Inflation Expectations Anchoring: New Insights from Microevidence of a Survey at High Frequency and of Distributions*

Nikos Apokoritis,[a] Gabriele Galati,[b] and Richhild Moessner[c]
[a]IRI
[b]De Nederlandsche Bank
[c]University of Heidelberg, Bank for International Settlements, and CESifo

We analyze the anchoring of long-term euro-area inflation expectations in the decade following the Global Financial Crisis, by exploring a new weekly survey, conducted among around 25 macroanalysts from 2010 to 2018. We perform a battery of tests on level expectations from the weekly survey and measures based on the distribution of inflation expectations from a quarterly survey. These include measures of uncertainty, the probability of expected long-term inflation lying between 1.5 percent and 2.5 percent, and deflation risk. We find that long-term euro-area inflation expectations remained broadly anchored to the European Central Bank's inflation aim.

JEL Codes: E31, E58, F62.

1. Introduction

This paper provides new evidence on the anchoring of inflation expectations of professionals using a new data set on short- and long-term inflation expectations in the euro area, which is based on a new survey at weekly frequency.

*The views expressed are those of the authors and do not necessarily reflect those of the Bank for International Settlements, De Nederlandsche Bank, or the Eurosystem. We would like to thank Maurice Bun, Sebastiano Manzan, an anonymous referee, and participants at the Bank of England CCBS Chief Economists' Workshop 2019 and the Swiss Society of Economics and Statistics Annual Conference 2021 for useful comments and discussions. Author e-mails: nikosapok@gmail.com, e.b.g.galati@dnb.nl, richhild.moessner@uni-heidelberg.de.

Inflation expectations play a key role in macroeconomic models and monetary policy (Bernanke 2007, 2022; Williams 2022). They are carefully monitored by central banks to gauge how private agents perceive the credibility of monetary policy in pursuing price stability. In the decade following the Global Financial Crisis, the credibility of monetary authorities in advanced economies was challenged by persistently low inflation. With inflation stuck at low levels and policy rates close to their effective lower bound, there were growing concerns that long-term inflation expectations would fall below central banks' inflation targets, thereby affecting the effectiveness of monetary policy (Schnabel 2021). When central banks reviewed their monetary strategies in those years, efforts to better anchor inflation expectations therefore played a significant role (Powell 2020; European Central Bank 2021). Since mid-2021, instead, global inflation increased persistently, raising concerns about a de-anchoring of inflation expectations on the upside.

A key question in the policy debate and the research literature is therefore whether inflation expectations have been firmly anchored to central banks' price inflation targets (e.g., Corsello, Neri, and Tagliabracci 2019; Moessner and Takáts 2020; Bems et al. 2021; Goel and Tsatsaronis 2022). This is particularly the case for the euro area, where significant cross-country differences in wage and price setting make the coordinating role of a nominal anchor more important (Cœuré 2019).

In the literature, the concept of anchored inflation expectations refers to long-term expectations and is defined in terms of several conditions (Kumar et al. 2015; Neri et al. 2022). First, average expectations should be close to the central bank's target ("level anchoring"). Second, long-term expectations should not co-move with changes in actual inflation, inflation surprises, or short-term expectations ("shock anchoring"). Third, expectations should not be overly dispersed among individuals. Fourth, agents should be fairly confident about their best guess of future inflation and have little uncertainty about the long term. And finally, agents should not attach a large weight to extreme inflation outcomes in the future. According to this view, a full picture of anchoring of expectations would therefore involve information also on the higher moments of their distribution.

Expectations of different types of agents—market participants, professional forecasters, firms, and households—matter for the transmission of monetary policy to the economy. Over the past years, also because of an increasing availability of data, inflation expectations held by firms and households have come to play a bigger role in both research and policy (Candia, Coibion, and Gorodnichenko 2021; Adrian 2022; D'Acunto, Malmendier, and Weber 2022; Neri et al. 2022; Weber et al. 2022). Nevertheless, central banks are, in practice, still focusing on inflation expectations held by professional forecasters and financial market participants (European Central Bank 2021). One reason is that expectations of financial market participants play an important role in the monetary transmission mechanism, since they are a driver or financial prices and hence financing conditions for firms and households. Another reason is that expectations of professional forecasters can be an input in wage negotiations and firms' price-setting decisions (see, e.g., Conflitti and Zizza 2021).

We shed new light on the behavior of short- and long-term euro-area inflation expectations between July 2010 and December 2018 by using microevidence from a new type of survey at weekly frequency. This survey has been conducted since July 2010 among economists, financial analysts, and statisticians at De Nederlandsche Bank (DNB, the Dutch central bank). Participants answer every week on Monday a questionnaire about their short- and long-term expectations of euro-area Harmonised Index of Consumer Prices (HICP) inflation.

Our survey has two main advantages with respect to existing surveys of professionals. First, the weekly frequency of our survey is unique since surveys of professional forecasters' expectations are typically conducted at monthly or quarterly frequency. The higher frequency of our survey allows a richer characterization of the anchoring of inflation expectations by using methods that in the literature have been applied to high-frequency data on market-based expectations measures. In particular, the high frequency allows an analysis of the reaction of expectations to news about inflation in the euro area. In this respect, our paper is related to research that exploits variation across survey panelists in the exact survey dates in monthly or quarterly surveys to investigate the effect of macroeconomic news and monetary policy decisions on expectations. These papers typically

examine expectations of households and focus on the United States.[1] To our knowledge, the paper by Bottone and Rosolia (2019), which examines the response of Italian firms' expectations of inflation in Italy to monetary policy shocks, is the only paper focusing on the euro area using this approach. In this respect, our paper is also related to that of Clements (2012); however, he uses a different approach than ours and relies on low-frequency survey data. By contrast, a large literature exists on whether financial market expectations pay attention to data releases, due to the availability of financial market data at high frequency (daily and intraday) (see, e.g., Fleming and Remolona 1997; Gürkaynak, Levin, and Swanson 2010; Beechey, Johannsen, and Levin 2011). Due to the high (weekly) frequency of the DNB survey, it allows us to study this question also for survey expectations.

Second, survey participants also answer once per quarter questions about the entire distribution of their inflation expectations. Only a few surveys of professional forecasters provide information about the probability distribution of individuals' inflation expectations, including the Survey of Professional Forecasters for the euro area (e.g., Rich and Tracy 2018), the Bank of England survey of external forecasters (Boero, Smith, and Wallis 2008), and the Survey of Professional Forecasters (D'Amico and Orphanides 2008) and the Federal Reserve Bank of New York Survey of Consumer Expectations (Bruine de Bruin et al. 2011) for the United States.

We use several methods to study whether long-term euro-area inflation expectations of DNB survey respondents have been well anchored, in line with the different conditions used in the literature to define anchoring.

To assess level anchoring of DNB survey inflation expectations, we investigate whether the European Central Bank's (ECB's) inflation aim has acted as a focal point for expectations. As an alternative focal point, we also test the role of Consensus survey inflation

[1]These papers on expectations of U.S. households use data from the Federal Reserve Bank of New York's Survey of Consumer Expectations (De Fiore, Lombardi, and Schuffels 2019; Binder, Campbell, and Ryngaert 2022), a Gallop survey (Lewis, Makridis, and Mertens 2019), or an ad hoc survey (Lamla and Vinogradov 2019).

expectations, which are included in the information set available to DNB survey participants.

To assess shock anchoring of long-term DNB survey expectations, we test whether they responded to data releases on inflation or to inflation data surprises. The response of long-term inflation expectations to macroeconomic data surprises is a common measure for the anchoring of inflation expectations (Gürkaynak et al. 2007; Beechey, Johannsen, and Levin 2011). If long-term expectations are well anchored, they should not respond to data surprises.

We also study whether long-term inflation expectations of DNB survey respondents have been shock anchored by investigating whether changes in long-term DNB survey expectations responded to changes in short-term DNB survey expectations. Such an approach has been considered, e.g., in Buono and Formai (2018). We also study whether there has been heterogeneity across survey respondents in these reactions. Heterogeneity in inflation expectations formation may matter for the anchoring of inflation expectations. Busetti et al. (2017) find that under heterogeneity in inflation expectations formation, a sequence of negative shocks may lead inflation to deviate from target and reinforce a de-anchoring of expectations.

Furthermore, we study the distribution of inflation expectations, and consider two measures of the anchoring of long-term inflation expectations based on the full distribution from the quarterly DNB survey, namely uncertainty and the effect of short-term deflation risk on long-term deflation risk.

We consider uncertainty about long-term inflation expectations as a distributions-based measure of the anchoring of long-term inflation expectations (Dovern and Kenny 2020). Moreover, we consider the survey-based probability of future inflation being in a certain range that is consistent with the inflation target as a measure of anchoring, in particular the probability of expected long-term inflation lying between 1.5 percent and 2.5 percent, as proposed by Grishchenko, Mouabbi, and Renne (2019). Relatedly, Mehrotra and Yetman (2018) consider the precision around forecasts of the level of inflation as a measure of the anchoring of inflation expectations.

Second, we consider the effect of short-term on long-term deflation risk from the DNB survey as a measure of the anchoring of long-term inflation expectations. A related measure has been applied to

deflation risk derived from market-based inflation options by Galati et al. (2018), who consider Granger causality between short-term and long-term deflation risk. A related measure is also presented by Antunes (2015) and Natoli and Sigalotti (2018), who analyze the tail co-movement between the moments of short- and long-term distributions of inflation expectations derived from market-based inflation options. Differently from these two papers, we investigate the co-movement of short-term and long-term deflation risk using deflation risk derived from survey-based distributions of inflation expectations, rather than using market-based measures of deflation risk.

Using the weekly survey, almost all the tests we conducted suggest that over the period 2010–18, long-term inflation expectations remained well anchored to the ECB's inflation aim, which has acted as a focal point. By contrast, we find no evidence that professional forecasts (reported by Consensus Economics) acted as focal points. But for one of the approaches we follow, namely tests of the reaction of long-term inflation expectations to short-term expectations, there are subtle signs of long-term inflation expectations not being perfectly well anchored, in line with the conclusions in ECB (2021). We also find that, notwithstanding the relative homogeneity of the sampled population, there is some evidence of heterogeneity in the anchoring of long-term inflation expectations.

Tests that use measures based on the distribution of inflation expectations—uncertainty based on the full distribution, the probability of expected long-term inflation lying between 1.5 percent and 2.5 percent, and the effect of short-term deflation risk on long-term deflation risk—confirm that long-term inflation expectations were well anchored and became better anchored at the end of the sample period in 2018 compared with the start of the sample period in 2011.

The remainder of the paper is organized as follows. Section 2 introduces the DNB inflation expectations survey. Section 3 presents the method and Section 4 the results. Finally, Section 5 concludes.

2. The DNB Inflation Expectations Survey

Since July 2010, participants in the DNB inflation expectations survey answer a questionnaire about their short- and long-term expectations of euro-area HICP inflation every week on Monday.

In addition, participants are asked questions about the distribution of their inflation expectations once per quarter.

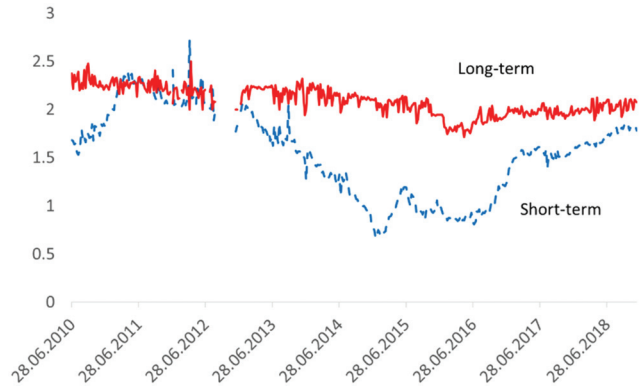
The survey panel consists of around 25 economists, financial analysts, and statisticians employed by DNB per week. In order to deal with panel attrition, new participants are added to the survey panel to replace participants with similar characteristics that left the panel. The participants in this survey have a background that is comparable to that of respondents to the ECB's Survey of Professional Forecasters (SPF), who are experts employed by financial or non-financial institutions, such as economic research institutions (Garcia 2003). In line with other surveys of inflation expectations, participants and their answers are treated anonymously, to encourage participants to submit their input without any concern about forecast errors. Panelists generally receive an e-mail on Monday morning with three questions on their short- and long-term inflation expectations, and generally answer the e-mail within that day. An example of this e-mail is provided in the appendix.

The survey has two novel features compared with existing surveys. First, the weekly frequency is higher than the frequency of other surveys of professional forecasters, which typically ranges from monthly to semi-annual. Secondly, participants in our survey are provided with common information sets. In particular, together with the questionnaire, participants receive each week an update of relevant data related to inflation in the euro area. This background information includes data releases on inflation for the euro area as a whole and for six euro-area member countries (Germany, France, Italy, Spain, the Netherlands, and Belgium) that were published during the previous week, a table with the latest Consensus forecasts for euro-area HICP inflation, and a graph with current and past actual euro-area HICP inflation.

The quarterly information on the distribution of expectations allows for tracking changes in the higher moments of expectations—in particular, uncertainty—over time.

The combination of a homogeneous set of participants, a common information set, and a high frequency allows us to focus on mechanisms of expectations formation and their heterogeneity since the Global Financial Crisis, a period characterized by high uncertainty. In particular, we can study more carefully some aspects of expectation formation, such as how inflation expectations depend on

Figure 1. Euro-Area Inflation Expectations from DNB Survey, in Percent



Note: Mean long-term and short-term euro-area inflation expectations from DNB survey.

realized inflation data and surprises; whether and how the anchoring of expectations changes with a crisis; and the role of focal points, such as the ECB's inflation aim or professional forecasters' inflation predictions.

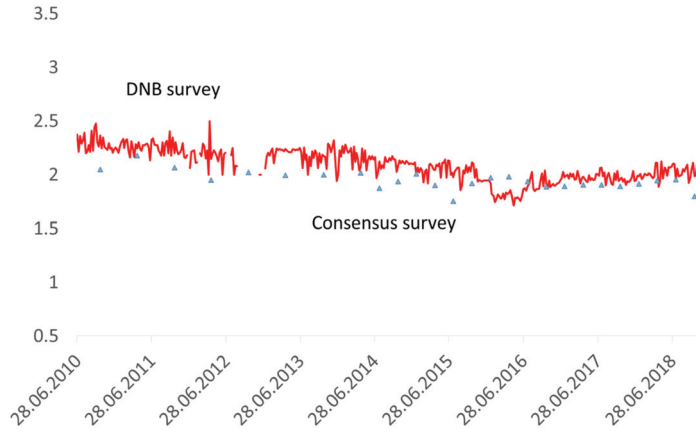
Short-term and long-term mean DNB survey expectations are shown in Figure 1. For long-term DNB survey expectations, these are the direct survey responses. For short-term DNB survey expectations, we interpolate between the current-year, π^c_{it}, and next-year, π^n_{it}, survey responses, in order to obtain a constant-horizon short-term expectation, π^{ST}_{it}, according to

$$\pi^{ST}_{it} = \left(1 - \frac{(m-1)}{11}\right)\pi^c_{it} + \frac{(m-1)}{11}\pi^n_{\mathrm{it}} \tag{1}$$

with $m = 1, \ldots, 12$, and $m = 1$ for January (this is when the survey expectations for the current year and the next year each switch to the following year), $m = 2$ for February, etc.[2] π^{ST}_{it} is referred to as short-term DNB survey expectations in the remainder of this paper.

[2]This is the most commonly used approach in the literature for approximating fixed-horizon forecasts using fixed-event forecasts (e.g., Gerlach 2007; Dovern, Fritsche, and Slacalek 2012; Siklos 2013). For an alternative approach constructing optimal weights, see Knüppel and Vladu (2016).

Figure 2. Long-Term Survey-Based Euro-Area Inflation Expectations, in Percent

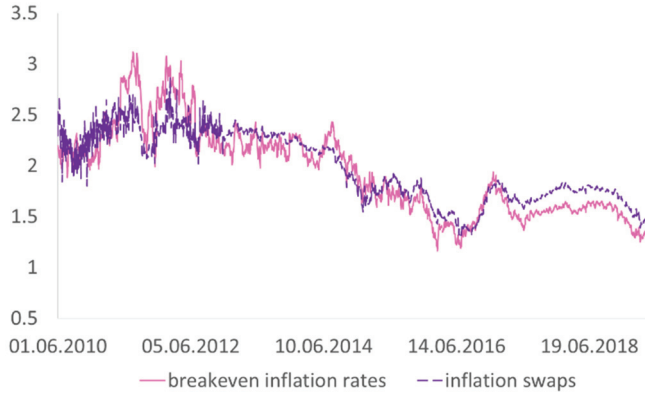


Note: Mean long-term inflation expectations from DNB survey and mean long-term (5 to 10 years ahead) inflation expectations from Consensus Economics surveys.

There is no consensus in the literature on the process through which agents form inflation expectations. Commonly used measures extracted from surveys or financial markets do not provide a uniform answer. In the euro area, for example, there is a visible difference in the level and variance between these two types of measures (see Figures 2 and 3). Survey-based measures are usually quite persistent, while financial-market-based measures are typically quite volatile. Both survey-based measures and financial-market-based measures of inflation expectations have advantages and drawbacks (for an overview, see ECB 2021; Neri et al. 2022). A main disadvantage of survey-based measures is that they are usually only available at low frequency. A main disadvantage of financial-market-based measures is that they are usually affected by risk and liquidity premia.

One caveat about the setup of this survey is that its external validity depends on how representative the participants are of the general population of macroanalysts. In particular, our results may be biased if there are incentive issues for employees of the central bank in our panel despite the anonymous character of the survey. A comparison of long-term DNB survey inflation expectations and

Figure 3. Long-Term Market-Based Euro-Area Inflation Expectations, in Percent



Note: Long-term market-based euro-area inflation expectations; inflation swap rates derived from euro inflation swaps; breakeven inflation rates derived from nominal and index-linked government bonds, average for France and Germany; five-year rates five years ahead.

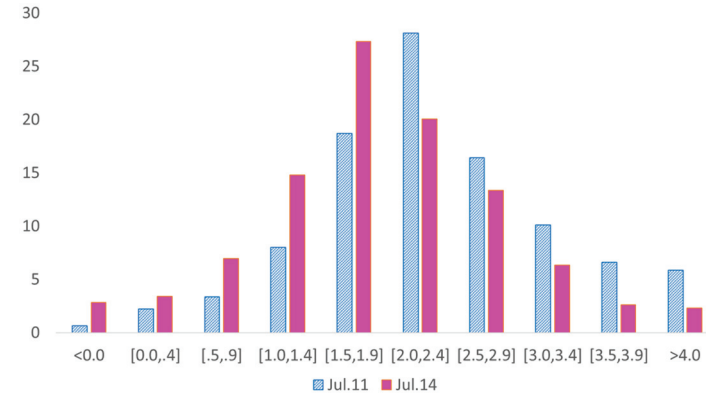
long-term inflation expectations based on Consensus surveys suggests that DNB survey respondents are representative of professional macroanalysts. Figure 2 shows that long-term DNB survey expectations lie in a range similar to that of long-term Consensus survey-based expectations. This similarly holds for short-term inflation expectations.[3]

Long-term inflation expectations from our survey instead differ visibly from those based on financial market prices, namely breakeven inflation rates based on government bond yields, and forward inflation rates based on inflation swaps, which are shown in Figure 3. In both cases we show five-year/five-year forward inflation rates commonly used as a measure of monetary policy credibility. This is in line with the literature, which commonly finds significant differences in expectations measures extracted from surveys and financial market prices.

In addition to the weekly questions about their inflation expectations, participants in the DNB survey are asked questions about

[3]This is available from the authors upon request.

Figure 4. Examples of Distributions of Long-Term Inflation Expectations from DNB Survey, in Percent

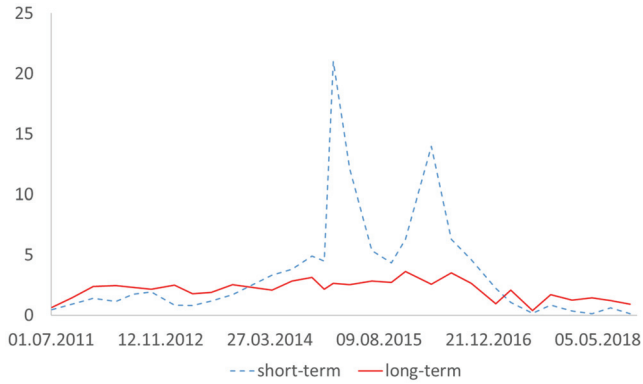


Note: Frequencies of the aggregate full distributions of expected long-term inflation rates per inflation interval from DNB surveys of July 2011 and July 2014, calculated from individual survey responses according to Equation (13); inflation interval in percent shown on x-axis.

the distribution of their short-term and long-term euro-area inflation expectations once per quarter. Survey respondents are asked to assign probabilities to $J = 10$ intervals $j, j = 1, \ldots, J$. These intervals are defined as <0.0, [0.0,.5[, [.5,1.0[, [1.0,1.5[, [1.5,2.0[, [2.0,2.5[, [2.5,3.0[, [3.0,3.5[, [3.5,4.0], and >4.0, in percent, where [,] denotes a closed interval and [, [denotes an interval closed on the left and open on the right. The frequency assigned by respondent i to interval j at horizon h and time t is denoted by $f_{it}^{j,h}$, where $h = LT$ or $h = ST$ for the long-term or short-term horizon, respectively. Examples of DNB survey responses for the distribution of long-term inflation expectations are shown in Figure 4. Figure 5 shows the mean of short-term and long-term deflation risk from the DNB survey over the sample period. Long-term deflation risk, dr_{it}^{LT}, is obtained directly from survey responses for the interval $j = 1$. Short-term deflation risk at a constant horizon, dr_{it}^{ST}, is obtained by interpolating between survey responses for current-year deflation risk, dr_{it}^{c}, and next-year deflation risk, dr_{it}^{n}, according to

$$dr_{it}^{ST} = \left(1 - \frac{(q-1)}{3}\right) dr_{it}^{c} + \frac{(q-1)}{3} dr_{it}^{n} \tag{2}$$

Figure 5. Euro-Area Deflation Risk from DNB Survey



Note: Mean long-term and short-term euro-area deflation expectations from DNB survey, calculated from individual survey responses according to Equation (13).

with $q = 1, \ldots, 4$, and $q = 1$ for the first quarter, $q = 2$ for the second quarter, and so on.

3. Method

We analyze inflation expectations formation by means of panel data estimation over the period June 28, 2010 to December 10, 2018 and with around 25 respondents per week, using weekly data.

We test whether long-term DNB survey expectations are well anchored or not, by verifying whether the different conditions hold that are used in the literature to characterize anchoring. These include average expectations being close to the central bank's target ("level anchoring"); long-term expectations not co-moving with changes in actual inflation, inflation surprises, or short-term expectations ("shock anchoring"); expectations not being overly dispersed between individuals; agents being fairly confident about their best guess of future inflation and having little uncertainty about inflation in the long term; and agents not attaching a large weight to extreme inflation outcomes in the future.

We assess level anchoring by testing whether the ECB's inflation aim of close to but below 2 percent has acted as a focal point for long-term DNB survey expectations, by estimating

Table 1. Role of the ECB's Inflation Aim

Dependent Variable: π^{LT}	**Full Sample Period**	**Including Euro-Area Crisis[1]**	**Post-Euro-Area Crisis[2]**
Constant	2.097^{***}	2.232^{***}	2.007^{***}
Wald Test of Const = 2 (p-value)	0.000	0.000	0.3279
No. of Observations	8,821	3,530	5,291

[1]Including euro-area sovereign debt crisis, June 28, 2010–December 31, 2013.
[2]Post-euro-area sovereign debt crisis, January 6, 2014–December 10, 2018. Pooled OLS regression; robust standard errors.
Note: ***, **, and * represent significance at the 1 percent, 5 percent, and 10 percent levels. Sample period: June 28, 2010–December 10, 2018, weekly data.

$$\pi_{it}^{LT} = c + \varepsilon_{it} \tag{3}$$

using pooled ordinary least squares (OLS) regression with robust standard errors. The results are shown in Table 1.

Consensus survey expectations could act as an alternative focal point for the formation of inflation expectations of DNB survey respondents. To test this hypothesis, we test whether changes in long-term Consensus survey inflation expectations affect changes in long-term DNB survey inflation expectations,

$$\triangle\pi_{it}^{LT} = \alpha_i + \beta\triangle\pi_t^{Cons,LT} + \varepsilon_{it}, \tag{4}$$

where $\pi_t^{Cons,LT}$ are long-term Consensus survey inflation expectations available at the time of the DNB survey in week t. We also include survey individual fixed effects (α_i) to control for any observed or unobserved time-invariant heterogeneity among survey respondents. We use fixed-effects within-group panel estimation. We also estimate Equation (4) for changes in short-term Consensus survey inflation expectations. The results are shown in Table 2.[4]

[4]In principle we could pool Equations (3) and (4) and test the joint hypothesis that the ECB's inflation aim acts as a focal point while survey participants do not react to changes in Consensus Forecasts. In practice, there is little variation in Consensus Forecasts' long-term expectations, and as a consequence, this joint test would have low power to identify any impact of the latter.

Table 2. Effects of Changes in Consensus Survey on Changes in Long-Term DNB Survey Inflation Expectations

Dependent Variable: $\Delta\pi^{LT}$		
$\triangle\pi^{Cons,ST}$	0.0552	—
$\triangle\pi^{Cons,LT}$	—	0.0623
No. of Observations	7,266	7,266

Note: ***, **, and * represent significance at the 1 percent, 5 percent, and 10 percent levels. Sample period: June 28, 2010–December 10, 2018, weekly changes. Fixed-effects within-group panel regression; robust standard errors. Using latest available Consensus survey.

To test for shock anchoring of inflation expectations, we first estimate whether long-term inflation expectations respond to changes in inflation,

$$\triangle\pi_{it}^{LT} = \alpha_i + \beta\triangle\pi_t + \varepsilon_{it}. \tag{5}$$

Here, $\triangle\pi_{it}^{LT}$ are weekly changes in long-term DNB survey expectations of respondent i in week t, and $\triangle\pi_t$ are weekly changes in euro-area HICP inflation (for the weeks in which new HICP inflation data are released, and zero otherwise). The hypothesis is that if long-term expectations are well anchored, they should be unresponsive to short-term developments in actual inflation, hence the estimate of β should not be significantly different from 0. Here and in the following regressions we again include survey individual fixed effects to control for any observed or unobserved time-invariant heterogeneity among survey respondents, and use fixed-effects within-group panel estimation. We use robust standard errors in this and all other regressions in this paper. We also estimate another variant of Equation (5) where we replace weekly changes in euro-area HICP inflation by weekly changes in the flash estimate of euro-area HICP inflation, $\triangle\pi_t^{flash}$. The results are shown in columns 1 and 2 of Table 3.

As a variant of the previous test, we also verify whether long-term DNB survey expectations respond to surprises in inflation, as

Table 3. Effects of Changes in Inflation, Inflation Surprises, and Short-Term DNB Survey Expectations on Changes in Long-Term DNB Survey Inflation Expectations

	(1)	(2)	(3)	(4)	(5)
Dependent Variable	$\Delta\pi^{LT}$	$\Delta\pi^{LT}$	$\Delta\pi^{LT}$	$\Delta\pi^{LT}$	$\Delta\pi^{LT}$
$\Delta\pi$	0.0013	—	—	—	—
$\Delta\pi^{flash}$	—	0.0064	—	—	—
π^{sur}	—	—	–0.076	—	—
$\pi^{flash,sur}$	—	—	—	0.018	—
$\Delta\pi^{ST}$	—	—	—	—	0.0755*
No. of Observations	7,266	7,266	1,761	1,656	7,266

Note: ***, **, and * represent significance at the 1 percent, 5 percent, and 10 percent levels. Sample period: June 28, 2010–December 10, 2018, weekly changes. Fixed-effects within-group panel regression; robust standard errors. Inflation surprises relative to median Bloomberg survey expectations.

measured by actual euro-area HICP inflation minus median Bloomberg survey expectations, π_t^{sur}, according to

$$\triangle\pi_{it}^{LT} = \alpha_i + \beta\pi_t^{sur} + \varepsilon_{it}. \tag{6}$$

This empirical specification is similar to that typically used in the empirical literature on inflation expectations anchoring that relies on high-frequency market-based measures of inflation expectations. We also estimate Equation (6) when replacing surprises in euro-area HICP inflation with surprises in the flash estimate of euro-area HICP inflation, $\pi_t^{flash,sur}$, since there is evidence that flash data releases for inflation have a bigger impact on financial-market-based inflation expectations compared with the final data releases (Garcia and Werner 2018). The results are shown in columns 3 and 4 of Table 3.

As a further test of whether long-term DNB survey expectations are well anchored in the sense of shock anchoring, we also estimate whether they respond to changes in short-term DNB survey expectations,

$$\triangle\pi_{it}^{LT} = \alpha_i + \beta\triangle\pi_{it}^{ST} + \varepsilon_{it}, \tag{7}$$

where $\triangle\pi_{it}^{ST}$ are weekly changes in short-term DNB survey expectations, again using fixed-effects within-group panel estimation. This is a common test of expectations anchoring in the literature. The hypothesis here is that if long-term inflation expectations are well anchored to the central bank's inflation target, they should be unresponsive to changes in short-term inflation expectations, which reflect changing views of the short-term economic outlook. The results are shown in column 5 of Table 3.

To assess whether expectations anchoring is dispersed between individuals, we first consider possible heterogeneity in whether the ECB's inflation aim of close to but below 2 percent has acted as a focal point for long-term DNB survey expectations, by allowing the intercept in the regression of long-term expectations to vary by respondent,

$$\pi_{it}^{LT} = c_i + \varepsilon_{it}. \tag{8}$$

Moreover, we study possible heterogeneity in the anchoring of long-term DNB survey expectations by allowing the coefficient of changes in long-term expectations on changes in HICP inflation to vary by respondent,

$$\triangle\pi_{it}^{LT} = \alpha_i + \beta_i \triangle\pi_t + \varepsilon_{it}. \tag{9}$$

We also study possible heterogeneity in the response of long-term DNB survey expectations to changes in short-term DNB survey expectations, by allowing the coefficient on changes in short-term DNB survey expectations to vary by respondent,

$$\triangle\pi_{it}^{LT} = \alpha_i + \beta_{\mathrm{i}} \triangle\pi_{it}^{ST} + \varepsilon_{it}. \tag{10}$$

The regressions of Equations (8), (9), and (10) all use fixed-effects within-group panel estimation.

Our survey allows us to also assess the role of demographic characteristics in the anchoring properties of long-term inflation expectations, considering age and gender on which we have information in the DNB survey. To do so, we rerun the regressions of Equations (3), (5), and (7) separately for women and men, as well as separately for the group of younger respondents (below 40 years of age) and of older respondents (40 years of age or above).

Furthermore, we study the anchoring of long-term inflation expectations by considering measures based on the full distribution and the second moments of the distribution. We consider disagreement between respondents (the second moment of the distribution of different agents' levels expectations), as well as average individual uncertainty from the quarterly DNB survey of individuals' expected distributions. The underlying idea is that changes in the higher moments of the distribution of long-term inflation expectations could foreshadow changes in the anchoring of the mean of the distribution.

For their expectations to be well anchored, there should be little disagreement between agents. Our survey allows us to determine disagreement between individual respondents as well as average individual uncertainty about long-term expected inflation. We calculate disagreement between individual respondents about long-term expected inflation as the standard deviation of individual respondents' expected levels of inflation in the long term, from the weekly surveys of levels.

Another condition for well-anchored expectations is that agents should be fairly confident about their best guess of future inflation and have little uncertainty about inflation in the long term. As argued by Kumar et al. (2015), the idea is that agents should perceive little risk of either high or low inflation in the future, and hence consider the range of possible outcomes for inflation to be limited. Importantly, this condition—and the concept of anchored expectations more generally—refers to expectations over the long term, over which unpredictable shocks and consequent short- to medium-term deviations from the inflation target have faded.

We determine average individual uncertainty about long-term expected inflation at time t from the average of individuals' interquartile range of their expected probability distribution of inflation in the long term, using the quarterly survey of distributions at time t. To determine the interquartile range of individual i at time t, we first calculate the expected cumulative distribution of individual i at time $t, cdf_{it}^{j,LT}$, from the frequencies assigned by respondent i to the 10 intervals at time t for the long-term horizon, $f_{it}^{k,LT}$. From this cumulative distribution we determine the first quartile, $\mathrm{Q1}_{it}^{LT}$, as the midpoint of the inflation interval j in which the cumulative distribution first reaches 0.25. That is, we assume that the

probability mass in each interval is concentrated at its midpoint. For the open intervals at either end of the distribution, we truncate the distribution by assuming that the interval has the same size as the other intervals, 0.5 percentage point (pp). Both these assumptions are based on D'Amico and Orphanides (2008). Similarly, we determine the third quartile, $\mathrm{Q3}_{it}^{LT}$, as the midpoint of the inflation interval in which the cumulative distribution first reaches 0.75. The interquartile range of the expected distribution of long-term inflation of individual i is then given by $iqr_{it}^{LT} = \mathrm{Q3}_{\mathrm{it}}^{LT} - \mathrm{Q1}_{it}^{LT}$. The average individual interquartile range at time t, iqr_t^{LT}, is then calculated as the average of the interquartile range over all N respondents. Average individual uncertainty about long-term expected inflation, $unc_t^{indiv,LT}$, is then calculated as the average individual interquartile range iqr_t^{LT} divided by 1.35 to make this measure more comparable to the standard deviation used as a measure for disagreement, since for a normal probability distribution the standard deviation equals the interquartile range divided by 1.35. Average individual uncertainty about long-term expected inflation is then given by

$$unc_t^{indiv,LT} = \frac{1}{1.35}\frac{1}{N}\sum_{i=1}^{N} iqr_{it}^{LT}. \tag{11}$$

Next, we study the anchoring of long-term inflation expectations by considering a measure based on the full aggregate distribution of inflation expectations from the quarterly DNB survey, namely the probability of future euro-area inflation being in a range that is consistent with the inflation target as a measure of anchoring. For expectations to be well anchored, agents should not attach a large weight to extreme inflation outcomes in the future. We therefore consider the survey-based probability of future euro-area inflation being in a certain range that is consistent with the inflation target as a measure of anchoring—in particular, the probability of expected long-term inflation lying between 1.5 percent and 2.5 percent (as in Grishchenko, Mouabbi, and Renne 2019). This probability, ptr_t^{LT}, is calculated as the sum of the frequencies assigned in the aggregated histogram at the long-term horizon at time t to inflation being in the two intervals $j = 5$ and $j = 6$, which together make up the interval between 1.5 percent and 2.5 percent, according to

$$ptr_t^{LT} = \sum_{j=5}^{6} f_t^{j,h}. \tag{12}$$

Here, the frequency of the aggregate histogram at time t in each interval j, $f_t^{j,h}$, is calculated according to (see Krueger and Nolte 2016)

$$f_t^{j,h} = \frac{1}{N} \sum_{i=1}^{N} f_{it}^{j,h}, \tag{13}$$

where N is the number of respondents to the survey questions about the distribution of inflation expectations. That is, we construct a histogram of the aggregate distribution of inflation expectations by a linear combination of the histograms of the individual distributions, with equal weights.

Finally, we consider information from the tails of individuals' expected distributions on the anchoring of long-term inflation expectations. To test whether long-term DNB survey expectations are well anchored or not, we estimate whether changes in long-term deflation risk respond to changes in short-term deflation risk derived from the DNB survey,

$$\triangle dr_{it}^{LT} = \alpha_i + \beta \triangle dr_{it}^{ST} + \varepsilon_{it}, \tag{14}$$

where $\triangle dr_{it}^{LT}$ are quarterly changes in long-term deflation risk, and $\triangle dr_{it}^{ST}$ are quarterly changes in short-term deflation risk, again using fixed-effects within-group panel estimation. The results are shown in Table 7.

4. Results

Overall, most but not all empirical tests suggest that over the period 2010–18, inflation expectations measured by our DNB survey have remained well anchored to the ECB's inflation aim. Our main findings are presented in this section.

First, we find evidence of well-anchored long-term inflation expectations based on the level-anchoring condition. The ECB's inflation aim has acted as a focal point for long-term DNB survey expectations, especially after the euro-area sovereign debt crisis, where we cannot reject that the mean of long-term DNB survey

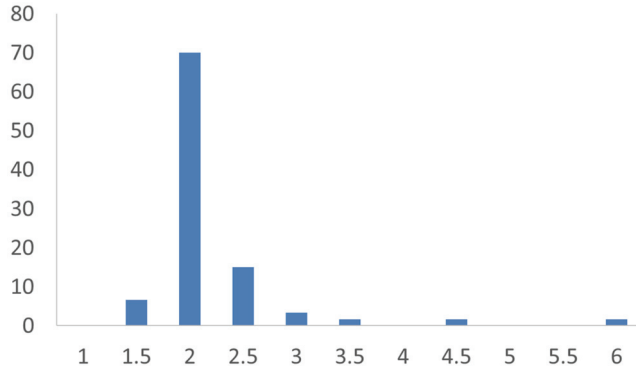
expectations equals 2 percent based on Equation (3) (Table 1). This is the case even though the mean short-term DNB inflation expectations were well below 2 percent after the euro-area crisis, at around 1.25 percent. But in the period including the euro-area sovereign debt crisis, mean long-term DNB survey expectations were slightly (around 25 basis points) above 2 percent (Table 1).

We find that Consensus surveys, which are provided to survey respondents as part of a common information set, do not act as focal points for long-term DNB survey expectations. There are no significant reactions of changes in long-term DNB survey expectations to changes in either long-term or short-term Consensus survey expectations based on Equation (4) (Table 2).

Second, tests for shock anchoring show some subtle signs of not perfectly well-anchored long-term inflation expectations for the group of survey respondents as a whole. There are no significant reactions of changes in long-term DNB survey expectations to changes in inflation, or in the flash estimate of inflation based on Equation (5) (Table 3, columns 1 and 2). Similarly, there are no significant reactions of changes in long-term DNB survey expectations to surprises in inflation, or in the flash estimate of inflation using Equation (6) (Table 3, columns 3 and 4). However, the coefficient of changes in long-term DNB survey expectations on changes in short-term DNB survey expectations is statistically significant, although only at the 10 percent significance level, and economically small (with a value of around 0.08) using Equation (7) (Table 3, column 5). This is consistent with results on subtle signs of a change in the anchoring properties of long-term inflation expectations found in other papers for the euro area (see ECB 2021).

Third, we find evidence that notwithstanding a fairly homogenous panel of survey participants and a common information set, there is heterogeneity across survey participants in their expected level of future inflation and the responsiveness of their expectations to shocks. The results for the individual intercepts c_i of Equation (8), which provide a measure of level anchoring, are shown as a histogram in Figure 6. We can see that there is some heterogeneity in this intercept. We therefore find some evidence of heterogeneity across survey respondents on whether the ECB's inflation aim of close to but below 2 percent has acted as focal point for long-term DNB survey expectations.

Figure 6. Heterogeneity in ECB's Inflation Aim Acting as Focal Point for Long-Term DNB Survey Inflation Expectations

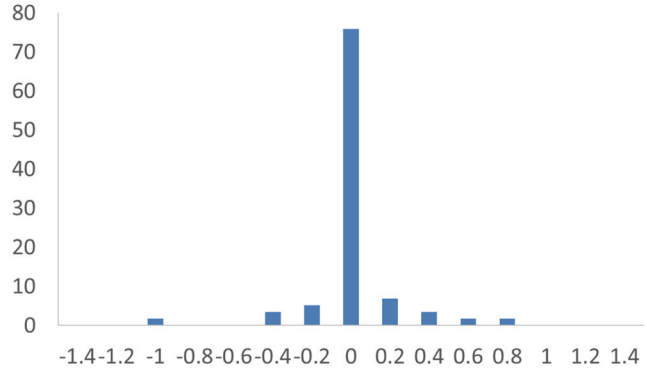


Note: Histogram of individuals' constant term c_i from Equation (8), for bins of width 0.5 pp with midpoint of bin shown on x-axis (in percent), from regression over full sample period of June 28, 2010–December 10, 2018.

The results for the coefficients β_i in estimates of Equation (9) suggest that there is also some heterogeneity in the response of long-term DNB inflation expectations to inflation (see Figure 7). Similarly, the results for the coefficients β_i in estimates of Equation (10) suggest that there is also some heterogeneity in the response of long-term to short-term DNB inflation expectations (see Figure 8). We therefore find some evidence of heterogeneity in the shock-anchoring properties across survey respondents on these measures.

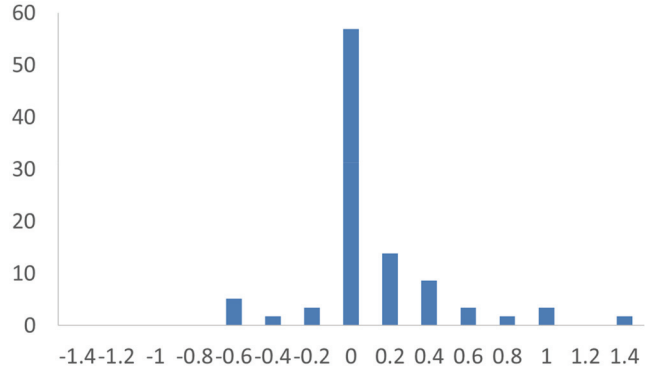
Fourth, heterogeneity across survey participants in the anchoring of long-term inflation expectations can in part be explained by demographic characteristics. The results of Equation (3) estimated separately for women and men are shown in Table 4 (columns 1 and 2). The intercept is significantly above the ECB's inflation aim of 2 percent for both women and men, but it is slightly higher for men. This also suggests that within this group of professionals, long-term inflation expectations of women are slightly better anchored than those of men. The results of Equation (3) estimated separately for the group of younger and older respondents are also shown in Table 4 (columns 3 and 4). The intercept is slightly below the ECB's

Figure 7. Heterogeneity in Effect of Changes in Inflation on Changes in Long-Term DNB Survey Inflation Expectations



Note: Histogram of individuals' coefficient β_i from Equation (9), for bins of width 0.2 with midpoint of bin shown on x-axis, from regression over full sample period of June 28, 2010–December 10, 2018.

Figure 8. Heterogeneity in Effect of Changes in Short-Term on Changes in Long-Term DNB Survey Inflation Expectations



Note: Histogram of individuals' coefficient β_i from Equation (10), for bins of width 0.2 with midpoint of bin shown on x-axis, from regression over full sample period of June 28, 2010–December 10, 2018.

Table 4. Demographic Characteristics and Role of ECB's Inflation Aim

	(1)	(2)	(3)	(4)
Demographic Characteristics	Female	Male	Young	Old
Dependent Variable	π^{LT}	π^{LT}	π^{LT}	π^{LT}
Constant	2.0519^{***}	2.1053^{***}	1.9645^{***}	2.1784^{***}
Wald Test of Const=2 (p-value)	0.0000	0.0000	0.0000	0.0000
No. of Observations	1,402	7,419	3,364	5,457

Note: ***, **, and * represent significance at the 1 percent, 5 percent, and 10 percent levels. Sample period: June 28, 2010–December 10, 2018, weekly data. Pooled OLS regression; robust standard errors.

Table 5. Role of Demographic Characteristics for Effects of Changes in Inflation on Changes in Long-Term DNB Survey Inflation Expectations

	(1)	(2)	(3)	(4)
Demographic Characteristics	Female	Male	Young	Old
Dependent Variable	$\Delta\pi^{LT}$	$\Delta\pi^{LT}$	$\Delta\pi^{LT}$	$\Delta\pi^{LT}$
$\Delta\pi$	–0.0237	0.0079	0.0220	–0.0010
No. of Observations	1,092	6,174	2,688	4,578

Note: ***, **, and * represent significance at the 1 percent, 5 percent, and 10 percent levels. Sample period: June 28, 2010–December 10, 2018, weekly data. Fixed-effects within-group panel; robust standard errors.

inflation aim of 2 percent for younger respondents, but it is slightly above 2 percent for older respondents, and both results are significant. This also suggests that within this group of professionals, long-term inflation expectations of younger respondents are slightly better anchored than those of older ones.

The results of Equation (5) estimated separately for women and men are shown in Table 5 (columns 1 and 2). Those estimated separately for the group of younger and older respondents are also shown in Table 5 (columns 3 and 4). The coefficient for the effects of changes in HICP inflation on changes in long-term expectations is insignificant for all the four different demographic groups, as in the sample

Table 6. Role of Demographic Characteristics for Effects of Changes in Short-Term on Changes in Long-Term DNB Survey Inflation Expectations

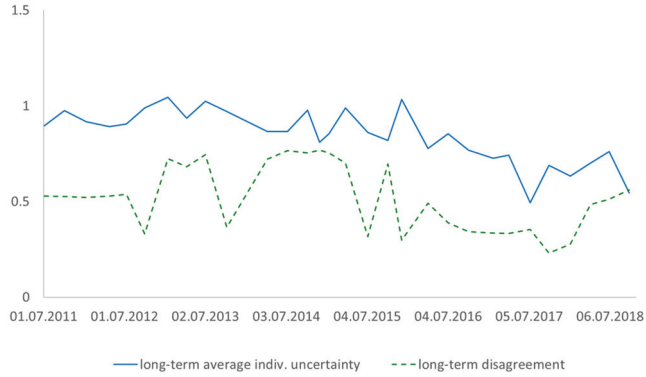
	(1)	(2)	(3)	(4)
Demographic Characteristics	Female	Male	Young	Old
Dependent Variable	$\Delta\pi^{LT}$	$\Delta\pi^{LT}$	$\Delta\pi^{LT}$	$\Delta\pi^{LT}$
$\Delta\pi^{ST}$	0.0251	0.0861***	0.0832	0.0708**
No. of Observations	1,092	6,174	2,688	4,578

Note: ***, **, and * represent significance at the 1 percent, 5 percent, and 10 percent levels. Sample period: June 28, 2010–December 10, 2018, weekly changes. Fixed-effects within-group panel regression; robust standard errors.

as a whole shown in Table 3. We therefore find that these demographic characteristics do not affect the anchoring properties on this measure.

The results of Equation (7) estimated separately for women and men are shown in Table 6 (columns 1 and 2). The coefficient for the effects of short-term expectations on long-term expectations is larger and more significant for men than for women. We therefore find that on this anchoring measure, the expectations of women are better anchored than those of men within this group of professionals. Household surveys tend to find that women's inflation expectations are less well anchored than those of men (see, e.g., Galati, Moessner, and van Rooij 2021 for euro-area expectations). The difference is likely to arise since we are considering a group of professionals, rather than households representative of the whole population. Moreover, most household surveys consider short- or medium-term inflation expectations rather than long-term expectations. The results of Equation (7) estimated separately for the group of younger and older respondents are also shown in Table 6 (columns 3 and 4). The coefficient for the effects of short-term on long-term expectations is of similar magnitude for older and younger respondents, but it is only significant for older respondents. This suggests that on this anchoring measure, the expectations of older respondents are slightly less well anchored than those of younger ones within this group of professionals.

Figure 9. Average Individual Uncertainty and Disagreement for Long-Term DNB Survey Inflation Expectations

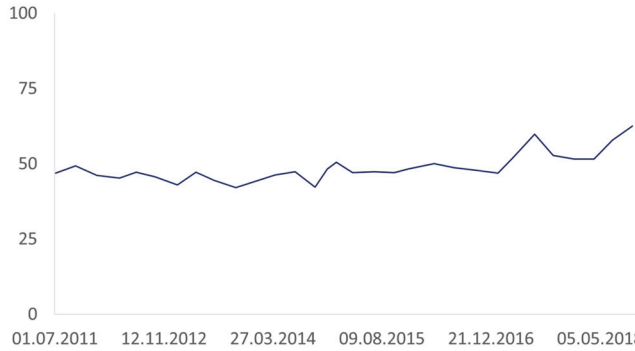


Note: Average individual uncertainty shown is $unc_t^{indiv,LT}$ of Equation (11) from the quarterly DNB survey of distributions of long-term expected inflation. Disagreement is the standard deviation of individuals' expected levels from the weekly DNB survey of long-term levels available closest to the time of the quarterly distributions survey.

Fifth, there is evidence that the patterns of disagreement between respondents and of individual uncertainty about future inflation show some differences. Figure 9 shows the time series of average individual uncertainty calculated from Equation (11), $unc_t^{indiv,LT}$, as well as disagreement, for long-term DNB survey inflation expectations. Disagreement is the standard deviation of individuals' expected levels from the weekly survey of levels available closest to the time of the quarterly distributions survey. We can see that average individual uncertainty has fallen over the sample period. This measure therefore points to long-term inflation expectations having become better anchored over the sample period. Disagreement shows a slightly different pattern, rising toward the end of the sample period.

Next, we find evidence that over time agents have tended to attach a lower weight to extreme inflation outcomes in the future. One way to see this is by tracking the survey-based probability of future euro-area inflation being in a certain range that is consistent

Figure 10. Probability of Expected Long-Term Inflation Lying between 1.5 Percent and 2.5 Percent from DNB Survey



Note: Mean expected probability of inflation lying between 1.5 percent and 2.5 percent in the long term, calculated from individual survey responses to DNB survey according to Equation (12).

with the inflation target as a measure of anchoring. Figure 10 shows the time series of the probability ptr_t^{LT} of expected long-term inflation lying between 1.5 percent and 2.5 percent derived from the DNB survey according to Equation (12). We can see that this probability has increased slightly over the sample period. This measure therefore also points to long-term inflation expectations having become better anchored over the sample period.

Finally, we present information from the tails of individuals' expected distributions on the anchoring of long-term inflation expectations using Equation (14). We find that changes in short-term deflation risk have no significant effect on changes in long-term deflation risk from the DNB survey, which also suggests that long-term euro-area inflation expectations have remained well anchored (Table 7).

5. Conclusions

We shed new light on the behavior of short- and long-term euro-area inflation expectations between 2010 and 2018 by using microevidence from a new type of survey at high (weekly) frequency. These

Table 7. Effects of Changes in Short-Term DNB Survey Deflation Risk on Changes in Long-Term DNB Survey Deflation Risk

Dependent Variable: Δdr^{LT}	
Δdr^{ST}	0.009
No. of Observations	369
Note: ***, **, and * represent significance at the 1 percent, 5 percent, and 10 percent levels. Sample period: 2011:Q3–2018:Q4, quarterly changes. Fixed-effects within-group panel regression; robust standard errors.	

data allow us to shed new light on the different dynamics of professional forecasters' inflation expectations, as reflected in survey measures of inflation expectations and market-based measures. A caveat is that the external validity of our setup depends on the representativeness of our sample of DNB survey participants for the general population of macroanalysts. Descriptive evidence suggests that this is indeed the case.

We run a battery of tests of anchoring of long-term inflation expectations to the ECB's inflation aim. In the literature, some of these tests have so far been applied only to market-based measures of inflation expectations. Overall, we find at most subtle signs of inflation expectations that are not firmly anchored.

We find that in the sense of level anchoring, long-term inflation expectations remained well anchored to the ECB's inflation aim, which has acted as a focal point. By contrast, we find no evidence that professional forecasts (reported by Consensus Economics) acted as focal points.

But when we look at tests for shock anchoring, we detect some subtle signs of long-term inflation expectations not being perfectly well anchored. This shows that subtle changes in the anchoring of inflation expectations by professionals can be detected by using survey-based measures at a weekly frequency. These changes are much more nuanced than those found in empirical exercises that rely on market-based measures of inflation expectations. We also find that notwithstanding a fairly homogenous panel of survey participants and a common information set, there is heterogeneity across

survey participants in their expected level of future inflation and the responsiveness of their expectations to shocks.

Using measures based on the full distribution of inflation expectations, namely average individual uncertainty based on the full expected distribution, the probability of expected long-term inflation lying between 1.5 percent and 2.5 percent, and the effect of short-term on long-term deflation risk, we find that long-term inflation expectations remained well anchored and became better anchored at the end of the sample period in 2018 compared with the start of the sample period in 2011.

Appendix. Example of Survey E-mail

Weekly Inflation Expectations Survey, October 15, 2018

Dear survey participant,

Please find attached the updated background information on euro area inflation.

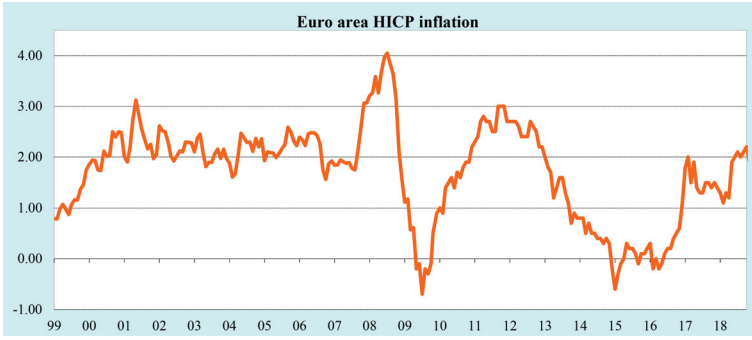
Please send us your answers to the questions below by Monday 5pm.

1. What HICP inflation do you expect for the euro area for the whole calendar year 2019?

2. What HICP inflation do you expect for the euro area for the whole calendar year 2020?

3. What HICP inflation do you expect for the euro area for the whole calendar year 2028?

Background Information



Consensus Forecast Euro-Area Inflation
(% change from previous calendar year)

	2015	2016	2017	2018	2019	5–10 Years Ahead
Jan. 16		x.x	x.x			
Feb. 16		x.x	x.x			
Mar. 16		x.x	x.x			
Apr. 16		x.x	x.x			x.x
May 16		x.x	x.x			
Jun. 16		x.x	x.x			
Jul. 16		x.x	x.x			
Aug. 16		x.x	x.x			
Sep. 16		x.x	x.x			
Oct. 16		x.x	x.x			x.x
Nov. 16		x.x	x.x			
Dec. 16		x.x	x.x			
Jan. 17			x.x	x.x		
Feb. 17			x.x	x.x		
Mar. 17			x.x	x.x		
Apr. 17			x.x	x.x		x.x
May 17			x.x	x.x		
Jun. 17			x.x	x.x		
Jul. 17			x.x	x.x		
Aug. 17			x.x	x.x		
Sep. 17			x.x	x.x		
Oct. 17			x.x	x.x		x.x
Nov. 17			x.x	x.x		
Dec. 17			x.x	x.x		
Jan. 18				x.x	x.x	
Feb. 18				x.x	x.x	
Mar. 18				x.x	x.x	
Apr. 18				x.x	x.x	x.x
May 18				x.x	x.x	
Jun. 18				x.x	x.x	
Jul. 18				x.x	x.x	
Aug. 18				x.x	x.x	
Sep. 18				x.x	x.x	

Note: Numbers for Consensus forecasts in this table, which were provided to survey respondents, have been replaced by "x.x" in this paper for license reasons.

Consumer Prices

	Jul.	Aug.	Sep.
Germany (Final)			
%m/m, nsa	0.3	0.1	0.4
%oya, nsa	2.0	2.0	2.3
HICP (%oya)	2.1	1.9	2.2
France (Final)			
%m/m, nsa	–0.1	0.5	–0.2
Index ex Tobacco, na	2.96	3.48	3.25
%oya, nsa	2.3	2.3	2.2
HICP (%oya)	2.6	2.6	2.5
Spain (Final)			
%m/m, nsa	–0.7	0.1	0.2
%oya, nsa	2.2	2.2	2.3
HICP (%oya)	2.3	2.2	2.3

References

Adrian, T. 2022. "Are Household Inflation Expectations De-anchoring?" Speech at the European Banking Institute, Frankfurt am Main, May 17.

Antunes, A. 2015. "Co-movement of Revisions in Short- and Long-Term Inflation Expectations." *Bank of Portugal Economic Studies* 1 (May): 1–20.

Beechey, M., B. Johannsen, and A. Levin. 2011. "Are Long-Run Inflation Expectations Anchored More Firmly in the Euro Area than in the United States?" *American Economic Journal: Macroeconomics* 3 (2): 104–29.

Bems, R., F. Caselli, F. Grigoli, and B. Gruss. 2021. "Expectations' Anchoring and Inflation Persistence." *Journal of International Economics* 132 (September): Article 103516.

Bernanke, B. 2007. "Inflation Expectations and Inflation Forecasting." Remarks at the Monetary Economics Workshop of the National Bureau of Economic Research Summer Institute, Cambridge, Massachusetts, July 10.

———. 2022. "Inflation Expectations and Monetary Policy." Keynote speech at the Brookings Institution Conference on Inflation Expectations: Determinants and Consequence, May 19.

Binder, C., J. Campbell, and J. Ryngaert. 2022. "Consumer Inflation Expectations: Daily Dynamics." Mimeo, December 15.

Boero, G., J. Smith, and K. Wallis. 2008. "Uncertainty and Disagreement in Economic Prediction: The Bank of England Survey of External Forecasters." *Economic Journal* 118 (530): 1107–27.

Bottone, M., and A. Rosolia. 2019. "Monetary Policy, Firms' Inflation Expectations and Prices: Causal Evidence from Firm-Level Data." Bank of Italy Working Paper No. 1218.

Bruine de Bruin, W., C. Manski, G. Topa, and W. van der Klaauw. 2011. "Measuring Consumer Uncertainty About Future Inflation." *Journal of Applied Econometrics* 26 (3): 454–78.

Buono, I., and S. Formai. 2018. "The Evolution of the Anchoring of Inflation Expectations." *Journal of Macroeconomics* 57 (3): 39–54.

Busetti, F., D. Delle Monache, A. Gerali, and A. Locarno. 2017. "Trust, but Verify. De-anchoring of Inflation Expectations under Learning and Heterogeneity." ECB Working Paper No. 1994.

Candia, B., O. Coibion, and Y. Gorodnichenko. 2021. "The Inflation Expectations of US Firms: Evidence from a New Survey." NBER Working Paper No. 28836, May.

Clements, M. 2012. "Do Professional Forecasters Pay Attention to Data Releases?" *International Journal of Forecasting* 28 (2): 297–308.

Cœuré, B. 2019. "Inflation Expectations and the Conduct of Monetary Policy." Speech at an event organized by the SAFE Policy Center, Frankfurt am Main, July 11.

Conflitti, C., and R. Zizza. 2021. "What's Behind Firms' Inflation Forecasts?" *Empirical Economics* 5 (November): 2449–75.

Corsello, F., S. Neri, and A. Tagliabracci. 2019. "Anchored or De-anchored? That is the Question." Bank of Italy Occasional Paper No. 516.

D'Acunto, F., U. Malmendier, and M. Weber. 2022. "What Do the Data Tell Us About Inflation Expectations?" NBER Working Paper No. 29825, March.

D'Amico, S., and A. Orphanides. 2008. "Uncertainty and Disagreement in Economic Forecasting." Finance and Economics Discussion Series No. 2008-56, Board of Governors of the Federal Reserve System.

De Fiore, F., M. Lombardi, and J. Schuffels. 2019. "Are Households Indifferent to Monetary Policy Announcements?" BIS Working Paper No. 956, August.

Dovern, J., U. Fritsche, and J. Slacalek. 2012. "Disagreement Among Forecasters in G7 Countries." *Review of Economics and Statistics* 94 (4): 1081–96.

Dovern, J., and G. Kenny. 2020. "Anchoring Inflation Expectations in Unconventional Times: Micro Evidence for the Euro Area." *International Journal of Central Banking* 16 (5): 309–47.

European Central Bank. 2021. "Inflation Expectations and Their Role in Eurosystem Forecasting." Occasional Paper No. 264, September.

Fleming, M., and E. Remolona. 1997. "What Moves the Bond Market?" *Economic Policy Review* (Federal Reserve Bank of New York) 3 (4): 31–50.

Galati, G., Z. Gorgi, R. Moessner, and C. Zhou. 2018. "Deflation Risk in the Euro Area and Central Bank Credibility." *Economics Letters* 167 (June): 124–26.

Galati, G., R. Moessner, and M. van Rooij. 2021. "Anchoring of Consumers' Long-Term Euro Area Inflation Expectations during the Pandemic." DNB Working Paper No. 715.

Garcia, J. 2003. "An Introduction to the ECB's Survey of Professional Forecasters." ECB Occasional Paper No. 8, September.

Garcia, J. A., and S. Werner. 2018. "Inflation News and Euro Area Inflation Expectations." IMF Working Paper No. 18/167.

Gerlach, S. 2007. "Interest Rate Setting by the ECB, 1999-2006: Words and Deeds." *International Journal of Central Banking* 3 (3): 1–46.

Goel, T., and K. Tsatsaronis. 2022. "Anchoring of Inflation Expectations: Has Past Progress Paid Off?" BIS Bulletin No. 51, March 17.

Grishchenko, O., S. Mouabbi, and J.-P. Renne. 2019. "Measuring Inflation Anchoring and Uncertainty: A U.S. and Euro Area Comparison." *Journal of Money, Credit and Banking* 51 (5): 1053–96.

Gürkaynak, R., A. Levin, A. Marder, and E. Swanson. 2007. "Inflation Targeting and the Anchoring of Inflation Expectations in the Western Hemisphere." *FRBSF Economic Review* (Federal Reserve Bank of San Francisco) 2007: 25–47.

Gürkaynak, R., A. Levin, and E. Swanson. 2010. "Does Inflation Targeting Anchor Long-Term Inflation Expectations?" *Journal of the European Economic Association* 8 (6): 1208–42.

Knüppel, M., and A. Vladu. 2016. "Approximating Fixed-Horizon Forecasts Using Fixed-Event Forecasts." Deutsche Bundesbank Discussion Paper No. 28/2016.

Krueger, F., and I. Nolte. 2016. "Disagreement versus Uncertainty: Evidence from Distribution Forecasts." *Journal of Banking and Finance* 72 (Supplement): S172–S186.

Kumar, S., H. Afrouzi, O. Coibion, and Y. Gorodnichenko. 2015. "Inflation Targeting Does Not Anchor Inflation Expectations: Evidence from Firms in New Zealand." *Brookings Papers on Economic Activity* 46 (Fall): 151–225.

Lamla, M., and D. Vinogradov. 2019. "Central Bank Announcements: Big News for Little People?" *Journal of Monetary Economics* 108 (December): 21–38.

Lewis, D., C. Makridis, and K. Mertens. 2019. "Do Monetary Policy Announcements Shift Household Expectations?" Federal Reserve Bank of New York Staff Report No. 897.

Mehrotra, A., and J. Yetman. 2018. "Decaying Expectations: What Inflation Forecasts Tell Us about the Anchoring of Inflation Expectations." *International Journal of Central Banking* 14 (5): 55–102.

Moessner, R., and E. Takáts. 2020. "How Well-Anchored Are Long-Term Inflation Expectations?" BIS Working Paper No. 869, June.

Natoli, F., and L. Sigalotti. 2018. "Tail Co-movement in Inflation Expectations as an Indicator of Anchoring." *International Journal of Central Banking* 14 (1): 35–71.

Neri, S., G. Bulligan, S. Cecchetti, F. Corsello, A. Papetti, M. Riggi, C. Rondinelli, and A. Tagliabracci. 2022. "On the Anchoring of Inflation Expectations in the Euro Area." Bank of Italy Occasional Paper No. 712, September.

Powell. 2020. "New Economic Challenges and the Fed's Monetary Policy Review." Speech at the "Navigating the Decade Ahead:

Implications for Monetary Policy" economic policy symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, Wyoming, August 27.

Rich, R., and J. Tracy. 2018. "A Closer Look at the Behavior of Uncertainty and Disagreement: Micro Evidence from the Euro Area." Federal Reserve Bank of Dallas Working Paper No. 1811.

Schnabel, I. 2021. "New Narratives on Monetary Policy — The Spectre of Inflation." Speech at the 148th Baden-Baden Entrepreneurs' Talk, Frankfurt am Main, September 13.

Siklos, P. 2013. "Sources of Disagreement in Inflation Forecasts: An International Empirical Investigation." *Journal of International Economics* 90 (1): 218–31.

Weber, M., F. D'Acunto, Y. Gorodnichenko, and O. Coibion. 2022. "Reality Check: How People Form Inflation Expectations and Why You Should Care." Becker Friedman Institute Working Paper No. 2022-40.

Williams, J. 2022. "A Steady Anchor in a Stormy Sea." Remarks at the SNB-FRB-BIS High-Level Conference on Global Risk, Uncertainty, and Volatility, Zurich, Switzerland, September 9.