},\ c_{3,i})'$. Using data through period t, the least squares regression parameters for equation (1) can be written in recursive form:

$$c_t = c_{t\ \ 1} + \kappa_t R_{t\ \ 1}^{-1} X_t(\pi_t \quad X_t' c_{t\ \ 1}), \tag{2}$$

$$R_t = R_{t\ \ 1} + \kappa_t(X_t X_t' \quad R_{t\ \ 1}), \tag{3}$$

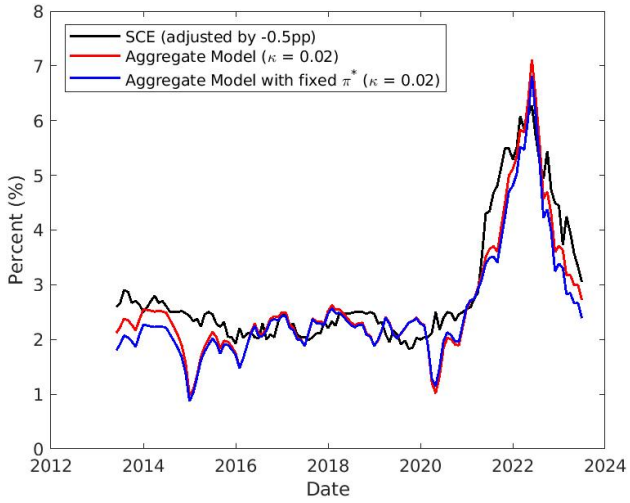
where κ_t is the gain. With least squares learning and infinite memory, $\kappa_t = 1/t$, so as t increases, κ_t converges to zero. To formalize perpetual learning we replace the decreasing gain in the infinite memory recursion with a small constant gain, $\kappa > 0$. We calibrate the gain parameter κ to match the magnitude of the movements in short-term IE at $\kappa = 0.02$.[12]

Since they are based on the same learning mechanism, the two models deliver similar results at the aggregate level, but the birth-cohort model is additionally able to speak to the cross-sectional distribution of IE along the age dimension. We also run a version of each model where the longer-run inflation expectation is fixed (at 2.3 percent). This is a simple way to impose perfectly anchored longer-run IE in the model. As we discuss below, this version delivers more muted movements in medium-term IE than the standard (unconstrained) one.

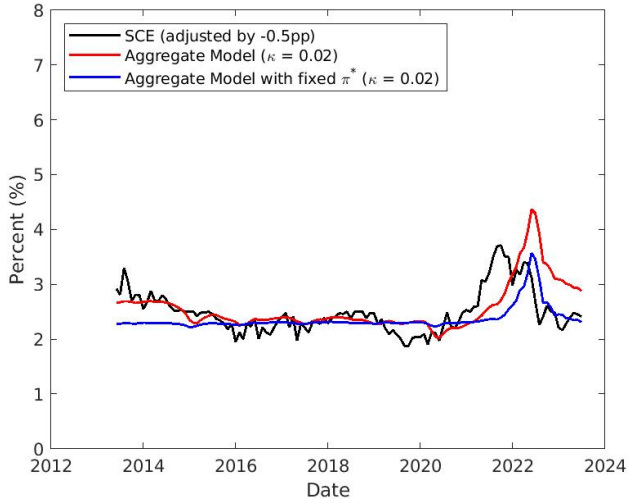
[11] The model is similar to that developed by Malmendier and Nagel (2016).
[12] See also the discussion in Orphanides and Williams (2005), p. 1939.

Figure 7: Model vs. Survey Inflation Expectations

(a) Short-Term Inflation Expectations



(b) Medium-Term Inflation Expectations



Note: The left panel shows median short-term IE in the monthly SCE vs. model-generated IE at the same horizon. The right panel shows median medium-term IE in the monthly SCE vs. model-generated IE at the same horizon. Simulated IE are reported for both the standard model and the model in which the longer-run IE is fixed.

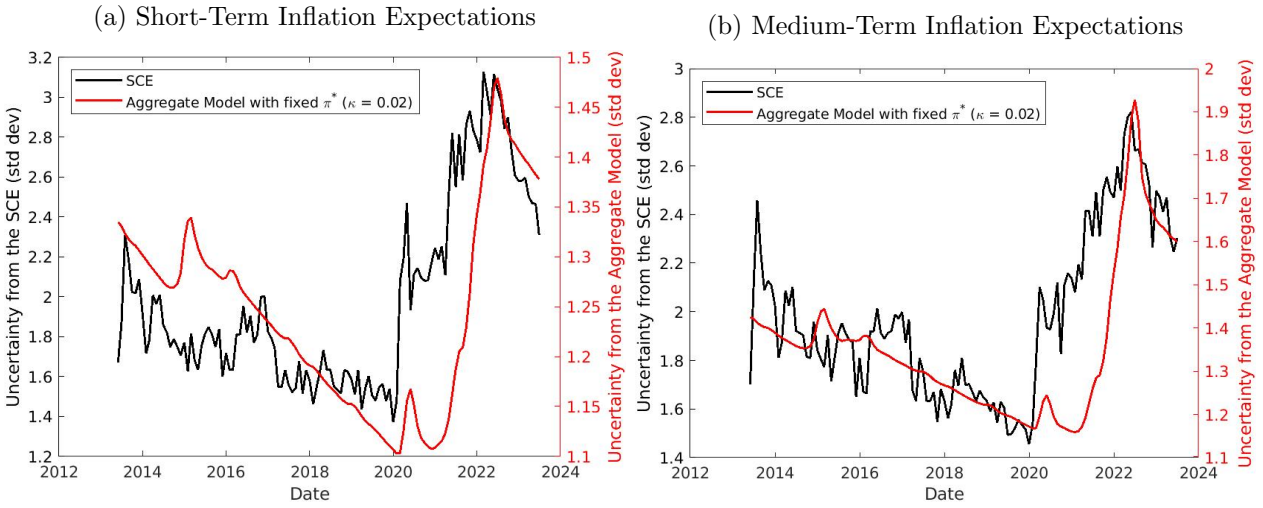
4.2 Model results

The aggregate model qualitatively replicates the increase and subsequent decline in median IE as inflation surges and subsequently moderates, but with some important differences across horizons. The left panel of Figure 7 shows that one-year-ahead IE in the SCE have behaved very similarly to model predictions, both in terms of timing and magnitude of movements. In contrast, the right panel shows that medium-term IE have behaved differently, with an earlier peak and a faster fall to normal levels. The fact that medium-term IE start turning well before inflation peaks suggests that agents use additional information in addition to realized inflation in updating their IE. The feature that model-implied IE move synchronously with realized inflation is not limited to learning models of IE formation but is a more general feature of IE formation models with imperfect information in which agents update their IE only on the basis of inflation realizations and do not incorporate other information in their updating.

Much like in the survey, model-generated medium-term IE move less than short-term expectations. Notably, the model where the longer-run IE is fixed delivers substantially smaller movements in medium-term IE. The magnitude of the rise and the speed of the subsequent decline in SCE medium-term IE is quantitatively more similar to the model with tightly anchored long-run inflation expectations than the standard model.

The aggregate model is also able to qualitatively capture the increase and subsequent (partial)

Figure 8: Model vs. Survey Inflation Uncertainty



Note: The left panel shows short-term inflation uncertainty in the monthly SCE vs. model-generated uncertainty at the same horizon. The right panel shows median medium-term inflation uncertainty in the monthly SCE vs. model-generated uncertainty at the same horizon.

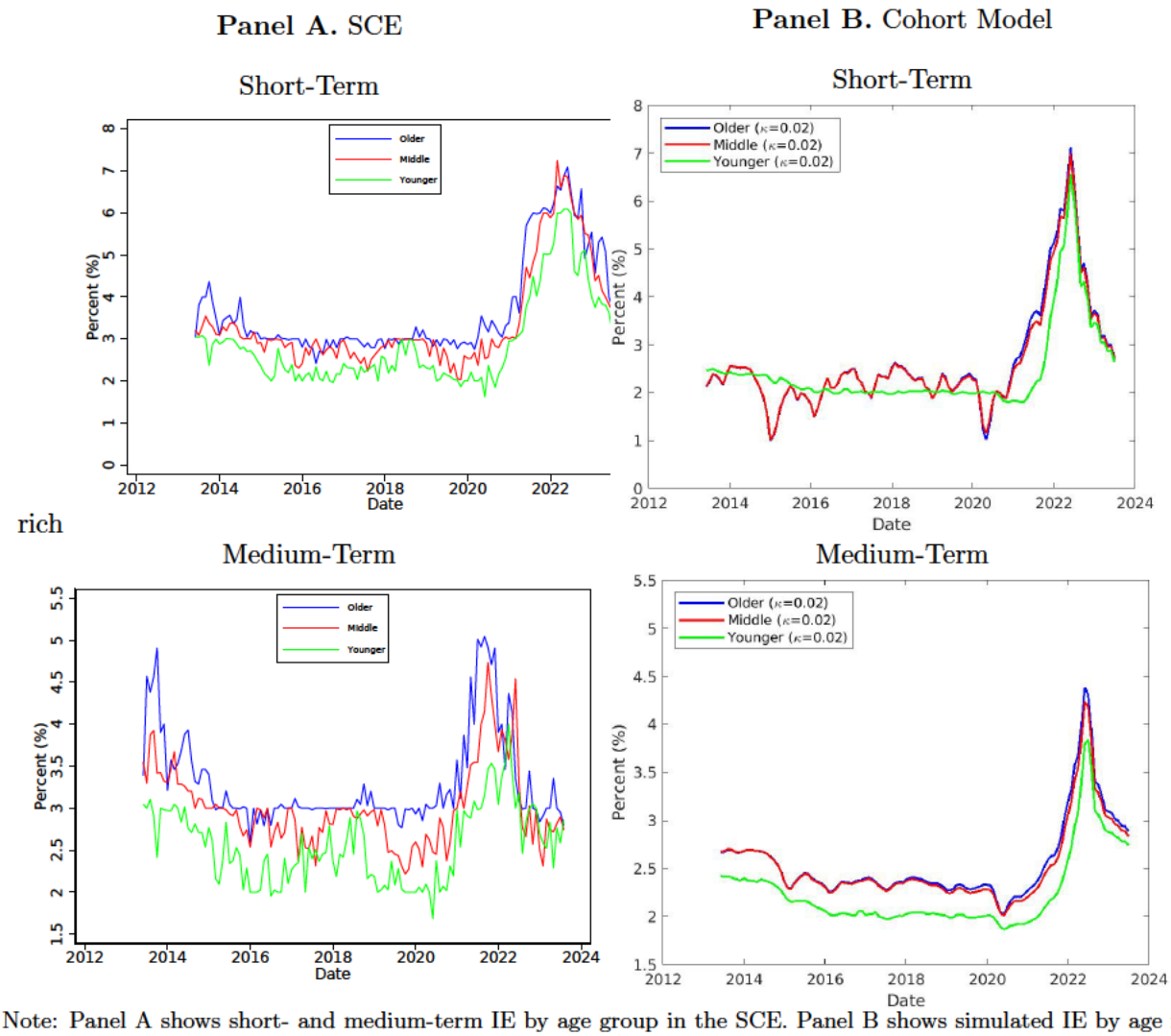
decline in inflation uncertainty at all horizons: see Figure 8.[13] However, inflation uncertainty rises much sooner in the SCE than in the model. In the survey, it increases sharply at the onset of the pandemic, while in the model it only starts rising gradually as inflation surged over 2021-22. This suggests that the pandemic represented a special set of circumstances and survey respondents use other information (outside the model) to increase their perception of inflation uncertainty.

The most striking difference between model and data is that the model is unable to generate the increase in the left tail of the medium-term aggregate forecast distribution that we observe in the survey data. More precisely, the model is silent on this feature of the data because it only generates forecast means and variances, and says nothing about the shape of the forecast distributions. We analyze potential explanations for this rise in the left tail (and associated increase in deflation expectations) in Section 5.

Turning to the cohort model, Figure 9 shows that median IE by age generated by the cohort model are qualitatively similar to the data. In the SCE, median IE tend to be lower for the younger set of respondents than for the other groups over the pre-Covid period at both horizons. Between early 2020 and early 2022 median IE rise by similar amounts across age groups, although at the medium-term horizon they rise more gradually and peak later for younger respondents. The cohort model matches these patterns qualitatively: median simulated IE rise by roughly similar amounts

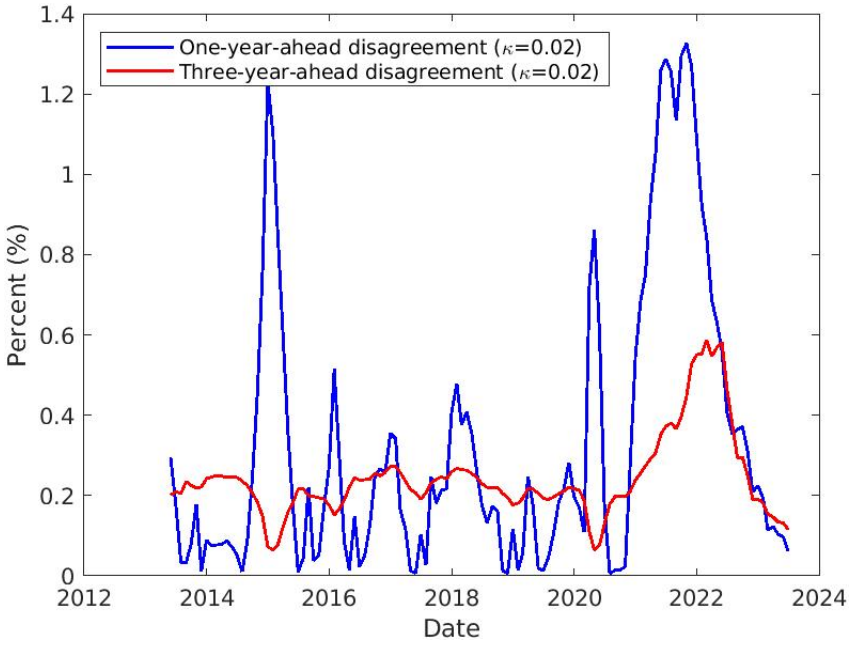
[13] In this figure, uncertainty in the model is measured by the time-varying forecast variance (standard deviation). For comparability, inflation uncertainty in the SCE is computed as the median standard deviation. Model-implied uncertainty is very similar in the standard model and in the version with tightly anchored IE.

Figure 9: IE By Age: SCE vs. Cohort Model



Note: Panel A shows short- and medium-term IE by age group in the SCE. Panel B shows simulated IE by age from the cohort model at the corresponding horizons. The "Younger" group includes individuals 18 to 39 years of age at each point in time; the "Middle" group includes individuals aged 40 to 59; and the "Older" group includes individuals aged 60 and over.

Figure 10: Disagreement in the Cohort Model



Note: The figure shows simulated short- and medium-term disagreement from the cohort model. Disagreement is computed as the IQR of the distribution of IE across all birth cohorts in the model.

across age groups starting in mid-2020. Further, much like in the data, at the medium-term horizon model-generated IE are lower in the pre-Covid period and rise more gradually for the younger group, although they peak at the same time as for the other groups.[14]

Finally, the cohort model is able to generate an increase in disagreement across birth cohorts, as inflation surges. However, the increase in disagreement in the data is larger than in the model. This is because the discounting of inflation realizations far in the past makes longer-lived cohorts more similar to each other (by construction), which limits our ability to see differences across cohorts.

Overall, while the learning model broadly captures the dynamics of IE in the data, the analysis points to some noteworthy differences between model implications and survey expectations. This suggests the need for richer models that, on the one hand, capture other dimensions of heterogeneity in addition to age; and on the other hand, include information other than realized inflation (e.g. about interest rates or unemployment) in agents' information sets.

[14] At each point in time, the "Younger" group includes birth cohorts 18 to 39 years of age at that time; the "Middle" group includes birth cohorts aged 40 to 59; and the "Older" group includes those aged 60 and over.

5 Dissecting the Increase in Deflation Expectations

Given the difficulties for a mainstream learning model to capture all the complex ways in which IE evolved in the 2021-2023 high-inflation environment and the rise in deflation expectations in particular, we delve further into potential factors that may have contributed to the observed IE dynamics and which may be missing from the model. To do so, as mentioned in Section 2, we fielded two special SCE surveys in May 2022 and June 2023. First, we study the demographic characteristics of those who expected deflation, and we investigate the persistence of deflation expectations for the same respondents over time. Next, we ask questions related to three hypotheses: confusion about the meaning of deflation, an expectation of price reversals for goods that experienced large price run-ups during the pandemic, and expectations of a weak economy or recession.

5.1 Who expects deflation and how persistent are deflation expectations?

Tables A.3 and A.4 show that the demographic composition of respondents who expected deflation in the May 2022 and June 2023 special surveys is broadly similar to the demographic make-up of respondents with IE in the other two broad "buckets" (inflation between 0 and 4 percent and inflation above 4 percent) – with a couple of exceptions where we see statistically significant differences.[15] First, the share of college graduates is somewhat lower for those expecting deflation in both surveys and at most horizons. Second, median household income tends to be lower for respondents with deflation expectations, although not for all inflation buckets.

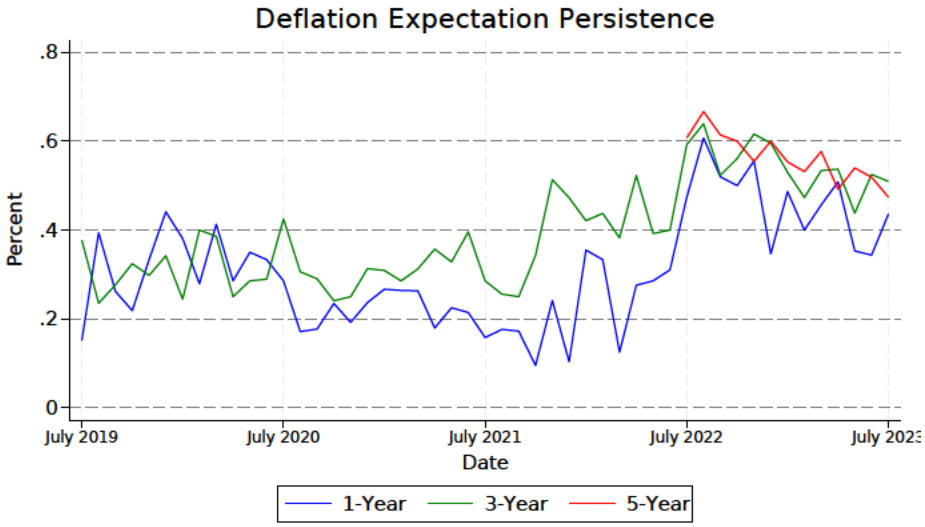
We also examine the persistence of deflation expectations for the same individuals over time. We do so in two ways, exploiting the longitudinal feature of our surveys. First, for the subset of 1,350 respondents who participated in both the May 2022 and the June 2023 special surveys, we look at the share of respondents with medium- and longer-term deflation expectations in May 2022 who also had individual expectations at or below zero percent in June 2023. We find that more than 40% of respondents with IE in deflation territory in May 2022 still expected deflation in June 2023 – a relatively high share, considering that the two surveys took place more than a year apart.[16]

Second, we use the rotating panel aspect of our monthly survey to compute transition matrices for all three broad inflation buckets: at or below zero percent, between zero and four percent, and above four percent. Specifically, for respondents with IE in a given bucket in month t, we compute

[15] We focus here on medium- and longer-term expectations since the share of respondents expecting deflation at the short-term horizon is quite low, hovering around 10 percent.

[16] To be precise, deflation expectations are persistent for 43% and 40% of respondents at the medium- and longer-term horizons, respectively.

Figure 11: Persistence of Deflation Expectations in the SCE



Note: We measure persistence as the share of survey respondents with deflation expectations in month t who also expected deflation in month $t+6$. The shares are plotted as of month $t+6$.

the probability that their IE transition into each of the three buckets in month $t+6$. The probability of remaining in the deflation bucket six months apart constitutes our measure of persistence. Figure 11 reports the time series of this measure. We find that between July 2022 and July 2023 about 50% to 60% of the monthly survey respondents who expected deflation at the medium- and longer-term horizons in a given month still did so six months later. These persistence measures have been substantially larger since early 2022 than pre-Covid when they hovered between 25% and 40% at the medium-term horizon.

5.2 Confusion about the meaning of deflation

In thinking about possible explanations for the rise in deflation expectations, we first consider the hypothesis 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 May 2022 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?"*[17] Overall, the vast majority of respondents (88 percent in May 2022 and 81 percent in June 2023) 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.

[17] In June 2023 we asked a slightly modified version of the question: *"Imagine that all prices increased by 9% last year, and imagine that all prices increase by 5% this year. In that case, would you say that there is inflation or deflation this year?"*

(2012) who find that most U.S. household heads understand the meaning of the term "inflation."

In the May 2022 survey, the proportion answering the question correctly is slightly, but statistically significantly, lower for those who expect deflation at the three-year horizon than for those who expect inflation. As shown in column 1 of Table 2, 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 in the summer of 2022.[18] On the other hand, in the June 2023 survey, there was no statistically significant difference in the proportion of respondents who answered the question correctly between those expecting deflation and those expecting inflation in the medium-term (see Table 3). We find similar results on the association between confusion and deflation expectations at the five-year-ahead horizon.[19]

Table 2: Marginal Effects on the Probability of Expecting Deflation, May 2022

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Deflation Confusion Question	-0.080**								-0.072**
	(0.035)								(0.034)
Gas Price Reversion		0.021***							-0.005
		(0.008)							(0.008)
Food Price Reversion			0.029***						0.022**
			(0.008)						(0.011)
Home Price Reversion				0.026***					0.017**
				(0.007)					(0.008)
Durables Price Reversion					0.023***				-0.006
					(0.008)				(0.011)
Recession in 3 Years						-0.190***			-0.055
						(0.049)			(0.055)
Higher Unempl in 3 Years							-0.180***		-0.091*
							(0.046)		(0.052)
Business Cond in 3 Years								0.069***	0.050***
								(0.012)	(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.

[18] This number (1 percentage point) 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).

[19] Figures A.9 and A.10 show the proportion of respondents who answer the question correctly by IE group and at all three horizons.

Table 3: Marginal Effects on the Probability of Expecting Deflation, June 2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Deflation Confusion Question	0.004								0.025
	(0.030)								(0.030)
Gas Price Reversion		0.018**							0.001
		(0.008)							(0.010)
Food Price Reversion			0.025***						0.013
			(0.008)						(0.011)
Home Price Reversion				0.028***					0.022**
				(0.008)					(0.009)
Durables Price Reversion					0.019**				-0.008
					(0.008)				(0.013)
Recession in 3 Years						-0.179***			-0.056
						(0.061)			(0.064)
Higher Unempl in 3yr							-0.216***		-0.132**
							(0.051)		(0.053)
Business Cond in 3yr								0.063***	0.041***
								(0.015)	(0.015)
Mean	0.211	0.212	0.211	0.211	0.211	0.210	0.212	0.211	0.210
PseudoR2	0.020	0.025	0.030	0.031	0.025	0.031	0.037	0.037	0.058
Observations	2137	2134	2136	2136	2135	2123	2134	2132	2114

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

5.3 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 expected 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 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. Again, we fielded these questions in both May 2022 and June 2023 special surveys.

Respondents to both special surveys who expect deflation in three years are significantly more likely to believe that various commodity prices generally exhibit mean reversion over a similar horizon.[20] The estimates reported in columns 2 to 5 of Table 2, using May 2022 data, indicate that, controlling for demographic characteristics, beliefs about price reversals are positively and statisti-

[20]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 in both special surveys (see Tables A.1 and A.2). Figures A.11 and A.12 plot average responses to the mean-reversion question by IE group for all four goods.

cally 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.[21] Remarkably, the estimated effects using June 2023 data go in the same direction and are quantitatively very similar (see Table 3): strongly agreeing versus strongly disagreeing about mean-reversion increases the probability of expecting deflation by between 11 and 17 percentage points, and the joint effect is also 17 percentage points.

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.[22] Again, the results are very similar in both May 2022 and June 2023 surveys (see Appendix tables A.9 and A.10, and tables A.11 and A.12, respectively). Interestingly, respondents who expect deflation in the medium-term on average also expect significantly smaller price increases for specific items than those expecting inflation (see Tables A.5 and A.6). Further, among those who expect deflation, the share of respondents who also expect outright declines in prices of individual items is quite high: For example, the share of respondents with deflation expectations who also expect gas prices to decline in the medium-term is 60% in May 2022 and 49% in June 2023.

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.

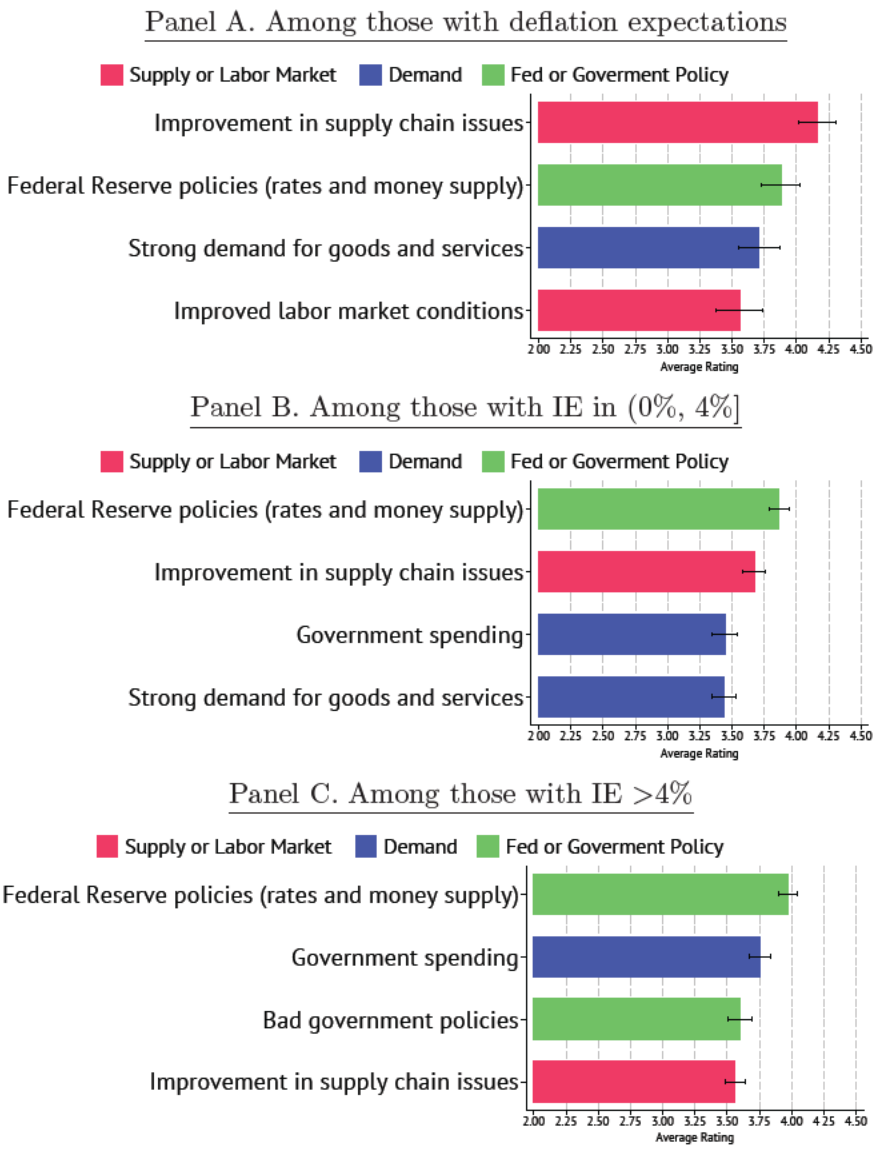
To further examine the importance of expected price reversal in the formation of IE, we asked respondents in the June 2023 special survey about the relative importance of various factors that, in their view, contribute to expected movements in inflation between June 2023 and June 2024 (expectations about inflation one year from the time of the survey).[23] About 82% of respondents expect inflation to decline or stabilize over the next 12 months. Focusing on these respondents, Figure 12 shows the four factors with the highest average importance rating that respondents assign to each

[21] 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.

[22] 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 Tables A.7 and A.8 in the online Appendix.)

[23] See Appendix C for the exact text of the question and the list of factors we asked about. The choice of factors was informed by a set of open-ended questions we fielded in a pilot survey prior to the June special survey.

Figure 12: Top Four Factors Contributing to Inflation Decline over Next Year



Note: This figure shows the average importance rating that respondents assigned to each factor as a contributor to the change in inflation over the next twelve months split by whether they expect deflation (panel A), moderate inflation between 0 and 4% (panel B), or high inflation in excess of 4% (panel C). The figure is based on the subset of respondents (82% of the total) who expect inflation to decline or stabilize over the next twelve months.

of 16 different factors as a contributor to a decrease in inflation over the next twelve months split by whether they expect deflation (panel A), inflation between 0 and 4 percent (panel B) or inflation in excess of 4 percent (panel C). The figure indicates first that respondents list Federal Reserve policies and improvements in supply chain issues as the highest rated contributors to a future decline in inflation. The figure further shows that those who expect deflation in the coming year rank as the main factor that will drive inflation down over the next 12 months "Improvement in supply chain issues" (Panel A). In contrast, this factor is ranked much lower by those who expect inflation to be greater than 4 percent (Panel C). This finding is consistent with our results on deflation expectations being associated with beliefs about price mean reversion and with expectations of positive economic outcomes.

5.4 Expectations about the economy

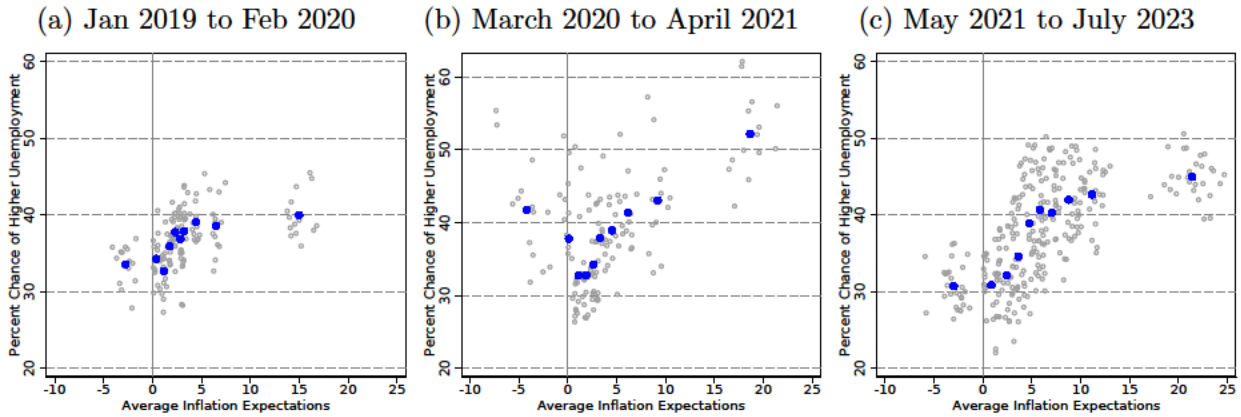
The rise in deflation expectations observed in our survey responses could be associated with an increase in consumers' perceived risk of an economic downturn or recession that leads to expectations of lower inflation or even deflation through a standard Phillips Curve channel. To investigate the extent 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 in both May 2022 and June 2023 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. In the May 2022 survey, the average perceived probability of a recession in three years is 28 percent for those expecting deflation vs. 35 percent for those who expect inflation (Table A.1). The corresponding numbers are very similar for the average probability of higher unemployment.[24] 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.[25]

[24]The results are again very similar in the June 2023 survey: see Appendix Table A.2.

[25]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 Tables A.1 and A.2). Appendix Figures A.13–A.14 and A.17–A.18 show visually the differences in economic expectations between those who expect deflation and their peers. Appendix Figures A.15–A.16 and A.19–A.20 show equivalent

Figure 13: 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.

Estimates shown in columns 6 to 8 of Tables 2 and 3 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. In the May 2022 survey, a 40-percentage-point decline in the likelihood of a recession (or higher unemployment) is associated with about a 8-percentage-point increase in the likelihood of reporting deflation,[26] while expecting much better rather than much worse business conditions three years from now increases the likelihood of expecting deflation by 28 percentage points. The results are again remarkably similar in June 2023. The fact that all our results on deflation expectations are very similar between May 2022 (when realized inflation was close to its peak) and June 2023 (when inflation had dropped substantially) strengthens the validity of our findings about consumers' views during the inflation surge of 2021-23.

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. As Figure 13 shows, 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

plots for the probability of recession at the short- and longer-term horizons.

[26] While we do not have a time series for the perceived probability of recession and of higher unemployment at the medium-term, the equivalent series at the short-term in the SCE monthly survey ranges from 31 percent to 51 percent.

inflation (May 2021 to July 2023).[27] 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 Tables 2 and 3 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, and for unemployment and business conditions maintain their statistical significance. Similarly, mean-reversion in food (in May 2022) 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.

5.5 Evidence from consumer surveys in other countries and in other periods

How unique is the increase in deflation expectations observed in the SCE? Consumer surveys in the U.S. and a small number of other countries show similar patterns. In the U.S., a longer time series from the Michigan Survey of Consumers shows that while for short-term IE the share expecting deflation seems to spike up whenever inflation falls sharply (including in the 2021-22 period), for longer-term IE the share expecting deflation rises as inflation increases (figure A.4). This pattern is present both in 2007-08 and, especially, in 2021-22 and is similar to what we see in the SCE. In the Canadian Survey of Consumer Expectations, run by the Bank of Canada, the share of respondents expecting deflation at the two- and five-year-ahead horizons started rising in late 2021 and during 2022 and remains elevated, similar to the SCE (see figure A.5). A qualitatively similar pattern is evident in the Bank of England's Inflation Attitudes Survey, showing an initial increase in one, two- and five-year ahead deflation expectations at the onset of the pandemic, and a second rise since the Spring of 2022 (figure A.6). More muted increases in deflation expectations are found in the ECB Consumer Expectations Survey[28] and in the Bundesbank Online Panel Households – albeit with a lag in some cases (figures A.7 and A.8). Thus, the increase in deflation expectations during the surge in inflation over 2021-22 is not an isolated occurrence, limited to the SCE and this particular episode, but rather seems to be generalizable to other historical episodes and other settings.

[27] Because of data limitation we can only explore the association between short-term IE and expected short-term unemployment over time.

[28] See Bańkowska et al. (2021) and Georgarakos and Kenny (2022) for an overview of the ECB survey.

6 Conclusion

In this paper we study the evolution of IE at different horizons during the high inflation period of 2021-23. We document several interesting patterns, including notable differences in the size and timing of IE movements at different horizons, increases in inflation uncertainty and disagreement, and a significant rise in the share of survey respondents expecting deflation in the medium- and longer-term. We show that a mainstream model of IE formation, based on least-squares learning, broadly captures the main features of IE during this period but with some important differences–especially with regard to the timing of the rise in medium-term IE and inflation uncertainty and the rise in deflation expectations.

Our results indicate 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–supported by our survey evidence–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 Russia's war on Ukraine and expect a reversal of these factors leading to a sharp fall in inflation and a return to a strong economy.

These results also indicate that the formation of inflation expectations is more nuanced than implied by simple univariate models of adaptive learning and incorporates the influence of other factors on inflation. One possible direction for future modeling efforts is provided in Orphanides and Williams (2007), where the agents' learning process is based on a VAR that includes the unemployment rate and a short-term interest rate in addition to realized inflation. Another potentially fruitful direction is the one indicated, among others, in Beaudry and Portier (2006), where a news shock series based on stock market information is used to model news-driven changes in agents' expectations. Such an approach could be useful to capture the sharp increase in inflation uncertainty that we observe at the onset of the pandemic.

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. While the cohort model broadly captures the increase in disagreement, it is quantitatively larger in the data, suggesting the need for richer forms of heterogeneity in models and related treatments of model uncertainty.

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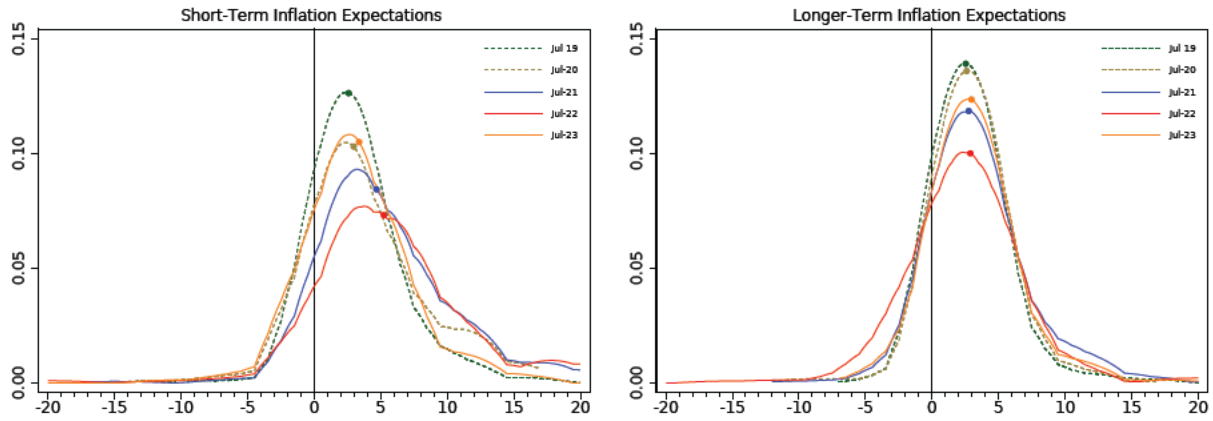
Online Appendix

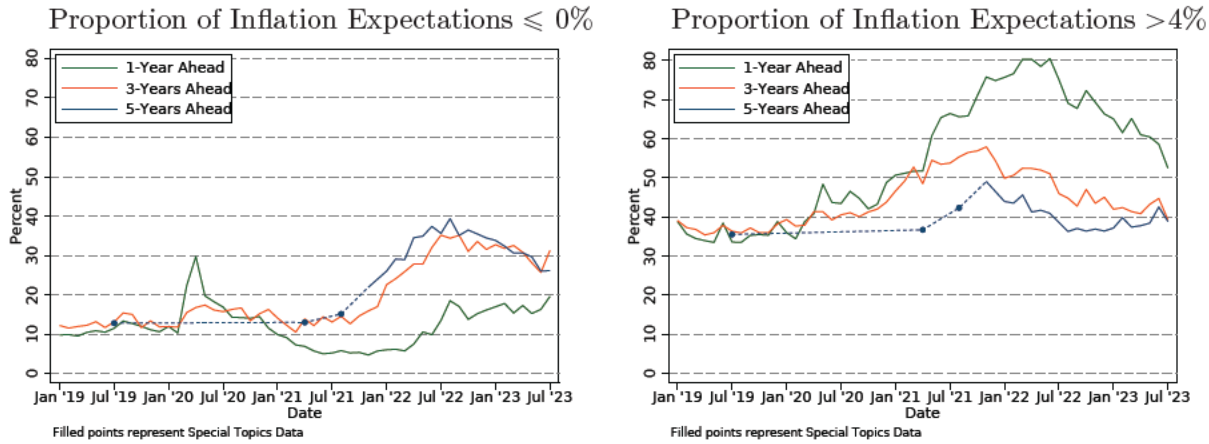
A Additional Figures and Tables

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



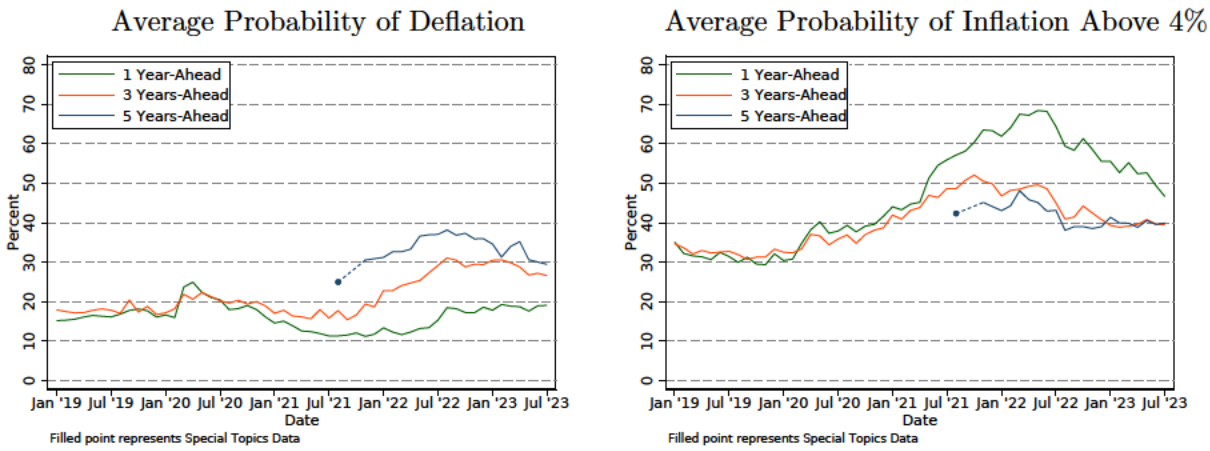
Note: The figure shows kernel densities fitted to individual inflation point forecasts elicited in the Michigan Survey of Consumers. We use an Epanechnikov kernel with a bandwidth of 2. Circles represent the median inflation expectations.

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



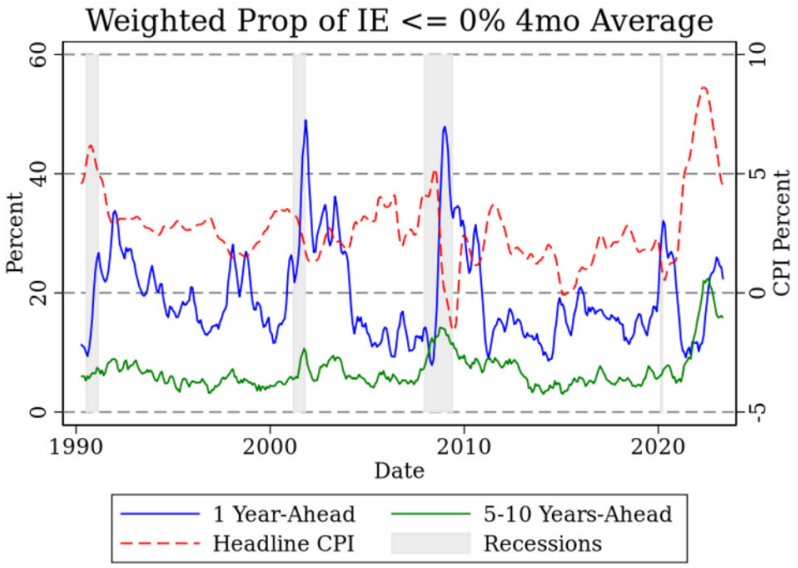
Note: The left panel shows the share of respondents with point inflation expectations less or equal to 0% in the monthly SCE. The right panel shows the share of respondents with point inflation expectations above 4% in the monthly SCE. The dots represent data from the July 2019, April 2021 and August 2021 special surveys.

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



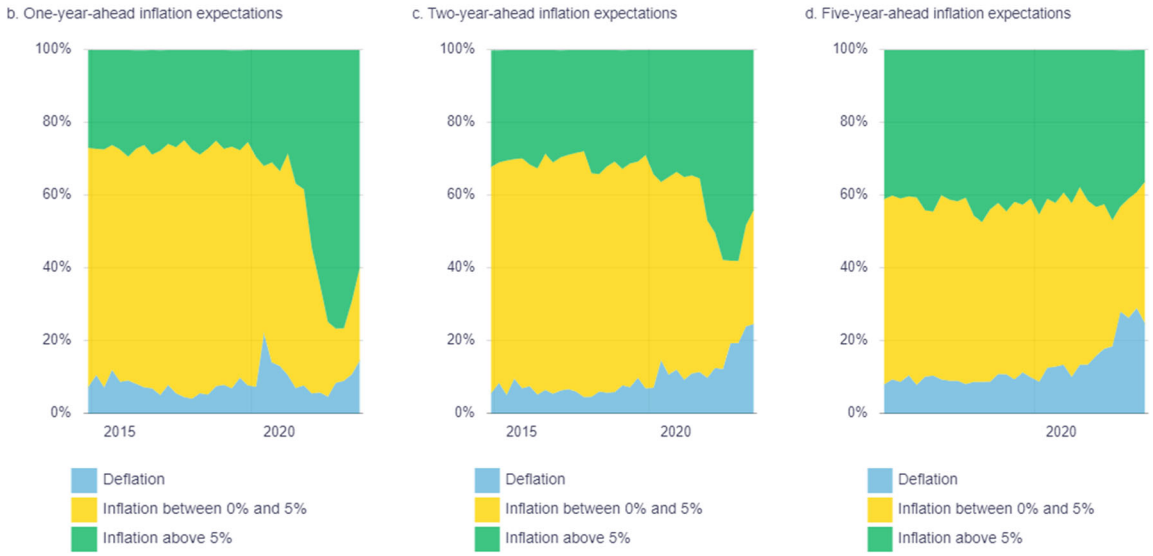
Note: Time series of the probability assigned to deflation outcomes and to inflation above 4 percent in the aggregate density forecast. The dot represents data from the August 2021 special survey.

Figure A.4: Michigan Survey - Share Expecting Deflation



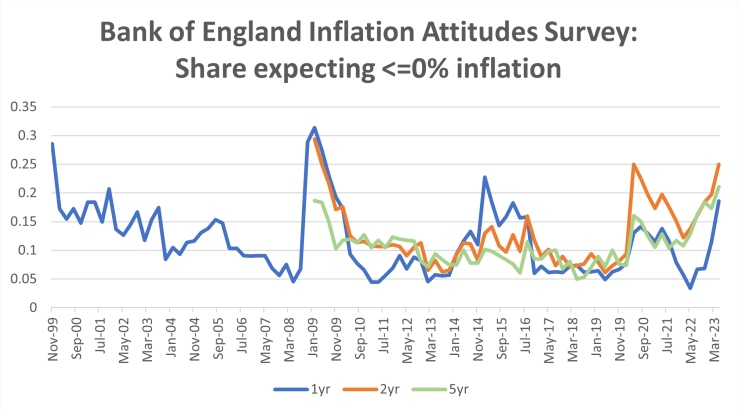
Source: Survey of Consumers, University of Michigan

Figure A.5: Bank of Canada - Share Expecting Different Inflation Outcomes



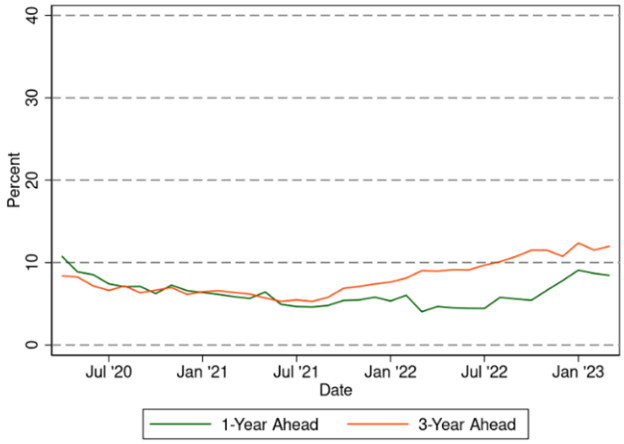
Source: Canadian Survey of Consumer Expectations, Bank of Canada

Figure A.6: Bank of England - Share Expecting Deflation



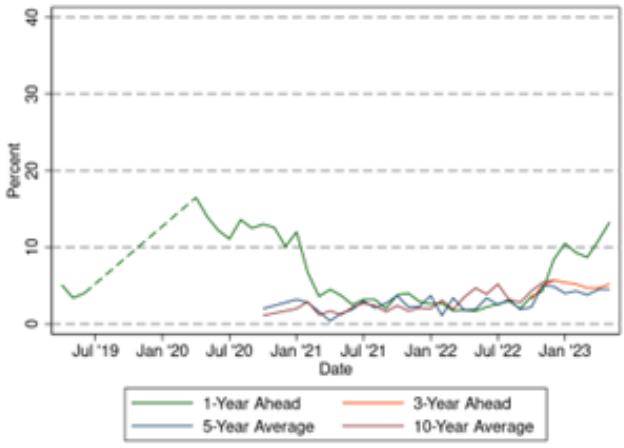
Source: Bank of England/Ipsos Inflation Attitudes Survey

Figure A.7: ECB - Share Expecting Deflation



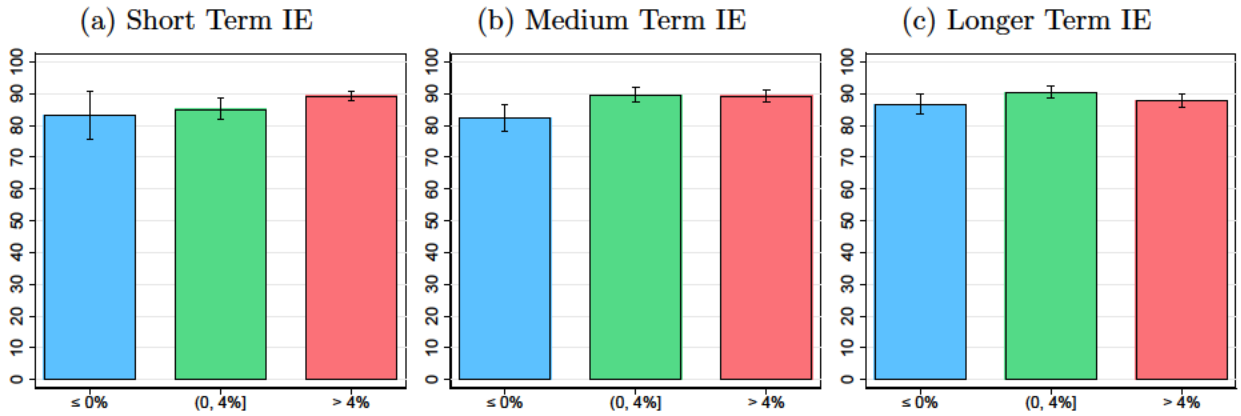
Source: ECB Consumer Expectations Survey

Figure A.8: Bundesbank - Share Expecting Deflation



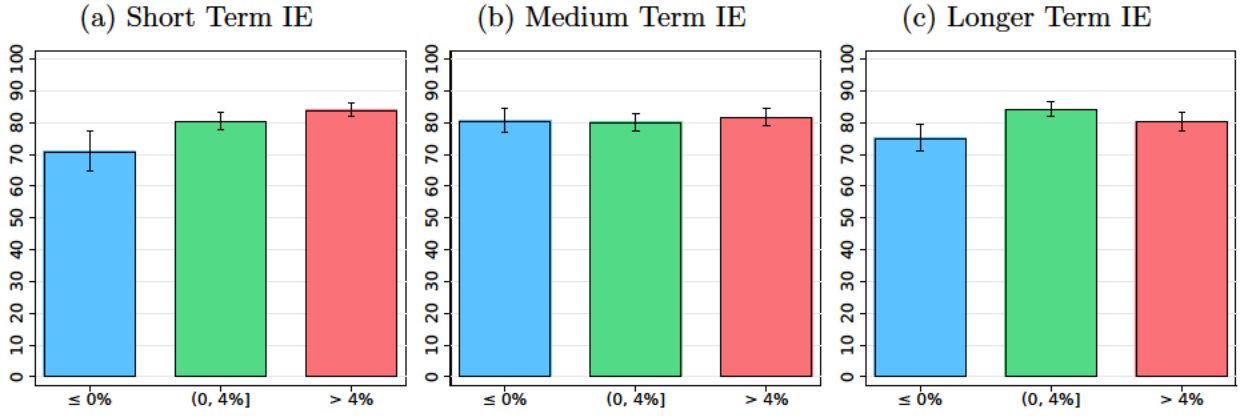
Source: Bundesbank Online Panel – Households

Figure A.9: Deflation Confusion and IE, May 2022



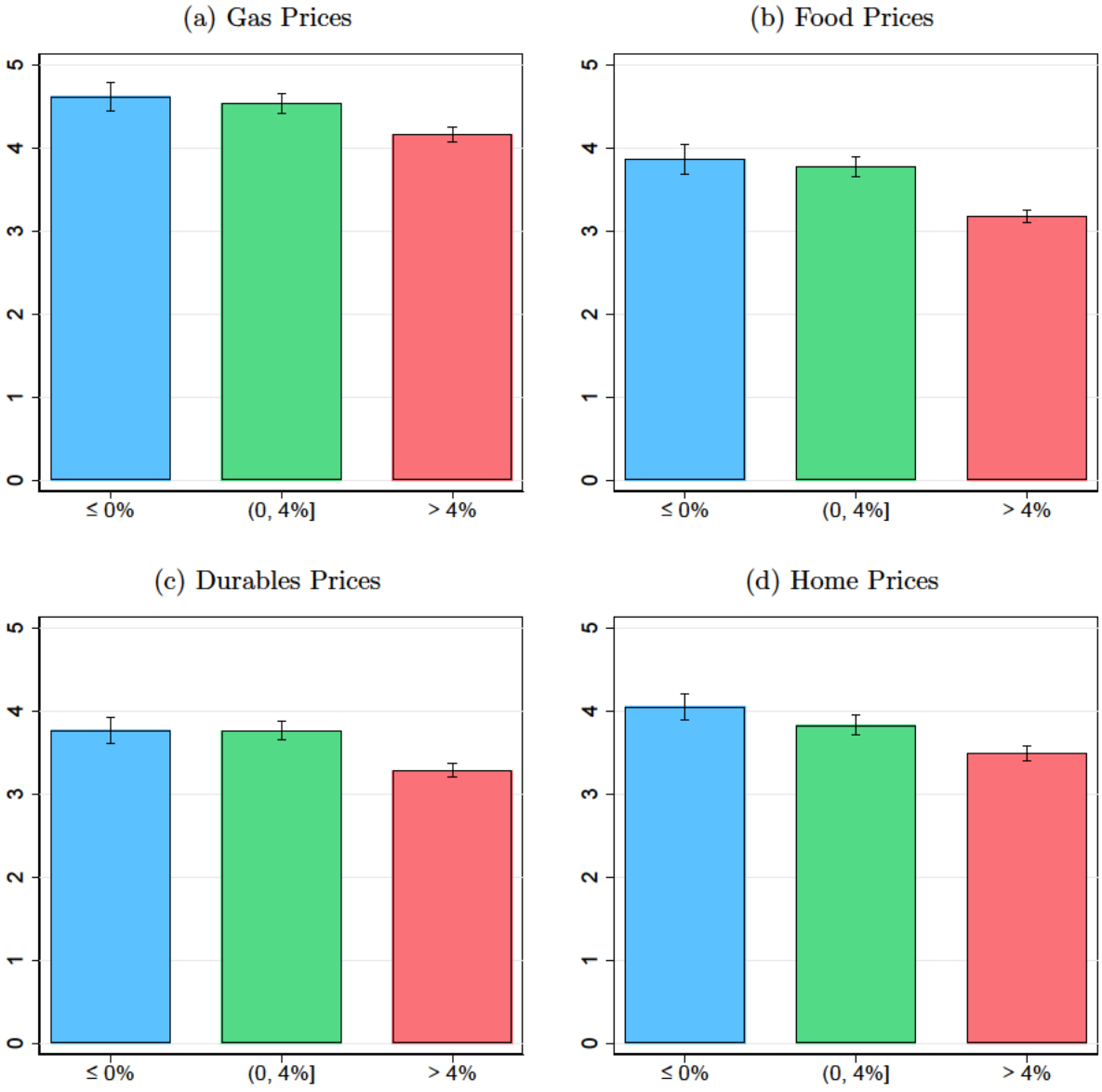
Note: The blue, green and red bars denote the average responses of respondents with IE at the one-year-ahead (left panel), three-year-ahead (middle panel) and five-year-ahead (right panel) horizon less or equal to 0%, in the (0%,4%] interval, strictly greater than 4%, respectively. Respondents are asked "*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.10: Deflation Confusion and IE, June 2023



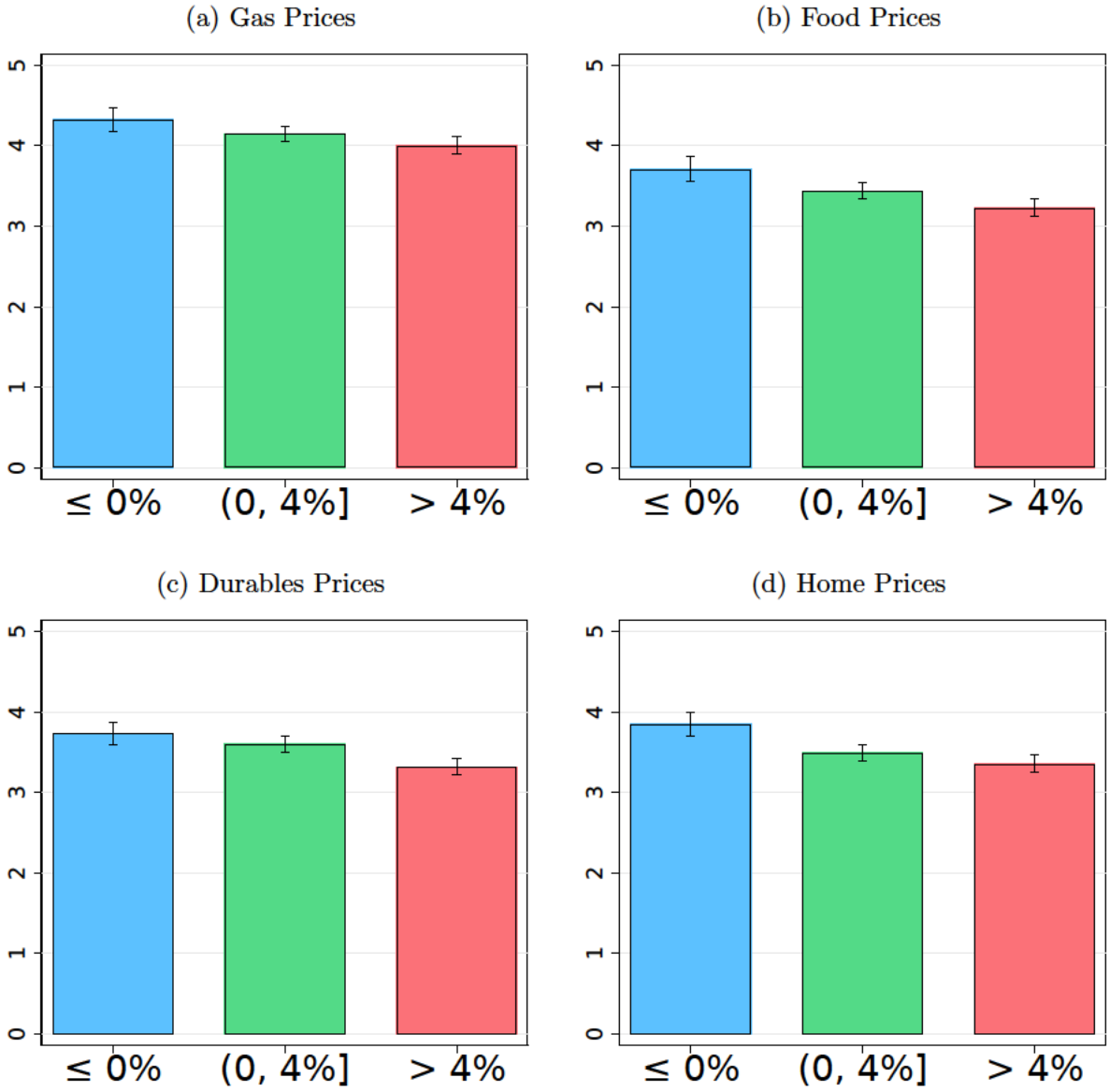
Note: The blue, green and red bars denote the average responses of respondents with IE at the one-year-ahead (left panel), three-year-ahead (middle panel) and five-year-ahead (right panel) horizon less or equal to 0%, in the (0%,4%] interval, strictly greater than 4%, respectively. Respondents are asked "*Imagine that all prices increased by 9% last year, and imagine that all prices increase by 5% 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.11: Three-year-ahead IE and Reversion in Commodities Prices, May 2022



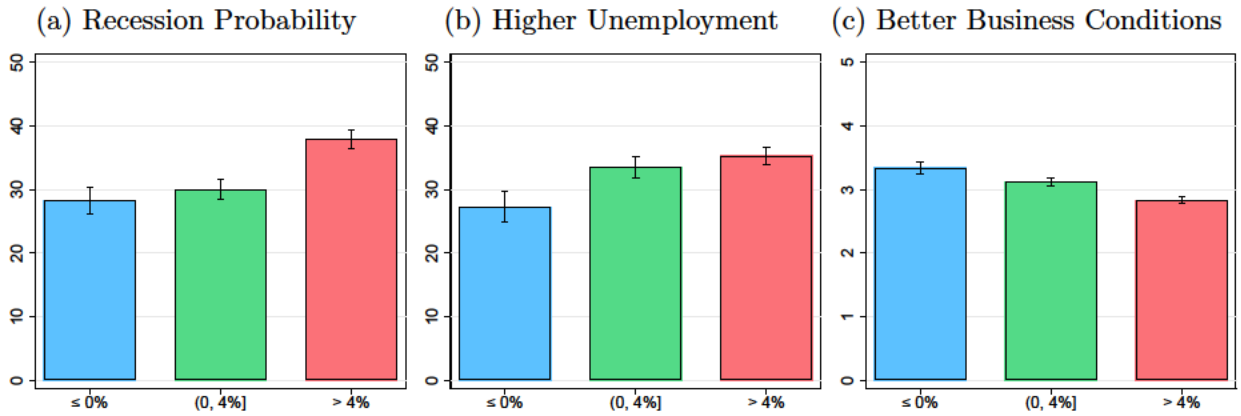
Note: The blue, green and red bars denote the average responses of respondents with three-year-ahead IE less or equal to 0%, in the (0%,4%] range, and strictly greater than 4%, respectively. For each commodity X, respondents are asked how much they agree with the statement: "*In general, when the price 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.12: Three-year-ahead IE and Reversion in Commodities Prices, June 2023



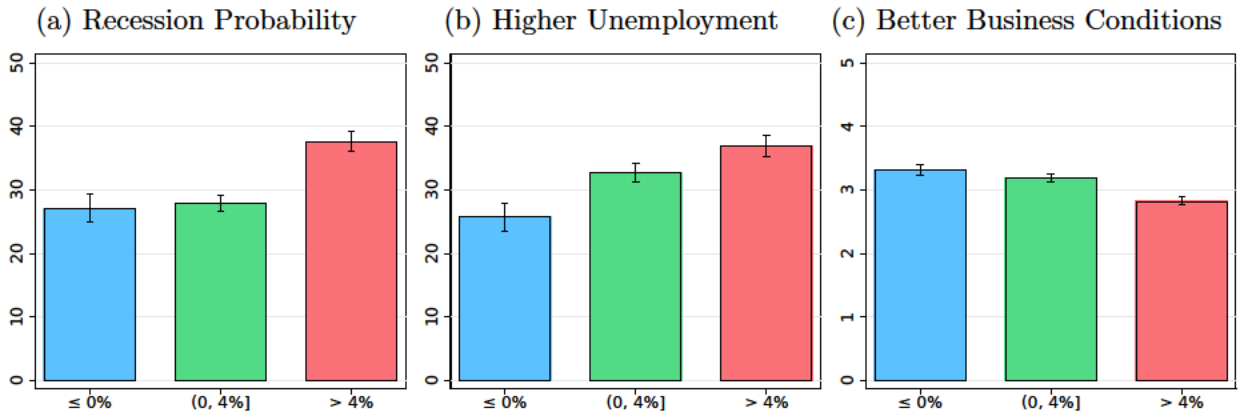
Note: The blue, green and red bars denote the average responses of respondents with three-year-ahead IE less or equal to 0%, in the (0%,4%] range, and strictly greater than 4%, respectively. For each commodity X, respondents are asked how much they agree with the statement: "*In general, when the price 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.13: Three-year-ahead IE and Expected Economic Conditions, May 2022



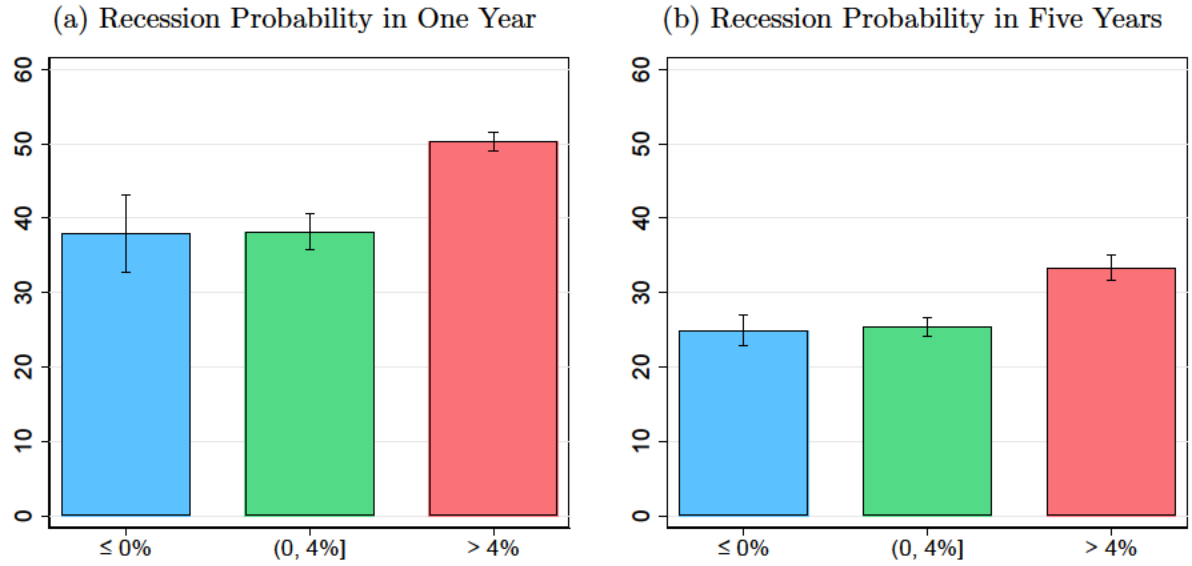
Note: The blue, green and red bars denote the average responses of respondents with three-year-ahead IE less or equal to 0%, in the (0%,4%] range, and strictly greater than 4%, respectively. Respondents are asked to assess to chance the U.S. economy will be in a recession in three years (left panel), 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.14: Three-year-ahead IE and Expected Economic Conditions, June 2023



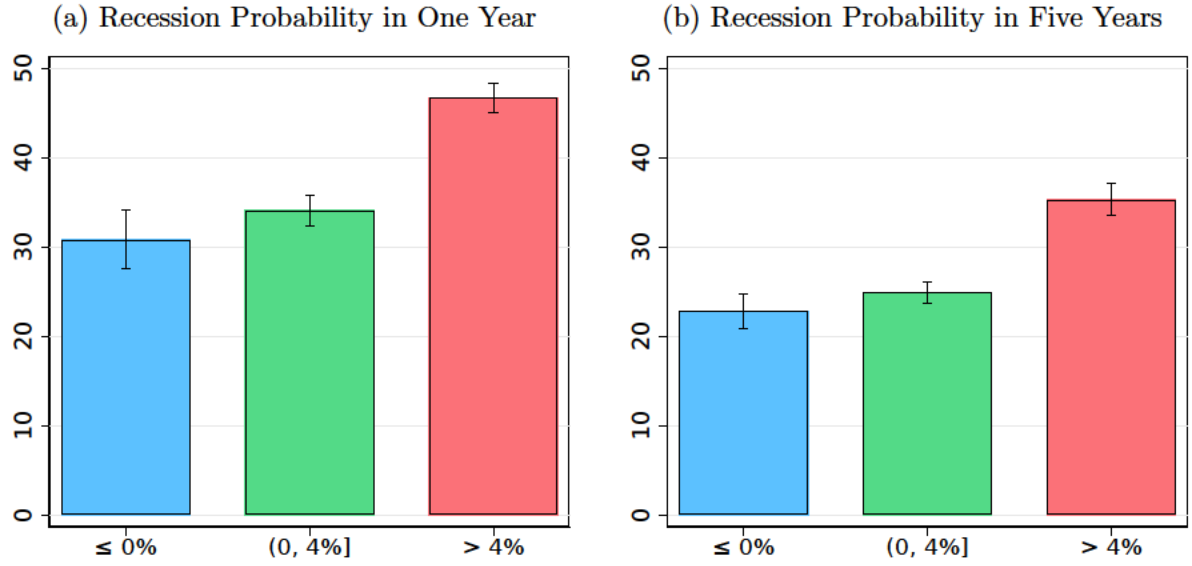
Note: The blue, green and red bars denote the average responses of respondents with three-year-ahead IE less or equal to 0%, in the (0%,4%] range, and strictly greater than 4%, respectively. Respondents are asked to assess to chance the U.S. economy will be in a recession in three years (left panel), 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.15: One- and Five-year-ahead IE and Recession Probabilities, May 2022



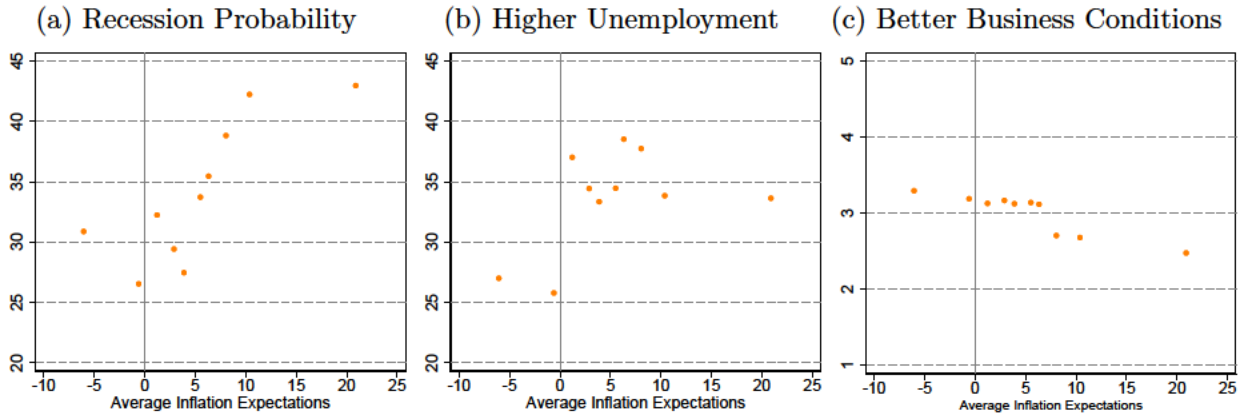
Note: The blue, green and red bars denote the average responses of respondents with one-year-ahead (left panel) and five-year-ahead (right panel) IE less or equal to 0%, in the (0%,4%] range, and strictly greater than 4%, respectively. Respondents are asked to assess the chance that the U.S. economy 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.16: One- and Five-year-ahead IE and Recession Probabilities, June 2023



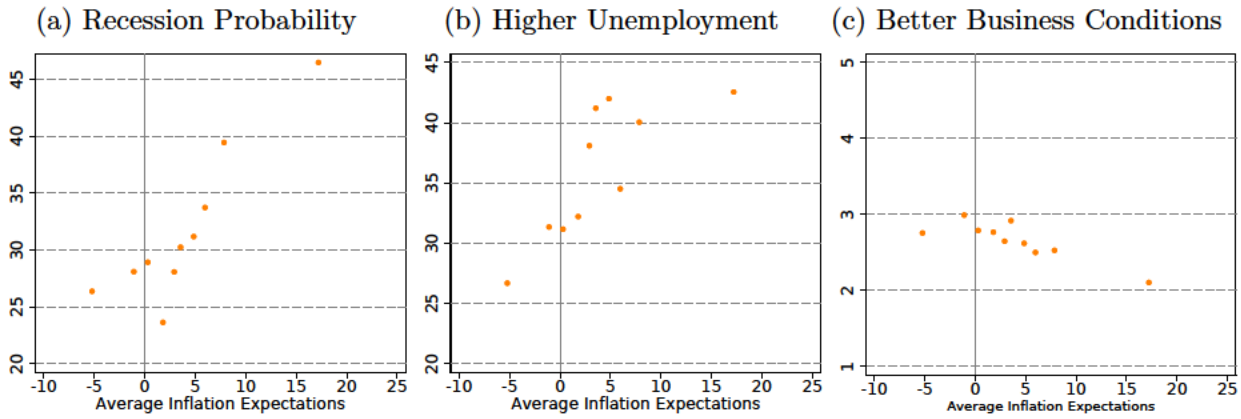
Note: The blue, green and red bars denote the average responses of respondents with one-year-ahead (left panel) and five-year-ahead (right panel) IE less or equal to 0%, in the (0%,4%] range, and strictly greater than 4%, respectively. Respondents are asked to assess the chance that the U.S. economy 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.17: Three-year-ahead IE and Expected Economic Conditions, May 2022



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

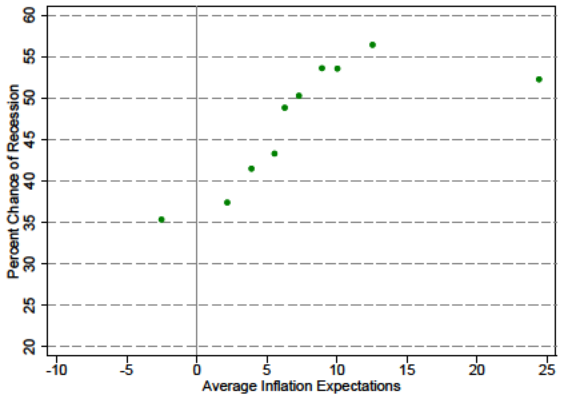
Figure A.18: Three-year-ahead IE and Expected Economic Conditions, June 2023



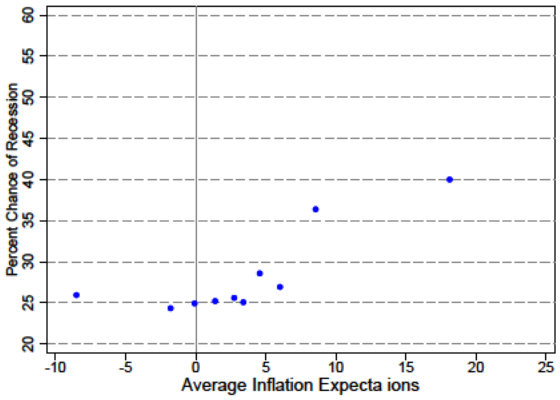
Note: Each dot represents a decile of three-year-ahead IE. Panel (c): 1 = Much Worse and 5 = Much Better.

Figure A.19: One- and Five-year-ahead IE and Recession Probabilities, May 2022

(a) Recession Probability in One Year



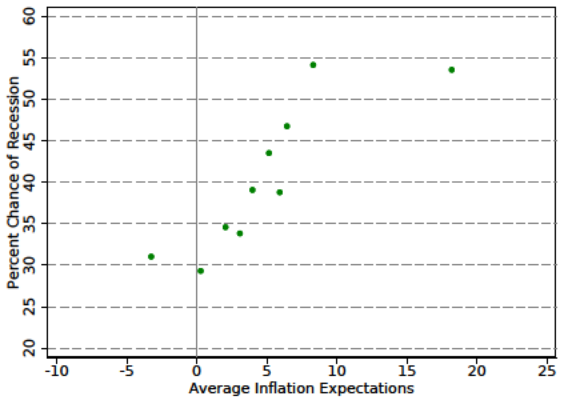
(b) Recession Probability in Five Years



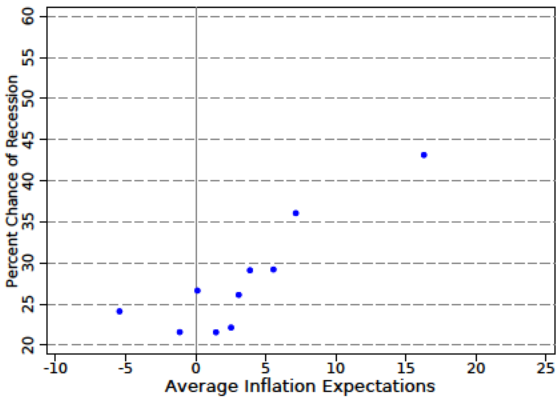
Note: Each dot represents a decile of IE at the 1-year-ahead (left panel) and 5-year-ahead (right panel) horizon.

Figure A.20: One- and Five-year-ahead IE and Recession Probabilities, June 2023

(a) Recession Probability in One Year



(b) Recession Probability in Five Years



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

Table A.1: Price Mean-Reversion and Economic Expectations by Three-Year-Ahead IE, May 2022

	Share expecting prices to revert in 2 to 3 years for:				Average Expected Probability of		
Expectations	Gas	Food	Home Prices	Durables	Recession	↑ Unemployment	Share exp. bus. cond. to improve
Deflation	0.80	0.61	0.68	0.59	28.22	27.28	0.81
Inflation	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***
0-4 % Inf.	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
4+ % Inf	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: Price Mean-Reversion and Economic Expectations by Three-Year-Ahead IE, June 2023

	Share expecting prices to revert in 2 to 3 years for:				Average Expected Probability of		
Expectations	Gas	Food	Home Prices	Durables	Recession	↑ Unemployment	Share exp. bus. cond. to improve
Deflation	0.72	0.57	0.61	0.60	27.14	28.62	0.66
Inflation	0.67	0.47	0.50	0.49	32.76	37.87	0.54
Δ from Exp. Def.	0.05**	0.10***	0.11***	0.11***	-5.62***	-9.25***	0.12***
0-4 % Inf.	0.70	0.50	0.51	0.53	27.83	35.94	0.64
Δ from Exp. Def.	0.02	0.07**	0.10***	0.08	-0.69	-7.33***	0.02
4+ % Inf	0.65	0.43	0.49	0.46	37.60	39.75	0.44
Δ from Exp. Def.	0.07***	0.14***	0.12***	0.15***	-10.46***	-11.13***	0.22***

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

Table A.3: IE and Demographic Characteristics, May 2022

	3-Year			5-Year		
	$\leqslant 0\%$	(0, 4%]	$> 4\%$	$\leqslant 0\%$	(0, 4%]	$> 4\%$
Male	0.44	0.51	0.48	0.39	0.54***	0.49**
College	0.28	0.40***	0.36**	0.28	0.41***	0.35**
Age	50.54	47.69**	52.14	50.95	49.16	51.55
HH Income	67.36	75.76*	68.03	61.67	78.64***	67.28
White	0.84	0.81	0.84	0.81	0.84	0.83
Employed	0.57	0.65*	0.55	0.57	0.62	0.56
High Numeracy	0.63	0.64	0.65	0.56	0.69***	0.65**
Homeowner	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 $\leqslant$0% range at the corresponding horizon. *, **, and *** denote statistically significant differences at the 10%, 5% and 1% level, respectively

Table A.4: IE and Demographic Characteristics, June 2023

	3-Year			5-Year		
	$\leqslant 0\%$	(0, 4%]	$> 4\%$	$\leqslant 0\%$	(0, 4%]	$> 4\%$
Male	0.41	0.53***	0.49*	0.40	0.52***	0.50**
College	0.28	0.41***	0.35**	0.30	0.40***	0.35
Age	50.93	48.97	52.38	50.65	50.50	51.11
HH Income	65.50	75.53**	65.78	60.90	77.55***	63.99
White	0.83	0.82	0.86	0.82	0.84	0.85
Employed	0.55	0.62	0.56	0.58	0.62	0.53
High Numeracy	0.56	0.64*	0.63	0.56	0.66**	0.60
Homeowner	0.72	0.68	0.66	0.70	0.72	0.63

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 $\leqslant$0% range at the corresponding horizon. *, **, and *** denote statistically significant differences at the 10%, 5% and 1% level, respectively

Table A.5: Three-Year-Ahead IE and Price Change Expectations, May 2022

	(a) Gas Price Change			**(b)** Food Price Change		
	$\leqslant 0\%$	(0, 4%]	$> 4\%$	$\leqslant 0\%$	(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		
	$\leqslant 0\%$	(0, 4%]	$> 4\%$	$\leqslant 0\%$	(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.6: Three-Year-Ahead IE and Price Change Expectations, June 2023

	Gas Price Change			Food Price Change			Rent Price Change			Durables Price Change		
	$\leqslant 0\%$	(0, 4%]	$> 4\%$	$\leqslant 0\%$	(0, 4%]	$> 4\%$	$\leqslant 0\%$	(0, 4%]	$> 4\%$	$\leqslant 0\%$	(0, 4%]	$> 4\%$
Mean	1.29	3.73***	10.39***	1.67	4.87***	11.42***	2.74	6.37***	12.67***	1.40	5.10***	10.56***
25%	-4.19	0.99	3.68	-3.97	1.62	4.37	-2.75	2.11	4.70	-4.32	1.65	4.27
Median	0.66	3.16	6.73	1.16	3.56	8.59	1.88	4.49	9.58	1.38	3.79	8.21
75%	5.07	5.70	14.01	4.77	5.92	14.83	5.28	9.58	16.13	5.02	5.63	12.96

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Tables A.5 and A.6 show 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.7: Marginal Effects on Probability of Expecting Inflation Above 4 Percent, May 2022

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Deflation Confusion Question	0.076								0.072
	(0.050)								(0.050)
Gas Price Reversion		-0.036***							0.011
		(0.010)							(0.012)
Food Price Reversion			-0.065***						-0.054***
			(0.010)						(0.016)
Home Price Reversion				-0.038***					-0.018
				(0.010)					(0.011)
Durables Price Reversion					-0.052***				0.001
					(0.012)				(0.017)
Recession in 3 Years						0.435***			0.323***
						(0.068)			(0.080)
Higher Unempl in 3 Years							0.213***		0.006
							(0.064)		(0.069)
Business Cond in 3 Years								-0.096***	-0.053***
								(0.016)	(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.

Tables A.7 and A.8 show the results of regressions where the dependent variable is an indicator for expecting inflation above 4 percent (instead of deflation). In both special surveys, the results are reversed and larger in magnitude relative to those in Tables 2 and 3 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 and 48 percentage points in May 2022 and June 2023, respectively.

Table A.8: Marginal Effects on Probability of Expecting Inflation Above 4 Percent, June 2023

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Deflation Confusion Question	0.027								0.011
	(0.040)								(0.040)
Gas Price Reversion		-0.017*							0.011
		(0.010)							(0.013)
Food Price Reversion			-0.029***						-0.003
			(0.010)						(0.014)
Home Price Reversion				-0.023**					-0.008
				(0.010)					(0.012)
Durables Price Reversion					-0.033***				-0.024
					(0.011)				(0.015)
Recession in 3 Years						0.511***			0.450***
						(0.075)			(0.082)
Higher Unempl in 3yr							0.259***		-0.037
							(0.061)		(0.068)
Business Cond in 3yr								-0.121***	-0.089***
								(0.019)	(0.020)
Mean	0.396	0.395	0.396	0.396	0.396	0.395	0.396	0.396	0.395
PseudoR2	0.013	0.015	0.019	0.017	0.020	0.053	0.026	0.045	0.077
Observations	2137	2134	2136	2136	2135	2123	2134	2132	2114

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table A.9: Marginal Effects of Agreeing with Mean-Reversion on Deflation Expectations, May 2022

	(1)	(2)	(3)	(4)	(5)	(6)
Deflation Confusion Question					-0.080**	-0.072**
					(0.035)	(0.034)
Above 4 Gas Reversion	0.070***				0.045*	0.020
	(0.023)				(0.025)	(0.024)
Above 4 Food Reversion		0.083***			0.063**	0.053*
		(0.025)			(0.030)	(0.031)
Above 4 Home Reversion			0.073***		0.056**	0.055**
			(0.024)		(0.025)	(0.025)
Above 4 Durables Reversion				0.046*	-0.035	-0.035
				(0.026)	(0.030)	(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.

Tables A.9 and A.10 report regression results for specifications with binary variables for whether the respondent agrees with the price reversal statement (response above 4). In May 2022, 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 inflation. Assuming stable beliefs in the population about price mean-reversion (note the use of "in general" in the wording of the question), the estimates imply that 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 mean-reversion 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.9, column 5). The results are qualitatively similar, albeit a bit smaller in magnitude, in June 2023.

Table A.10: Marginal Effects of Agreeing with Mean-Reversion on Deflation Expectations, June 2023

	(1)	(2)	(3)	(4)	(5)	(6)
Deflation Confusion Question					0.011	0.024
					(0.030)	(0.029)
Above 4 Gas Reversion	0.060**				0.051*	0.030
	(0.025)				(0.028)	(0.027)
Above 4 Food Reversion		0.049*			0.034	0.026
		(0.028)			(0.035)	(0.035)
Above 4 Home Reversion			0.052*		0.041	0.042
			(0.027)		(0.027)	(0.028)
Above 4 Durables Reversion				0.020	-0.033	-0.028
				(0.028)	(0.036)	(0.036)
Recession in 3 Years						-0.057
						(0.063)
Higher Unempl in 3yr						-0.133**
						(0.053)
Business Cond in 3yr						0.046***
						(0.015)
Mean	0.212	0.211	0.211	0.211	0.212	0.210
PseudoR2	0.026	0.023	0.024	0.021	0.028	0.053
Observations	2134	2136	2136	2135	2133	2114

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

Table A.11: Marginal Effects of Price Change Expectations on Deflation Expectations, May 2022

	(1)	(2)	(3)	(4)	(5)
Deflation Confusion Question					-0.055
					(0.035)
Gas Price Change in 3 Years	-0.007***				-0.002
	(0.001)				(0.002)
Food Price Change in 3 Years		-0.009***			-0.003
		(0.002)			(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.11 shows that, in the May 2022 special survey, 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. The effects are larger in the June 2023 special survey (see Table A.12): here reporting 10 percentage points lower expected price changes for each of these spending items is associated with a 16 to 21 percentage point increase in the probability of expecting deflation.

Table A.12: Marginal Effects of Price Change Expectations on Deflation Expectations, June 2023

	(1)	(2)	(3)	(4)	(5)
Deflation Confusion Question					0.028
					(0.029)
Price of Gas in 3 Years	-0.016***				0.002
	(0.002)				(0.003)
Price of Food in 3 Years		-0.021***			-0.011***
		(0.003)			(0.004)
Price of Rent in 3 Years			-0.019***		-0.014***
			(0.002)		(0.004)
Price of Durables in 3 Years				-0.021***	-0.001
				(0.002)	(0.005)
Recession in 3 Years					0.057
					(0.063)
Higher Unempl in 3yr					-0.076
					(0.054)
Business Cond in 3yr					0.034*
					(0.018)
Mean	0.211	0.206	0.207	0.196	0.199
PseudoR2	0.085	0.124	0.120	0.112	0.147
Observations	1971	1941	1956	1936	1763

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.010$

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 Deflation

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
○	○	○	○	○

C Additional questions from the June 2023 SCE Special Survey

Drivers of Changes in Inflation Perceptions/Expectations

Earlier you said that you think the rate of [inflation/deflation] was [Y]% this year **(between June 2022 and June 2023)** and that you expect the rate of [inflation/deflation] to be [Z]% next year **(between June 2023 and June 2024)**.

Which factors do you think will contribute to [this increase in the rate of inflation / inflation remaining unchanged / this decrease in the rate of inflation][29]?

The order of the factors was randomized across respondents. The factors were listed in a table, with a 1-5 Likert scale next to each factor.

Not at all important				Very important
1	2	3	4	5

Government spending

Bad government policies

Fiscal stimulus during Covid

Federal Reserve policies (interest rates and money supply)

Product shortages and supply chain issues

Improvement in supply chain issues

The war in Ukraine

Covid-related shutdowns

What goes up must come down

Worker shortages and staffing problems

Improved labor market conditions

Workers demanding higher wages

Strong demand for goods and services

Weaker demand for goods and services

Companies making record profits or price gouging

International geopolitical tensions

[29]Depending on whether $Z > Y$, $Z = Y$ or $Z < Y$. The other questions in the June 2023 special survey are the same as in the May 2022 special survey, but with dates shifted accordingly for questions involving three- or five-year-ahead horizons.