



BANCA D'ITALIA
EUROSISTEMA

Questioni di Economia e Finanza

(Occasional Papers)

On the anchoring of inflation expectations in the euro area

by Stefano Neri, Guido Bulligan, Sara Cecchetti, Francesco Corsello,
Andrea Papetti, Marianna Riggi, Concetta Rondinelli and Alex Tagliabracci

September 2022

Number

712



BANCA D'ITALIA
EUROSISTEMA

Questioni di Economia e Finanza

(Occasional Papers)

On the anchoring of inflation expectations in the euro area

by Stefano Neri, Guido Bulligan, Sara Cecchetti, Francesco Corsello,
Andrea Papetti, Marianna Riggi, Concetta Rondinelli and Alex Tagliabracci

Number 712 – September 2022

The series Occasional Papers presents studies and documents on issues pertaining to the institutional tasks of the Bank of Italy and the Eurosystem. The Occasional Papers appear alongside the Working Papers series which are specifically aimed at providing original contributions to economic research.

The Occasional Papers include studies conducted within the Bank of Italy, sometimes in cooperation with the Eurosystem or other institutions. The views expressed in the studies are those of the authors and do not involve the responsibility of the institutions to which they belong.

The series is available online at www.bancaditalia.it .

ISSN 1972-6627 (print)

ISSN 1972-6643 (online)

Printed by the Printing and Publishing Division of the Bank of Italy

ON THE ANCHORING OF INFLATION EXPECTATIONS IN THE EURO AREA

by Stefano Neri, Guido Bulligan, Sara Cecchetti, Francesco Corsello, Andrea Papetti,
Marianna Riggi, Concetta Rondinelli and Alex Tagliabracci*

Abstract

This paper assesses the anchoring of long-term inflation expectations in the euro area, a key issue from a monetary policy perspective, using a range of measures of inflation expectations and methods. The overall reading of the evidence is that long-term inflation expectations in the euro area have rapidly returned to levels close to the new 2 per cent symmetric inflation target of the ECB announced in July 2021, in a context of elevated inflationary pressures linked to the recent surge in energy prices and persistent supply-side bottlenecks. Nonetheless, the risk of an upward de-anchoring of long-term inflation expectations deserves close and continuous monitoring. This risk has to be taken into account when assessing the appropriate pace of normalization of the ECB's monetary policy stance, acknowledging that the inflation outlook is surrounded by high uncertainty, as signalled by all types of expectations.

JEL Classification: E31, E52, C22, G12.

Keywords: inflation expectations, survey data, professional forecasters, consumers' expectations, market based expectations.

DOI: 10.32057/0.QEF.2022.0712

Contents

1. Introduction and motivation	5
2. Available measures of long-term inflation expectations in the euro area	6
3. Professional forecasters' inflation expectations	7
4. Market-based measures of inflation expectations	12
5. Consumers' inflation expectations	20
6. Firms' inflation expectations in Italy Consumers' inflation expectations.....	26
7. Concluding remarks.....	30
References	31

* All authors are from the Economic Outlook and Monetary Policy Directorate at Banca d'Italia.

1. Introduction and motivation¹

Long-term inflation expectations play a key role in monetary policy. Their anchoring to the inflation target is a necessary condition for central banks to maintain price stability, as it prevents temporary shocks from having persistent effects on inflation. If the public firmly believes that the central bank will deliver on its mandate, i.e. if it is credible, long-term expectations will remain close to the inflation target (Blinder, 2000) and insensitive to data releases (Bernanke, 2007). Financial market participants' inflation expectations are relevant in the pricing of financial assets and can thus directly affect the transmission of monetary policy to the real economy. If consumers and firms expect that the central bank will achieve the inflation target, they will set price and wage increases accordingly. However, large and persistent inflation surprises can lead investors, firms and households to revise their long-term inflation expectations, which can disanchor from the central bank's target.

In the current environment of high inflationary pressures, which have repeatedly surprised forecasters to the upside since the fall of 2021, assessing the risk of disanchoring of long-term inflation expectations from the ECB's 2 per cent symmetric target is of the utmost importance, along with the assessment of potential second-round effects stemming from surging energy prices. The ongoing strong inflation dynamics may spill over to long-term inflation expectations, leading to more persistent inflationary pressures, especially if the expectations formation mechanism follows an adaptive 'learning' process that incorporates past forecast errors in the presence of heterogeneity of beliefs (Busetti et al., 2017; Carvalho et al., 2022; Gáti, 2022). Assessing this risk is key when setting the appropriate pace of normalization of the monetary policy stance (Panetta, 2022).

This paper assesses the anchoring of long-term inflation expectations in the euro area using a range of methodologies and measures of expectations, ranging from those of professional forecasters, those implicit in the price of financial instruments to households' and firms' ones. We consider two concepts of anchoring of long-term expectations: "level anchoring" and "shock anchoring" (Corsello, Neri and Tagliabracchi, 2021). Long-term inflation expectations are level-anchored when they remain stable at the central bank's target. Expectations are shock-anchored when they do not respond to shocks. We also characterize the uncertainty surrounding long-term expectations to complement the two concepts of anchoring.²

A thorough assessment of the recent developments in inflation expectations should not ignore the abrupt transition to a high inflation environment that market participants, professionals forecasters, households and firms have faced since mid-2021. For several years, from 2013 to 2020, a persistently low level of inflation sensibly affected long-term inflation expectations, especially in the presence of an effective lower bound to the policy rates and a capped inflation target ("*below, but close, to 2 per cent*"; see Rostagno et. al, 2021), suggesting a substantial de-anchoring to the downside (Corsello, Neri and Tagliabracchi, 2021). Since the summer of 2021, the euro area economy started facing record inflationary pressures that brought inflation to levels not seen since the 1980s.

¹ We thank Roberta Zizza, Marco Taboga, Marcello Pericoli, Michele Caivano, Giuseppe Ferrero and Fabrizio Venditti for their comments and suggestions.

² Kumar et al. (2015) define five conditions that anchored long-term inflation expectations should satisfy. First, average expectations should be close to the target. Second, expectations should not be overly dispersed among individuals. Third, agents should be fairly confident in their forecasts and display little uncertainty about the long term. Fourth, revisions in forecasts should be small at long horizons. Fifth, long-term expectations should not co-move with short-term expectations.

The key messages are the following. Surveys among professional forecasters and financial market prices do not indicate an upward de-anchoring of long-term inflation expectations. Absent further upward movements in such expectations, these developments would be compatible with a re-anchoring to the new ECB's 2 per cent symmetric target. The expectations of forecasters and investors are extremely useful since they likely incorporate expectations about the pace of normalization of the ECB's monetary policy when forming their expectations. Households' and (Italian) firms' inflation expectations, despite generally being biased upwards, incorporate the transitory nature of current strong inflationary pressures, as short-term expectations are higher than longer term ones. This narrative of re-anchoring reconciles the two definitions of anchoring. After a long period in which expectations were disanchoring to the downside, as their level was persistently and significantly below the target and they responded to negative inflation surprises, the re-anchoring may induce some responsiveness to upward inflationary pressures, which may be desirable as long as it supports the process.

The sharp transition from low to high inflation has definitely shaped the inflation expectations of all agents. Nevertheless, coupled with the rise in uncertainty and disagreement in inflation expectations, which typically emerge in phases of a rapidly changing macroeconomic outlook, the upward movement in expectations provides a picture that is compatible with the ECB's inflation target. This evidence is robust to different measures of expectations: both the more attentive and responsive agents, as financial market participants and professional forecasters, and the relatively more biased and uncertain agents, such as households and firms, who still think that inflation will return to levels close to the target. However, the risk of a disanchoring deserves careful and continuous monitoring, since the credibility of the ECB's monetary policy strategy is not exogenous with respect to the fulfilment of the mandate.

The remainder of the paper is as follows. Section 2 describes the indicators of long-term inflation expectations. Section 3 focuses on professional forecasters and analysts. Section 4 considers market-based indicators and presents estimates of risk-adjusted inflation expectations. Sections 5 and 6 focus on households and firms' expectations, respectively. Section 7 concludes.

2. Available measures of long-term inflation expectations in the euro area

Measures of inflation expectations in the euro area have not been all available since the beginning of the monetary union. Information on long-term inflation expectations from the ECB Survey of Professional Forecasters (SPF) is available since 1999, while Consensus Economics started collecting such information for the euro area in 2003. The market for euro-area inflation linked swaps and options has been developed since mid-2000s. Eventually, the ECB started its fully-fledged euro area households' survey in 2020, while there is still no euro-area wide survey for firms that asks for quantitative long-term expectations. This section describes the data used in this paper, highlighting the main advantages and informational content of each source.

The ECB Survey of Professional Forecasters (SPF) collects information, at the quarterly frequency, on the expected rates of inflation in the euro area at several horizons, ranging from the current year to five-year ahead (long-term). Expectations are reported not only as point forecasts, but also as probability distributions. The long-term expectations are available since the first quarter of 2001 and are based on the answers provided by, on average, around 60 panellists.

Market-based measures of inflation expectations can be derived from the market prices of inflation-linked financial instruments, such as nominal and inflation-linked bonds, inflation linked swaps and options, which are traded daily. Inflation swaps provide a direct measure of inflation expectations at different horizons, while inflation options contain information on the entire distribution of future inflation. The inflation expectation implied in financial instruments cannot be interpreted as pure estimates of the expectations as they refer to those of a representative risk-neutral investor, and hence include a risk premium. This premium compensates investors for the correlation of their future endowment with inflation outcomes and can be either positive or negative depending on the sign of such correlation. In the literature, different models allow to disentangle the objective component from the risk-neutral inflation expectation providing different results regarding the magnitude and even the sign of the inflation risk premium (see, among others, Joslin et al., 2011; Adrian et al., 2013; Pericoli, 2014; Cecchetti et al., 2022).

The availability of quantitative measures of households' inflation expectations is more limited than for professional forecasters. For the euro area, consumer inflation perceptions and expectations can be retrieved from the harmonized European Commission Consumer Surveys (ECCS). These data go back to 1985. However, up to 2004, the data only provide qualitative information on respondents' perceptions and expectations on the direction and speed of price changes. Quantitative data on the magnitude of inflation expectations have been collected since 2004.³ The ECB Consumer Expectations Survey (CES) was launched in January 2020 and collects monthly data on consumers' inflation expectations for the six largest euro area economies (namely, Germany, France, Italy, Spain, the Netherlands and Belgium). Households provide qualitative and quantitative answers about their inflation expectations, over two horizons: the next 12 months and from two to three years ahead. The survey provides a probabilistic measure of inflation expectations that allows us to gather the respondents' uncertainty about their own expectations. Since its inception, the sample size has been rising, encompassing around 10,000 households in the latest waves.

Surveys providing information on firms' long-term inflation expectations are not available at the euro-area level. Qualitative information on euro-area firms' expectations concerning their selling prices in the short-term (three months) are provided by the European Commission survey on businesses. The *Survey of Growth and Inflation Expectations (SIGE)* conducted on a quarterly basis by the Bank of Italy represents an exception, as it collects quantitative measures of firms' inflation expectations. The survey is conducted among about 1,000 Italian firms operating in the industry and in the non-financial private service sectors with 50 or more workers. Firms report their expectations at four horizons: the next six, twelve and twenty-four months, and between three and five years ahead.

3. Professional forecasters' inflation expectations

In this section, we provide an overall assessment of inflation expectations anchoring along several dimensions, following Kumar et al. (2015): (i) level anchoring of long-term inflation expectations; (ii) magnitude of revisions to long-term forecasts; (iii) dispersion of these forecasts across agents; (iv) uncertainty around their projections; (v) responsiveness of long-term inflation expectations to short-run inflation developments. The ECB SPF allows digging in-depth inside each of these facets, since

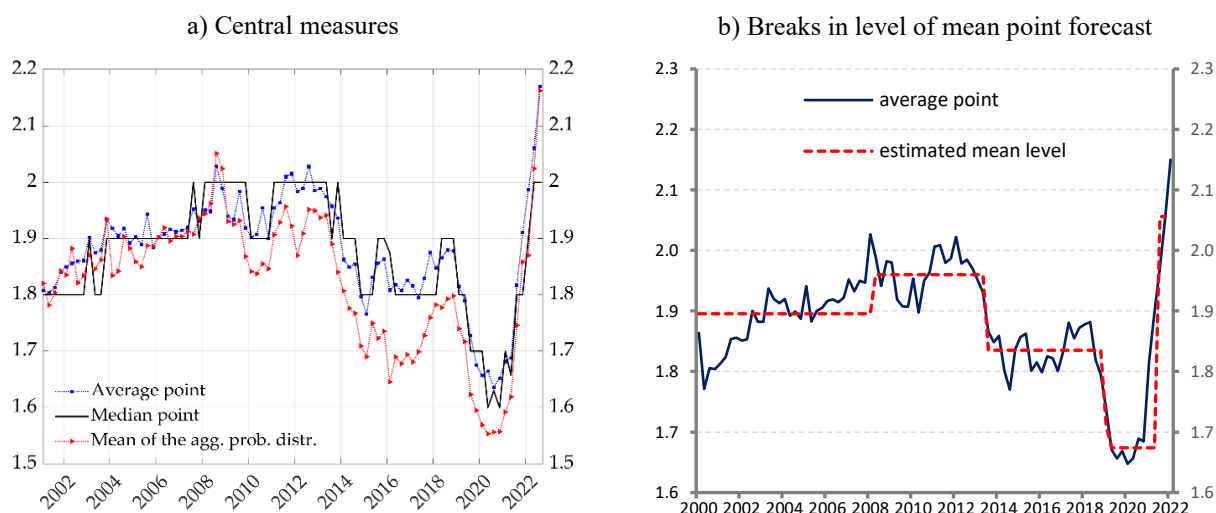
³ These data were made publicly available in aggregated form, for the EU and the euro area and including breakdowns by socio-economic categories, following a study by Arioli et al. (2017). They have been reported quarterly since 2019 by the European Commission in its European Business Cycle Indicators (EBCI) publication (European Commission, 2019).

it provides an extended set of information on inflation expectations expressed by a panel of professionals, which includes point and density forecasts over short- and long-term horizons.

After several years well below the target, in the October round of the SPF the level of long-term inflation expectations reached levels consistent with the new inflation target announced in July 2021. Figure 1 (panel a) illustrates three types of measures referred to the level of long-term inflation expectations (5-years ahead forecasts): the mean and median point forecasts, and the mean of the aggregate probability distribution. With the beginning of the disinflation in early 2013, long-term inflation expectations started to decline reaching historical low levels in 2020. Statistical tests exploiting both the time series dimension of the point forecasts (Bai and Perron, 2003) as well as the panel dimension of individual point forecasts (Bai 2010) point to a regime break in early 2013 in the level of long-term inflation expectations (Corsello, Neri and Tagliabracci, 2021) and a further break at the end of 2019 (Bulligan et al., 2021).

In 2021, inflation expectations gradually started to increase. In July, the ECB adopted an explicit and symmetric 2% inflation target removing any existing ambiguity about its inflation objective. This may have contributed to re-anchor long-term inflation expectations to levels close to 2 per cent, as inflation expectations have rapidly increased since then. In the three 2022 rounds of the survey, all aggregate measures of central tendency stood at levels that are consistent with the renewed inflation target: even though the average measures are slightly above the 2 per cent target since April 2022, the median point estimate has stabilized exactly at 2. Indeed, a break detecting approach proposed for panel data by Bai (2010) indicates that a break occurred in the October 2021 round after which the common mean around which forecasters' long-term inflation expectations fluctuate increased from 1.67 to 2.06 per cent (Figure 1, panel b). Absent further upward pressures to expectations, these developments would be consistent with a re-anchoring to the new ECB's 2 per cent symmetric target. To this end, the monitoring of the next rounds of the SPF will be crucial.

Figure 1. ECB SPF long-term inflation expectations

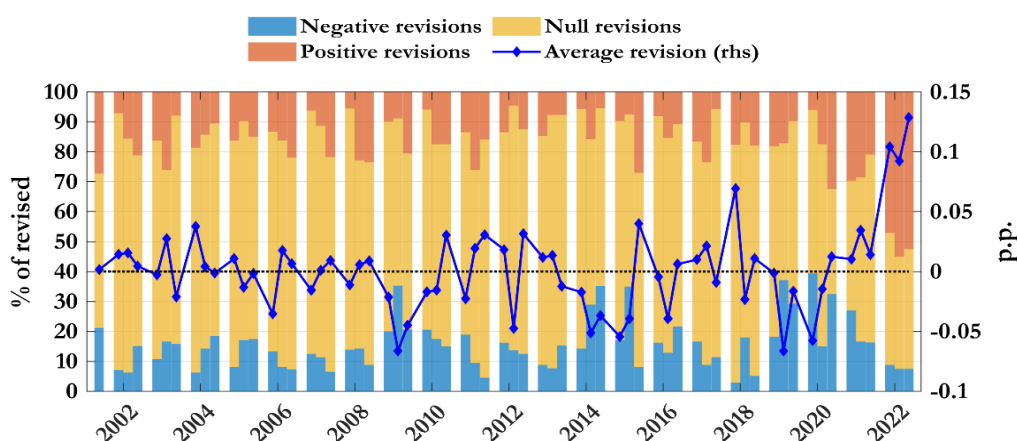


Note: Panel a) presents the mean, the median and the mean point of the aggregate distribution of the long-term inflation forecasts. Panel b) presents the estimated mean level once accounting for the estimated break dates. *Source:* ECB Survey of Professional Forecasters. *Last observation:* July 2022.

Yet, the pace of upward revisions observed since October 2021 to long-term inflation forecasts has been unprecedented, favoured by the rapidly evolving macroeconomic landscape. Figure 2 allows

us assessing the frequency and magnitude of the revisions to long-term inflation point forecasts within the SPF panel over time. Since long-term inflation expectations are closely related to the credibility of monetary policy, their revisions tend to be smaller and more infrequent compared to the revisions in short-term expectations. In the past, episodes of negative revisions that were diffuse across forecasters and on average more intense occurred in periods in which inflation was exceptionally low (2009, 2013-2014 and 2019-2020). The three rounds of the survey in 2022 have been characterized by the largest and most diffuse revisions ever recorded. The extraordinary speed of these upward adjustments mirrors not only the strong recovery from the deepest recession ever experienced in the euro area, but also the dramatic increase in energy prices that boosted inflation to unprecedented levels since the beginning of the monetary union.

Figure 2. Revisions to point forecasts



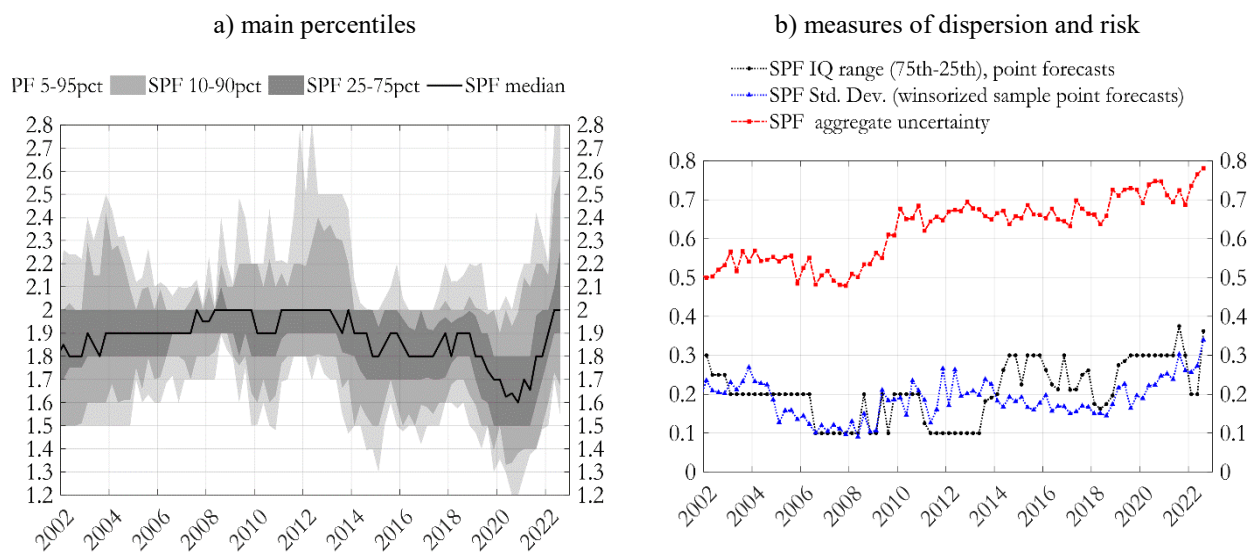
Note: the chart shows the share of positive, null, and negative revisions to the point forecast of long-term inflation across SPF participants, and the average revision. *Source:* ECB Survey of Professional Forecasters. *Last observation:* July 2022.

The recent developments are also reflected in a rising degree of disagreement and uncertainty of forecasts. However, amidst a rebalancing between the left- and right- tails, the bulk of the distribution remains concentrated around 2 per cent. Figure 3 shows the dispersion around the median point forecast over time, by means of percentiles⁴ (panel a) and displays measures of both disagreement and uncertainty within the SPF sample, computed using both point and the density forecasts (panel b). The overall dispersion, measured by the standard deviation of the point forecasts (winsorized at 2 per cent), after a long phase of stability has been on a rising path since the beginning of the pandemic, suggesting that forecasters have increased their disagreement; also a measure of uncertainty, provided by the standard deviation of the aggregate probability distribution, kept increasing, reaching a maximum. The interquartile (IQ) range of point forecasts, which is a narrower concept of dispersion that focuses more on the modal segment of the distribution, has remained stable at high levels (around 0.3 p.p.) between 2019 and 2021. In the first two waves of 2022, when the mean point forecast has returned to levels consistent with the 2 per cent symmetric inflation target, the IQ range has reduced to 0.2 p.p., before increasing back to 0.3 in the third round (July).

⁴ A clear co-movement between the level and the disagreement of expectations does not emerge over the whole sample, since there have been phases where the dispersion of the point forecast distributions have widened amidst a stable or decreasing median or episodes of shrinking dispersion in the face of rising inflation.

Nevertheless, even though slightly asymmetric to the upside, the IQ range remains centered around 2 per cent (panel a).

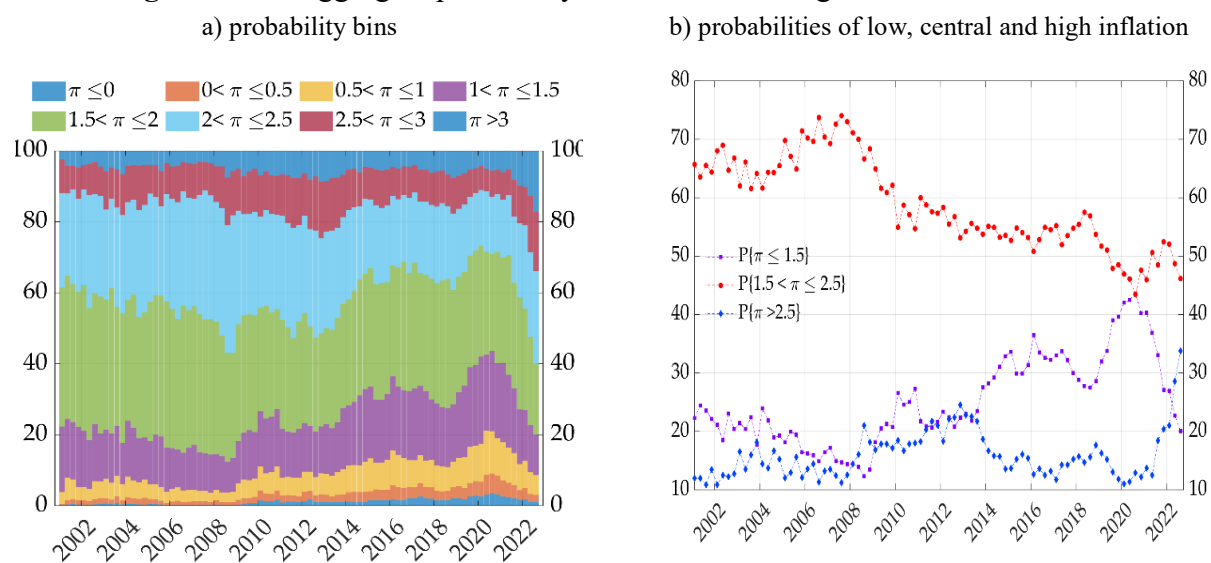
Figure 3. Disagreement and uncertainty of long-term inflation forecasts



Note: Panel a) presents the median point forecast, along with the bands built using selected percentiles of the distribution of point forecasts. Panel b) presents two measures of dispersion (interquartile range and standard deviation of the winsorized distribution), and a measure of uncertainty, given by the standard deviation of the aggregate probability distribution. *Source:* ECB Survey of Professional Forecasters. *Last observation:* July 2022.

Forecasters have recently shifted the probability mass from low to high inflation outcomes, after many years of elevated probability of low inflation (Figure 4, panel a). In the April 2022 round, the gap between the probabilities of inflation significantly above and below the target (respectively, above 2.5 and below 1.5 per cent) has closed for the first time since 2013 (Figure 4, panel b). In the July round, this gap has further increased, signalling a rise in the perceived risks of high inflation.

Figure 4. The aggregate probability distribution of long-term inflation forecasts

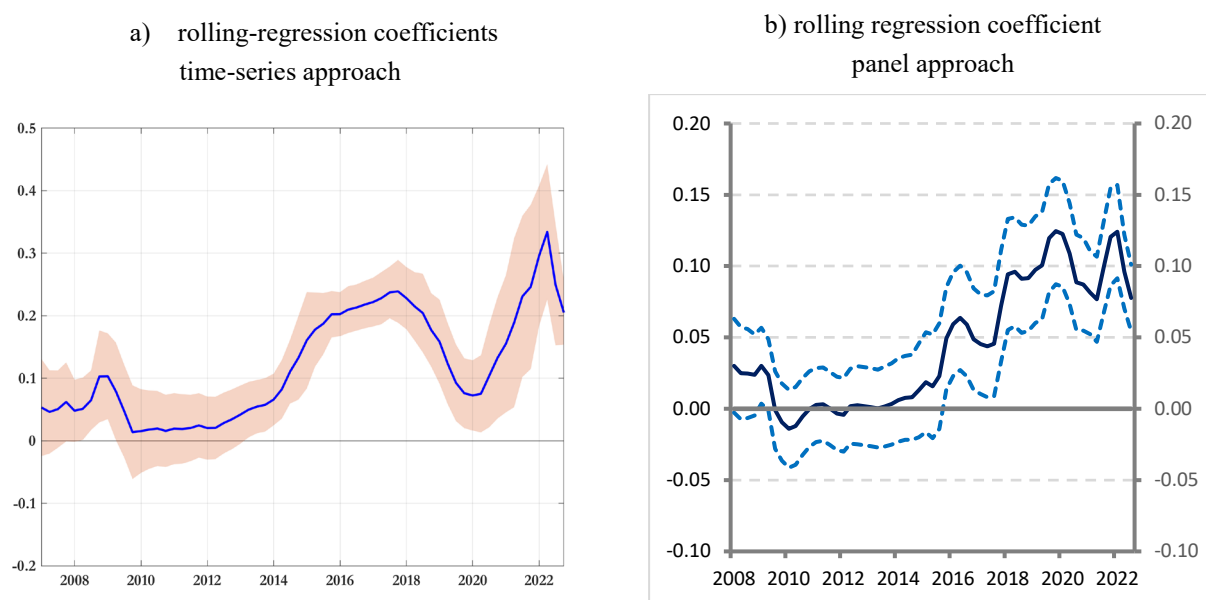


Note: Panel a) displays the aggregate probability distribution obtained by averaging the individual probability bins provided by forecasters about the long-term inflation forecast; Panel b) reports the average probabilities of long-term inflation being expected below 1.5, between 1.5 and 2.5, and above 2.5, respectively. *Source:* ECB Survey of Professional Forecasters. *Last observation:* July 2022.

Since the outbreak of the pandemic (early 2020), long-term inflation expectations has proved to be more responsive to short-term inflation swifts. Nevertheless, as long-term inflation expectations have been lingering persistently below the target for several years, this sensitivity might be a sign of re-anchoring to the inflation target. Future rounds of the survey will be key to assess whether this responsiveness hides, instead, the risk of upward disanchoring.

Łyziak and Paloviita (2017) and Corsello, Neri and Tagliabracci (2021) assess the degree of shock-anchoring by regressing mean long-term expectations on short-term ones. Bulligan et al. perform the same analysis using panel techniques. Figure 5 (panels a and b) shows the updates of some of the analyses in Corsello, Neri and Tagliabracci (2021) and Bulligan et al. (2021). During the 2013-2020 low inflation period, the responsiveness of long-term expectations to short-term ones has remained positive, in association with repeatedly negative revisions to short-term forecasts. Together with a relatively low level of long-term inflation expectations, this evidence suggests a downward disanchoring of expectations after the beginning of the low inflation period. The steep increased in responsiveness estimated in the second half of 2021, as inflation climbed above 2%, reversed quickly in the latest two survey rounds (April and July 2022). Figure 6 (top panels) shows the results obtained regressing long-term inflation expectations on negative inflation surprises (i.e. the difference between the flash estimate of the euro-area headline inflation and the median forecasts in the Bloomberg survey; see Corsello, Neri and Tagliabracci, 2021) has become statistically not significant in the last two years, suggesting that the downward “shock” disanchoring that occurred in late 2013 has disappeared (Figure 6, top panels). The sensitivity to positive inflation surprises, which has remained statistically not significant since 2008, becomes statistically significant, although quantitatively small, only if the results of the April and July 2022 SPF are included in the rolling estimation.

Figure 5. Short- and long- term expectations

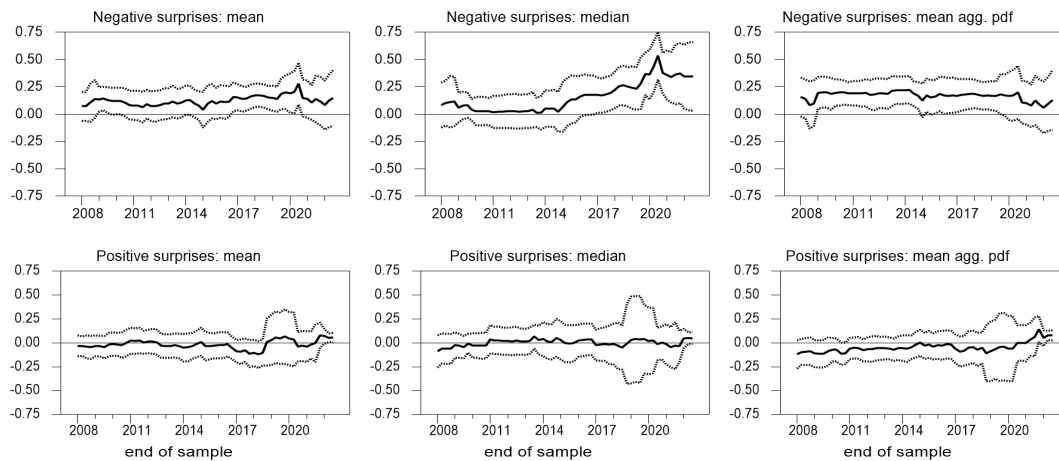


Note: Panel a) shows the rolling coefficients and the 95 per cent confidence bands computed on the basis of the HAC standard errors of the estimated coefficients. Panel b) solid lines denote the estimated rolling coefficient; dotted lines denote the ± 2 standard deviation range. *Source:* authors’ calculations based on SPF data. *Last observation:* July 2022.

Since 2020:Q3 short-term inflation expectations have been gradually revised upward, in association to the recovery from the pandemic and the mounting pressures from input costs. In this context, as long-term inflation expectation lied below the target, a positive sensitivity to upward

pressures in short term expectations may have been, to some extent, desirable. Indeed, the re-anchoring of long-term inflation expectations is more likely to occur smoothly, with long-term inflation expectations gradually responding to changes in actual inflation and to the awareness of a renewed inflation target, rather than via a one-off movement. In the latest two rounds (April and July 2022), the elasticity of long to short-term forecast has declined (Figure 5, panels a and b), implying that the exceptional revision to one-year ahead expectation has passed to a more limited extent to longer horizons.

Figure 6. Sensitivity of long-term inflation expectations to inflation surprises



Notes: solid lines denote the estimated coefficients, the dotted lines denote the ± 2 standard deviation range. The horizontal axis reports the end of each rolling sample. The bands indicate the 95 per cent confidence interval based on the HAC standard errors of the estimated coefficients. *Source:* authors' calculations based on SPF data. *Last observation:* July 2022.

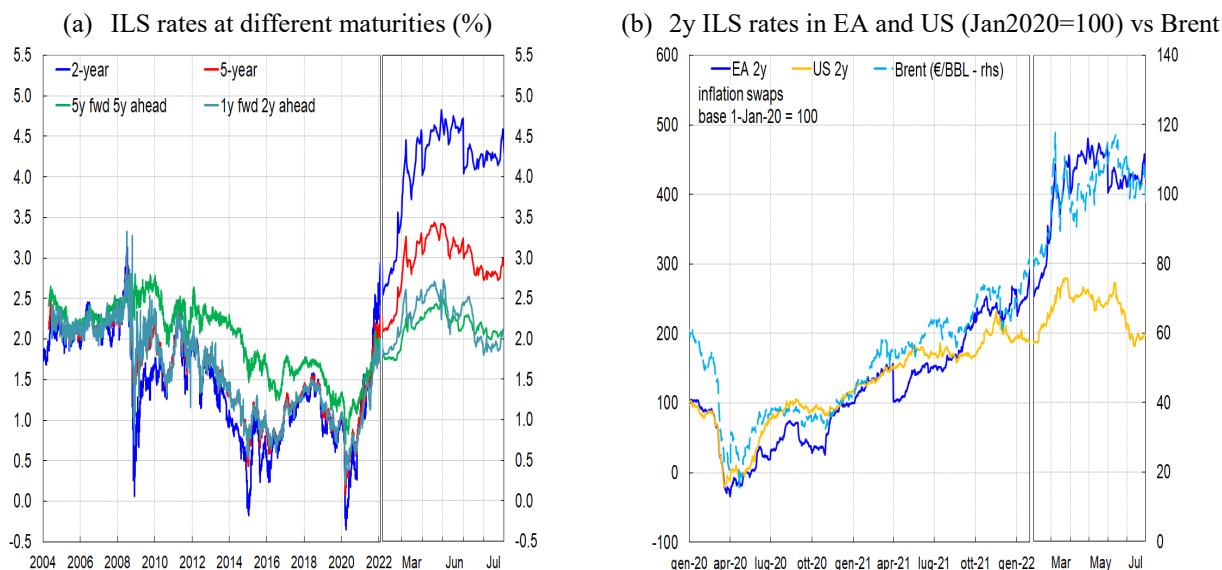
4. Market-based measures of inflation expectations

In this section, we provide an overall assessment of inflation expectations anchoring along several dimensions using data on inflation linked options and swaps. The section starts by describing the recent trends in inflation linked swap (ILS) rates at different maturities and relating their rise to that of energy prices. Given that inflation swap rates represent risk-neutral market expectations of inflation, i.e. they include the risk premium required by investors, we estimate and compare inflation expectations net of this risk premium using different models. We also analyse the co-movement between Banca d'Italia's staff estimate of the inflation risk premium and option-implied metrics such as measures of tail risk of the medium-to-long-term inflation distribution, the uncertainty surrounding the estimates representing the dispersion of investors' views, and the probability of inflationary scenarios in the medium to long term. Finally, we provide an assessment of the anchoring of medium-to long-term inflation expectations by estimating their response to inflation surprises and, more generally, macroeconomic surprises.

Overall, the analysis shows that, while there has been an increase in both the inflation risk premium and genuine inflation expectations that could raise concerns about a possible level disanchoring, the estimates are surrounded by high uncertainty and are quite dispersed, and are affected by the risk of adverse scenarios. Indeed, the low concentration of investors' beliefs around scenarios of high inflation in the medium-to-long run, coupled with the absence of signs of shock

disanchoring, might reflect the transition towards a regime of symmetric inflation targeting, as introduced by the 2021 review of the ECB’s monetary policy strategy.

Figure 7. ILS rates and energy prices



Source: calculations based on Bloomberg and Refinitiv. *Note:* the dashed vertical line marks the last day before the April 2022 ECB Governing Council meeting. *Last observation:* 31 July 2022.

Inflation-linked swap (ILS) rates in the euro area have seen a marked increase since the beginning of 2022, especially at shorter horizons, in association with the rise in energy prices that was exacerbated by the Russia’s invasion of Ukraine. In March 2022, ILS rates recorded the largest monthly positive variation in history on almost all horizons amid the outbreak of the war in Ukraine (24 February): by about 1.1 and 0.5 ppts on 2 and 10 year horizons, respectively, and by about 0.4 ppts on the 5-year forward 5-year ahead horizon. ILS rates have raised in April, albeit at a slower pace compared to March. In May they have started to stabilize back to values close to 2% on medium to long term horizons (Figure 7, panel a). Shorter-term ILS rates have risen in tandem with oil prices since 2020 with a dynamics that has outpaced that of the United States since the outbreak of the war in Ukraine (Figure 7, panel b).⁵

Inflation expectations implied by financial market prices differ from the objective counterparts by the so-called inflation risk premium, whose estimation is notoriously very model-dependent and characterized by large uncertainty (Cecchetti et al., 2021). Economic theory suggests that the level of the inflation risk premium is a function of the uncertainty about future inflation and economic growth as well as investors’ risk aversion.⁶ While the absolute level of inflation risk premium should increase with risk aversion, its sign depends on the correlation between expected inflation and consumption.

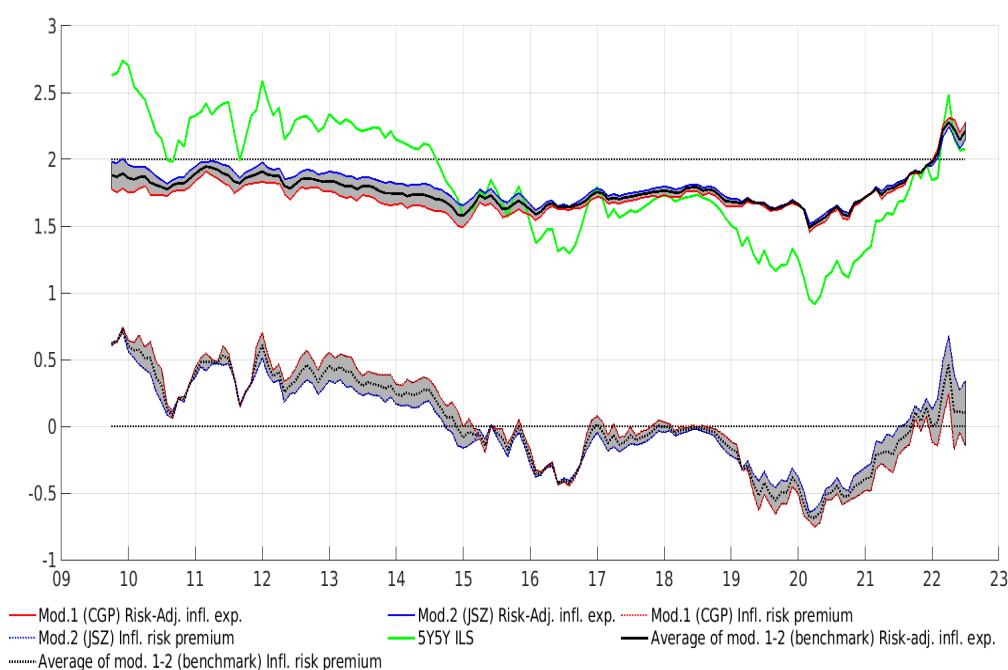
⁵ Recall that the correlation between oil price changes and inflation expectations tends to fade as the horizon lengthens. Furthermore, econometric analyses find that the key feature of oil-price changes that pass-through more on inflation expectations are associated mostly on identified global activity shock and oil-specific demand shocks while oil-specific supply shocks tend to trigger more muted responses (Baumann et al., 2021). Overall, while one is tempted to conclude that there is a causal link running from oil-price changes to inflation expectations, the link loses ground when more controls are considered in the form of additional relevant variables (Conflitti and Cristadoro, 2018), or when accounting for the different kinds of shock that are driving global oil-price movements (Aastveit et al., 2020). Finally, when larger reactions of market-based measures of inflation expectations to oil-price changes are detected, these tend to largely reflect developments in inflation risk premia. See Baumann et al. (2021) for further details.

⁶ For a general description of such a theoretical approach see e.g. Cochrane (2009).

Positive inflation risk premia may be a sign that inflation outcomes above inflation expectations are less favourable than outcomes below (and vice versa). Thus, interpreting the drivers of inflation risk premium requires extreme caution.

Focusing on the 5y5y ILS rates, the estimates generally employed as benchmark by Banca d'Italia's staff (average of estimates of Cecchetti et al., 2022 – CGP; and Joslin et al., 2011 – JSZ) and ECB's staff (JSZ) agree on the rapid increase of the inflation risk premium in 2021 and in the first months of 2022. In spite of the model uncertainty, both estimates consistently explain the recent increase in inflation expectations by a rise of both the objective expectations and the risk premium (Figure 8). The estimated risk premia have rapidly increased in 2021 and in the first quarter of 2022, particularly after the outbreak of the war in Ukraine.⁷ The main difference between the CGP and JSZ's models can be ascribed to the greater sensibility of the CGP's model to potential regime changes. This is obtained by allowing for stochastic volatility and variable long-term average inflation while also disciplining long-term objective inflation expectations via the SPF data (rather than via a fixed constant of 1.9%, as in the JSZ's approach). Therefore, the estimates of the objective component of expectations over the entire estimation period tend to vary more over time in the CGP's model compared to the JSZ's model.

Figure 8. Objective inflation expectations and inflation risk premia



Source: Bloomberg and SPF. *Note:* 5-year 5-year ILS decomposition according to CGP, JSZ and Banca d'Italia models; 5y5y ILS are market data; Risk-Adj. infl. exp. are the estimated objective expectations and the inflation risk premium is computed as the difference between the estimated inflation swap (technically the estimated risk-neutral expectations) and the estimated objective counterparts. Monthly data. Last observation: July 2022.

⁷ The change in the sign of the inflation risk premium is typically related to the change in the correlation between inflation and growth expectations. The inflation risk premium should be positive when high inflation is associated with poor economic performances (i.e. the covariance between inflation and growth is negative); this result is consistent with a predominance of economic shocks that move inflation and real growth in opposite direction, such as a supply shocks that simultaneously raise inflation and lower real consumption. Conversely, a negative inflation risk premium is consistent with an increasing role for demand shocks that instead push inflation and real economic activity in the same direction.

In order to interpret the estimated inflation risk premium, we follow Di Iorio and Fanari (2022) which, inspired by Camba-Mendez and Werner (2017),⁸ construct an indicator of upside vs. downside tail risk for the long-term inflation distribution derived from the SPF. Specifically, their balance of risks is defined as the (standardized) difference between the probability of inflation being higher than 3 per cent and that of inflation being below the 1 per cent threshold. We compute the same balance of risk indicator of Di Iorio and Fanari (2022) using our estimated risk-neutral probabilities, comparing these indicators with the inflation risk premium. We find a strong positive co-movement between the estimated inflation risk premium on 5y5y ILS rates and the SPF-based and option-implied inflation balance of risks indicators, signalling that investors were concerned with downside risks until 2020 and have become more concerned with upside risks recently (Figure 9, panel a). Indeed, the balance of risks moved to the downside around the end of 2013, rose between 2016:Q1 and 2018:Q1, and then decreased again reaching a minimum with the outbreak of the pandemic. Since mid-2021, the balance of risk has turned positive.

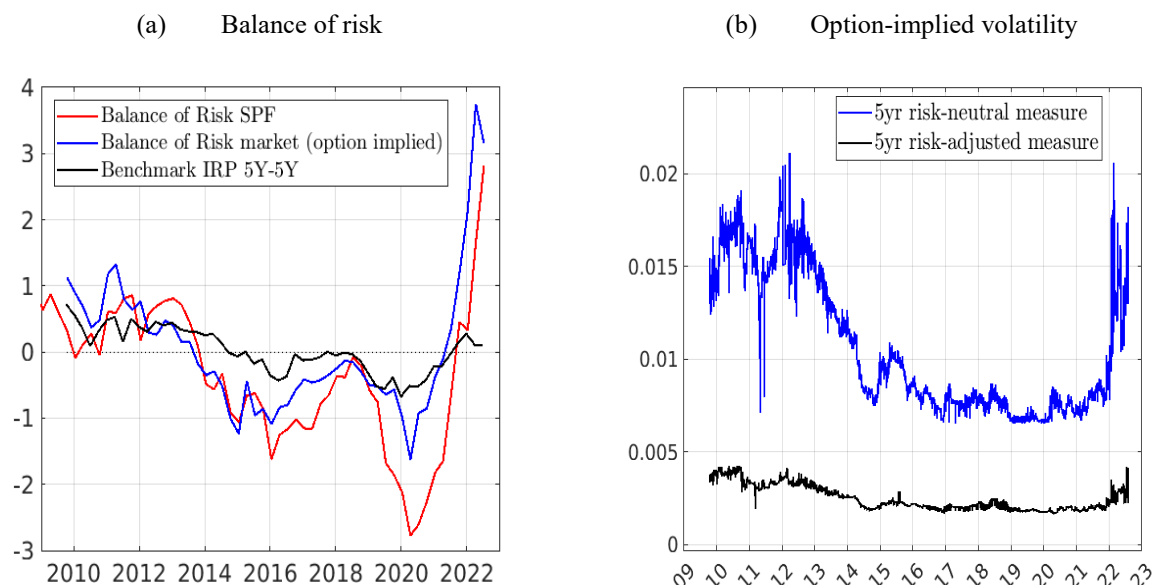
Yet, the recent increase of inflation expectations was accompanied by a rise of uncertainty around their estimates, in contrast with past episodes of falling inflation expectations characterized by low uncertainty, thus indicating low concentration of investors' beliefs around scenarios of markedly high inflation (Figure 9, panel b). Looking at the estimated volatility of inflation offers insights on the degree of uncertainty on market inflation expectations representing dispersion of investors' beliefs and difficulty in forecasting inflation. Moreover, in the context of medium-to-long term expectations departing from the target, the attenuation of uncertainty around the estimates could be seen as an indicator of diminished credibility of the ECB's monetary policy. Estimates based on the CGP's model on ILS rates at the 5-year maturity suggest that in times of low inflation, e.g. after the sovereign debt crisis, the disanchoring of long-term expectations was accompanied by the decrease in their volatility, indicating a concentration of beliefs around low levels of inflation over the long-term. On the contrary, the increase of inflation expectations since early 2022 was accompanied by a rise of uncertainty around the estimates especially on risk-neutral inflation which tend to be systematically more volatile than those on objective inflation. This recent rise in uncertainty points out that there is no concentration of investors' beliefs towards very high inflation scenarios in the medium to long term, possibly reflecting the intrinsic uncertainty characterizing the transition process towards a symmetric medium-term inflation objective as introduced by the 2021 ECB's strategy review.

The risk-neutral density of the euro-area inflation has evolved in recent years in response to both exogenous economic developments and the adoption of unconventional monetary policy measures by the ECB. The changes have affected all moments of the distribution: its mean – approximately the ILS rate – its standard deviation – approximately the consensus around the mean – and its skewness – a measure of the asymmetry of down- and up-side risks. While the level of inflation expectations (represented by the ILS rates) provides indications about the distance of these expectations from the ECB target, analysing the entire distribution of inflation allows us to evaluate the tail risks, i.e. the probability of very unfavourable scenarios. In particular, the comparison between

⁸ Camba-Mendez and Werner (2017) define the balance of inflation risk as the difference between the price of a one-year-ahead inflation cap with a strike price of 4 per cent and a one-year-ahead inflation floor with a strike price of 0.

forward and spot probabilities of inflation far from the target provides information on whether risks are of a short-term nature or rather reflect a progressive disanchoring of expectations.

Figure 9. Balance of risk and option-implied inflation volatility



Source: Bloomberg and Refinitiv. *Note:* (a) Balance of risk is estimated as difference between the probability of inflation being higher than 3 per cent and the probability of inflation being under the 1 per cent threshold using SPF distribution (red line) and risk neutral option implied distribution (blue line); the black line shows the Bank of Italy estimates of inflation risk premium; quarterly data (last observation: 2022:Q2). (b) Volatility is estimated according to the CGP's model using the parameters estimated under both the risk-neutral and the objective (risk-adjusted) probability; daily data. *Last observation:* July 2022.

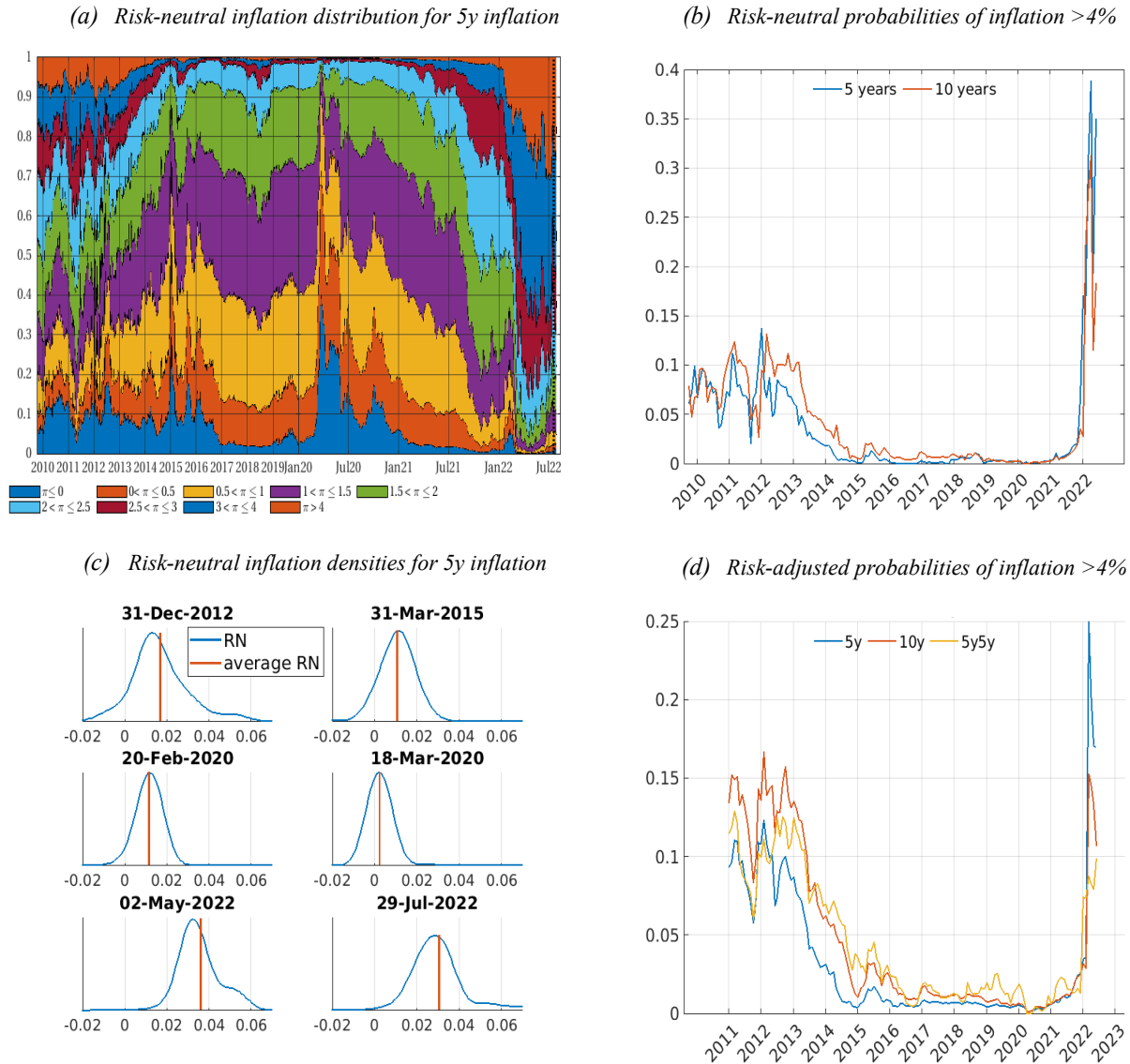
Risk-neutral inflation distributions show persistent upward pressures on medium-to-long-term inflation expectations as the Covid-19 crisis eased in 2021 and especially since early 2022 as the war in Ukraine unfolded (Figure 10).⁹ Indeed, the probability of an inflation rate above 3 per cent discounted by a risk-neutral investor over a 5 year horizon (given by the sum of the blue and orange areas in the higher part of Figure 10 panel a) has faced a remarkable increase since the beginning of 2022. More in detail, we consider six snapshots of the risk neutral density of the euro area inflation 5 years ahead, to visualize its shifts and changes in the shape, at significant dates (Figure 10, panel c):

- 31/01/2012 : before the beginning of the low inflation period;
- 31/03/2015 : after the launch of EAPP (01/2015);
- 20/02/2020 : eve of Covid-19 spread to the euro area;
- 18/03/2020 : height of the pandemic crisis;
- 02/05/2022 : the date in which 5y5y ILS reached the maximum value of 2.49%;
- 29/07/2022 : last date of estimation.

⁹ We report risk-neutral inflation distributions used in the CGP's model which are estimated as in Cecchetti et al. (2015) using inflation options written on the rate of growth of the euro-area HICP and adopting the estimation technique developed by Taboga (2016) which is such that estimated errors due to low liquidity, especially large in turmoil, should not have a significant impact on the results. For details on the methodology, see Cecchetti et al. (2015).

The first four snapshots document the transition from a density of inflation in line with the previous target of the ECB (“*below, but close, to two per cent*”) to that of a very low inflation. The last two snapshots show markets’ fears of an excessively high inflation.

Figure 10. Inflation probability distribution and probability of high inflation



Source: Bloomberg. Note: a) The distribution of expected inflation is estimated based on the prices of zero-coupon inflation options in the euro area over a 5-year horizon. The underlying inflation rate is calculated based on the HICP excluding tobacco; daily data; d) The 5y-5y objective probability of inflation >4% is provided by the estimates of Hilscher et al. (2022); monthly data. Last observations: July 2022 for panels a), b) and c); June 2022 for panel d).

Empirical evidence shown so far suggests that, since the fall of 2021, market data might predominantly reflect investors’ risk aversion and concerns about high inflation in the near term, with no evidence of a progressive disanchoring of inflation expectations in the medium-to-long term. Specifically, the objective probability of inflation above 4% over the medium-to-long term has increased sizably since fall-2021 but is much smaller than its risk-neutral counterpart, especially on forward rates where the probability is below the levels that prevailed, on average, before the 2013-14 disinflation (Figure 10, panel b and panel d). In addition, the risk neutral probability that inflation will be on average in the next 5 or 10 years more than 4% has seen an unprecedented rapid and marked

increase since fall-2021 but short-term concerns and rising risk aversion of investors seem to weigh heavily on the result. Indeed, despite the risk-neutral probability of inflation above 4% on average over the next 5 years is close to 40%, the risk-adjusted counterpart is smaller, standing below 20%. More importantly from a monetary policy perspective, the probability of inflation above 4% in 5 years on average over the following 5 years (yellow line in panel d) is slightly less than 10%, below the levels that prevailed on average before 2013, suggesting a relatively transitory nature of a high inflation environment currently priced by markets.

To provide assessments of the possible shock disanchoring of inflation expectations, we base our analysis on market data, which implicitly contain the inflation risk premium.¹⁰ Since July 2021 the release of the monthly flash HICP estimate for the euro area has always surprised analysts on the upside, amid greater dispersion of their expectations, leading to inflation surprises of about 3.3 ppts on a cumulative basis – recording in March the largest surprise (by 0.8 ppts; Figure 11, panel a). Yet, over the same period the variations of the ILS rates around the flash HICP releases has tended to be correlated negatively with the inflation surprises, differently from what emerged historically (Figure 11, panel b). Based on the conclusions of the ECB’s strategy review work-stream on inflation expectations (Baumann et al., 2021), which suggests to prefer, among a set of responsiveness-based metrics of inflation de-anchoring, the responsiveness of ILS forward rates to macroeconomic surprises, we employ the methodology developed in Miccoli and Neri (2019) and Speck (2017).¹¹ First, we analyse the responsiveness of market-based medium-to-long term inflation expectations to surprises in euro area inflation releases (Figure 12, top panel) estimating the following equation:

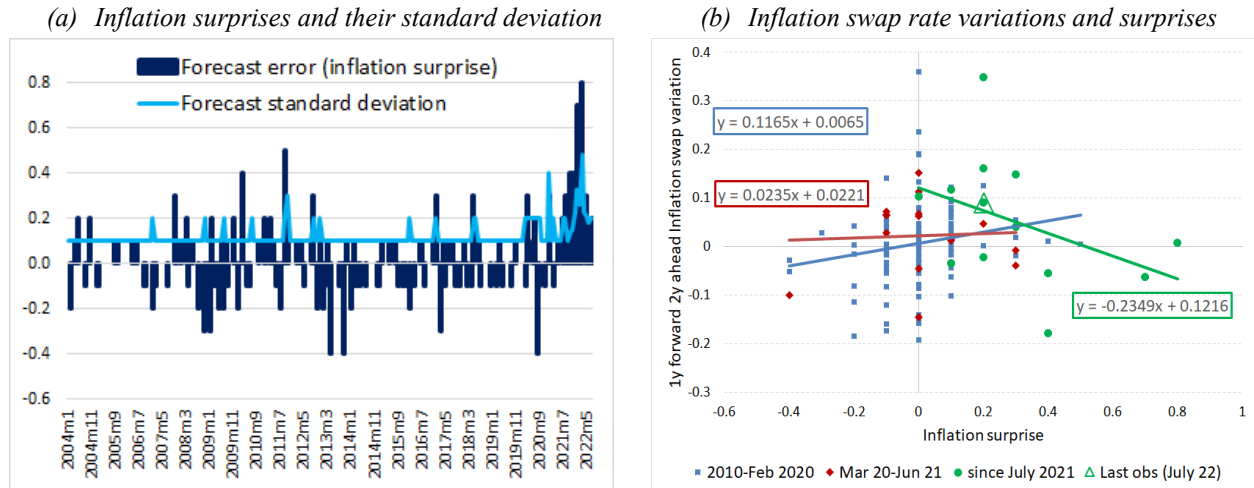
$$\pi_{t>t_0}^{Exp5Y5Y} - \pi_{t<t_0}^{Exp5Y5Y} = \mu + \alpha(\pi_{t_0} - \pi_{t_0}|I_{t<t_0}) + \beta\Delta P_{t-1}^{oil} + \gamma\epsilon_{t-1} + \varepsilon_t \quad (1)$$

where $\pi_{t>t_0}^{Exp5Y5Y}$ indicates the average 5-year forward 5-year ahead ILS in the five working days following the HICP release (t_0) and $\pi_{t<t_0}^{Exp5Y5Y}$ indicates the average 5-year forward 5-year ahead ILS in the five working days preceding the release; $(\pi_{t_0} - \pi_{t_0}|I_{t<t_0})$ is the inflation surprise released at t_0 ; ΔP_{t-1}^{oil} is the lagged change in euro-denominated oil prices (considered as one of the determinants of future inflation changes); ϵ_{t-1} is the €-coin indicator at $t - 1$ (which provides a smoothed estimate of the quarterly growth rate of euro area real GDP, produced by Banca d’Italia and CEPR).

¹⁰ This choice allows to avoid having to take into account the model dependency of the estimates of objective inflation expectations. Such an approach can be based theoretically on the desirability of grounding policy decisions on the evolution of risk-neutral probabilities, rather than subjective ones, precisely because they weigh more the adverse and costly states that consumers and policymakers should guard against (Kocherlakota, 2013). Of course, one should be particularly cautious with such an approach. As noted by Bauer and Christensen (2014), there exist forces that might significantly distort market-based expectations such as limited participation to financial markets, market incompleteness, illiquidity and shifts in sentiments rather than fundamentals.

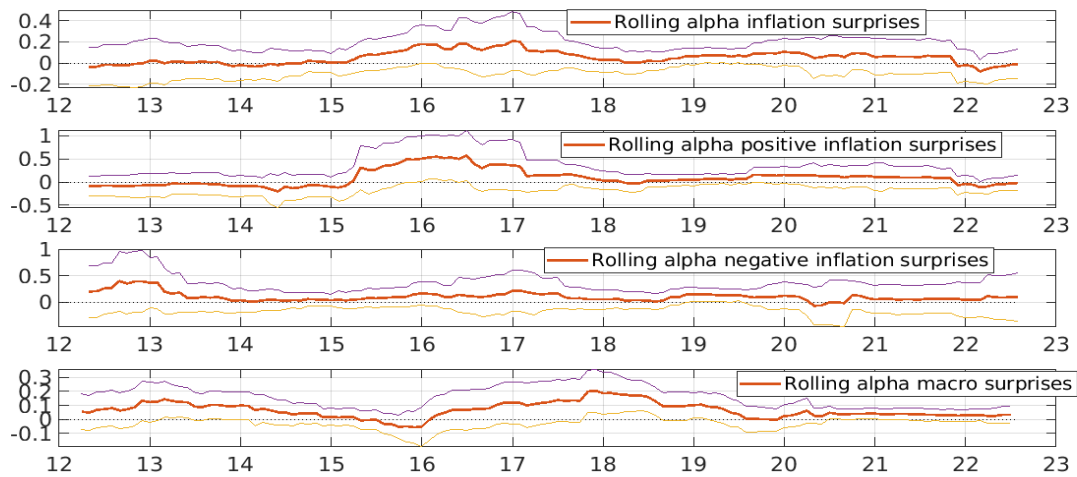
¹¹ Part of the literature studying the anchoring of inflation expectations analyses responsiveness-based metrics that relate longer-term inflation expectations to shorter-term developments; in particular, empirical studies often measure short-term developments as (i) changes in short-term inflation expectations, (ii) movements in actual inflation or (iii) macroeconomic surprises. As shown by the ECB’s strategy review workstream on inflation expectations (Baumann et al., 2021), while studies on the responsiveness of long-term expectations to changes in short-term expectations or actual inflation do not provide a conclusive picture, assessing the responsiveness of ILS forward rates to macroeconomic surprises provides some indication of periods with less well-anchored expectations. However, results are sensitive to the specification of the empirical model. The responsiveness metrics proposed by Speck (2017) consists of estimating the time-varying responsiveness of the 5-year forward 5-year ahead ILS rate to macroeconomic (inflation and corporate sentiment) surprises. Another responsiveness-based approach involves considering whether longer-term expectations react differently depending on the “direction” of surprises. Corsello, Neri and Tagliabracchi (2021) test for the responsiveness of SPF long-term expectations to surprises inflation releases, distinguishing between positive and negative surprises.

Figure 11. Inflation surprises vs inflation swaps variation



We repeated the same exercise considering separately positive and negative inflation surprises (Figure 12, second and third panel). Finally, based on Speck (2017), we estimated the time varying sensitivity of the monthly variation of 5-year forward 5-year ahead ILS rates to macroeconomic surprises (Figure 12, bottom panel).

Figure 12. Responsiveness of 5y-5y ILS to inflation and macroeconomic surprises



Source: Bloomberg. Note: The first three panels show the time varying sensitivity of 5-year forward 5-year ahead ILS rates to inflation surprises (overall, only positive and only negative respectively) corresponding to the coefficient of the rolling regression estimated in Miccoli and Neri (2019). The surprises are measured by the difference between the monthly flash releases of the euro area (Harmonized Index of Consumer Prices) year-on-year inflation rates and the median forecasts of the analysts surveyed by Bloomberg. The bottom panel shows the time varying sensitivity of the monthly variation of the 5y-5y ILS rates to an indicator of macroeconomic surprises, provided by the variation of the Economic Surprise Index by Citigroup. A positive reading of the index suggests that economic releases have on balance been beating consensus. The purple and yellow lines represent the 95 per cent confidence intervals. Monthly data. Rolling window of 30 months. Last observation: July 2022.

While there is evidence of de-anchoring of inflation expectations in the past (in different periods depending on the metric employed), in the recent periods the responsiveness of 5-year forward 5-year ahead ILS rates to (either positive or negative or both) inflation surprises and to macroeconomic

surprises does not provide any sign of de-anchoring. The evidence provided by Figures 11 and 12 suggests that, while between July 2021 and April 2022 inflation has always surprised analysts' expectations on the upside, financial market prices showed no evidence of shock de-anchoring.

5. Consumers' inflation expectations

Households are key economic agents, with private consumption accounting for the largest portion of economic activity. However, unlike professional forecasters or financial market participants, households are generally not macroeconomic experts and less likely to follow macroeconomic developments and monetary policy closely on a regular basis. Thus, they are likely to be less informed about actual inflation developments and the macroeconomic factors impacting on the outlook for inflation, and less attentive to the implications for monetary policy. Thus, their inflation expectations can differ noticeably with respect to professional forecasters or financial market participants.

According to the literature, several factors drive consumers' inflation expectations. Socio-demographic characteristics play a key role: women, lower income earners and individuals with lower level of education tend to perceive and expect higher levels of inflation (Pfajfar and Santoro 2008; Del Giovane et al., 2009; Binder, 2015; Arioli et al., 2017; Meyler and Reiche, 2022, among others). Households' beliefs about inflation appear consistent with a supply-side narrative (Candia et al., 2020); when consumers perceive a deterioration in the general economic situation, they raise their inflation perceptions or expectations. The inflation experience that individuals have undergone over their lifetime affects their inflation expectations (Malmendier and Nagel, 2016). Inflation expectations are mostly shaped by consumer's purchasing experience: the inflation rate of consumption baskets that relate to the socio-economic group to which the individual belongs matters much more than overall inflation in driving consumers' inflation expectations (Pfajfar and Santoro, 2008; Menz and Poppitz, 2013); in forming their expectations, households are more likely to be influenced by changes in prices of the items they purchase at high frequency (e.g. Coibion and Gorodnichenko 2015; Georganas et al., 2014), and more by positive price changes than by similar-sized negative price changes (D'acunto et al., 2021).

Research has identified three stylised facts about consumers' inflation expectations. First, consumers consistently overestimate both perceived and expected inflation. Abildgren and Kuchler (2021) call the former phenomenon the "inflation perception conundrum". Second, consumers' inflation expectations are characterized by heterogeneity across countries and individuals. Some of this heterogeneity is systematically correlated with some socio-demographic characteristics, in particular age, gender, education and income (Jonung, 1981; Arioli, et al., 2017; Abildgren and Kuchler, 2021; Bryan and Venkatu, 2001; Ehrmann et al., 2017). Third, negative economic sentiment is correlated with high inflation expectations (Kamdar, 2019; Candia et al., 2020; Andre et al., 2019; Binder, 2020; Rondinelli and Zizza, 2020).

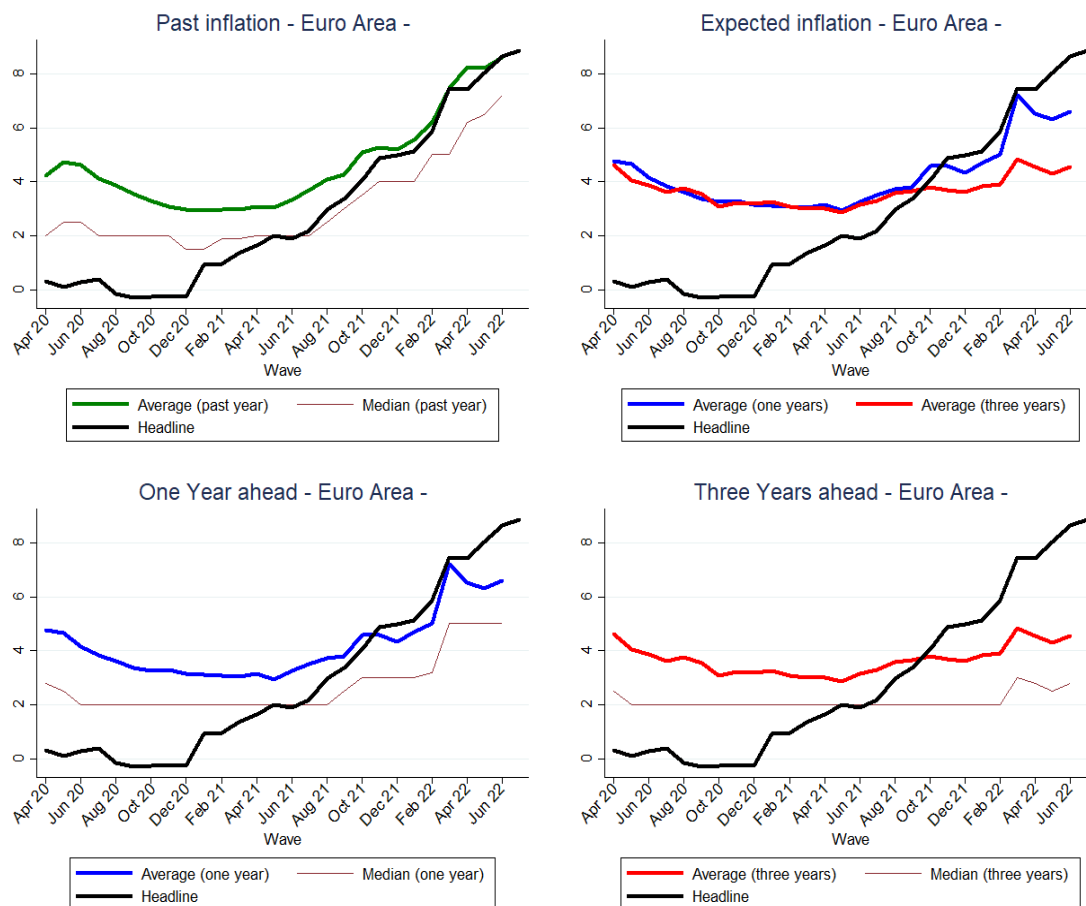
In January 2020, the ECB launched the first waves of its pilot Consumer Expectations Survey (CES).¹² The survey was set up to fill important knowledge gaps that exist in relation to households in the euro area, which could be useful for monetary policy and financial stability. To strengthen

¹² The results of the first three pilot surveys (January to March 2020) have not been made available by the ECB. Since August 2022, the ECB releases every month special aggregates, summarising consumers' expectations about inflation, the housing market, access to credit, income, consumption, the labour market and economic growth.

economic analysis, the CES aims to provide reliable information on households' income and consumption, labour market activities and inflation expectations.

The CES includes a series of questions to measure consumers' perceptions about past inflation as well as their expectations about future inflation one-year and between two- and three-years ahead (that is aligned with the ECB's projection horizon). Open-ended quantitative measures of inflation expectations provide point forecasts, but no information on individual uncertainty about inflation. An important feature of the CES is that it employs a probabilistic-type question to elicit individual uncertainty about inflation over the next year. The survey asks respondents to assign probabilities to future inflation outcomes by allocating 100 points over different ranges of inflation outcomes. The survey allows us to gather some insights on the level anchoring, by focusing on consumers' medium-term expectations. Moreover, we consider the evolution of the disagreement and the dispersion of these expectations, which typically show some peculiarities when compared with other types of survey-based expectations. We also assess how the dynamics of short-term expectations are reflected into longer-term ones, as done with those of professional forecasters and those implied by ILSs.

Figure 13. Households' inflation perceptions and expectations and the level of inflation



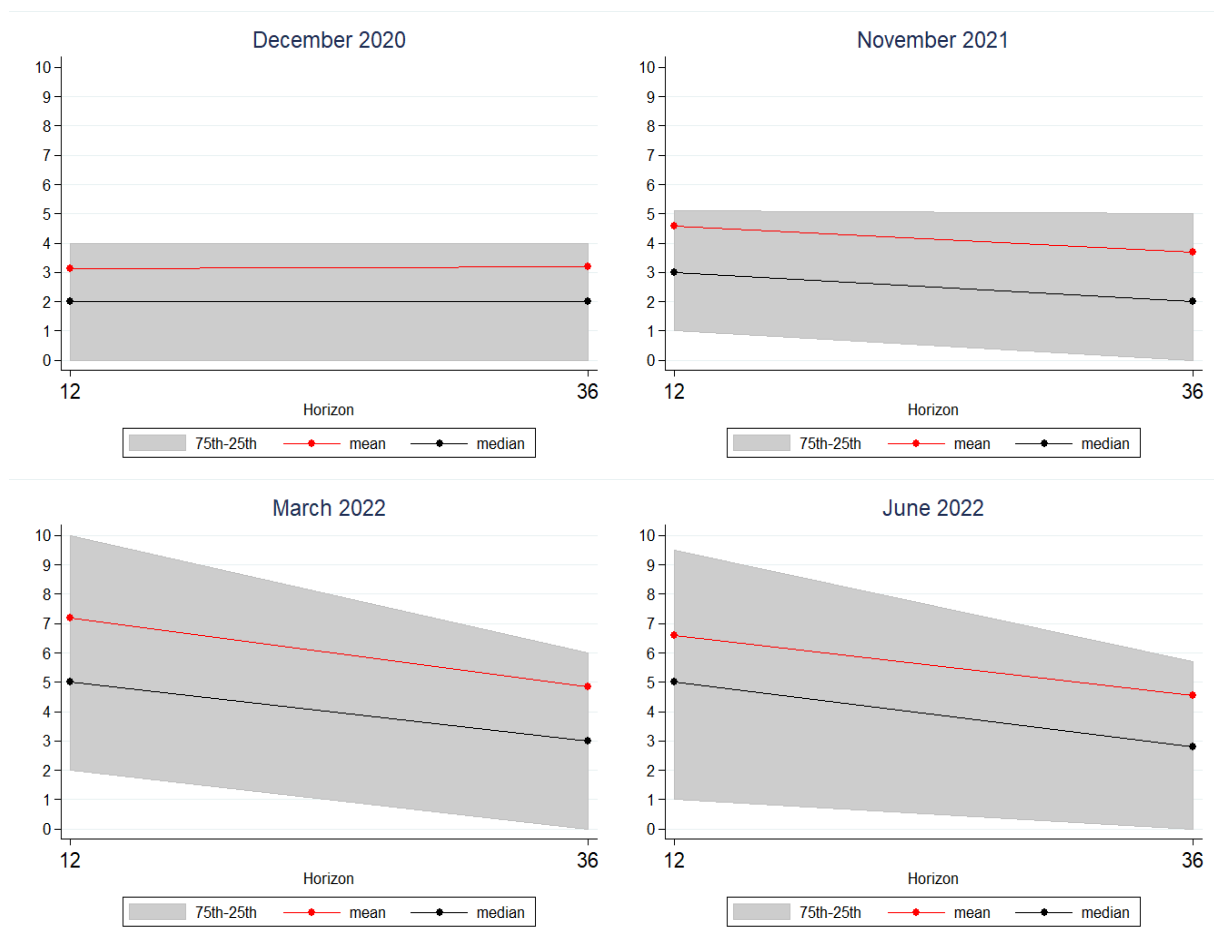
Source: authors' calculations on CES data.

Note: the question to elicit inflation perception on past inflation is "How much do you think prices in general are now compared with 12 months ago in the country you currently live in? Please give your best guess of the change in percentage terms. You can provide a number up to one decimal place". For one year ahead inflation expectations households are asked "How much do you think prices in general will be 12 months from now in the country you currently live in? Please give your best guess of the change in percentage terms. You can provide a number up to one decimal place". For the question on three years ahead expectations households are asked "Please think further ahead to <survey month year+2>. What do you think will happen to prices in general in the country you currently live in over the 12-month period <between survey month year+2 and survey month year+3>". Last observation: June 2022.

Households' inflation expectations, both at short and long horizon, are largely driven by current inflation developments. Over the last year, they have risen significantly. Increases are more prominent in the case of short-term expectations, but longer-term ones have also inched up (Figure 13). Expectations co-move with actual price dynamics at all horizons, with a moderate upward bias (i.e. forecast is above realization) until the increase in oil and gas prices started in mid-2021. Since then, one-year ahead inflation expectations stand below actual inflation; the downward bias is even more significant for longer term inflation expectations. Additionally, Figure 13 shows that the median of inflation expectations, which was well anchored to 2%, has started increasing since the summer of 2021 for the 1-year ahead horizon, and since March 2022 for the 3-year ahead one, standing at 5% and 2.8%, respectively in June 2022 (last data available).

The gradual upward revision of inflation expectation at short and long horizon, which affected both households in lowest and highest income quintile of the income distribution, was more intense for less affluent households. The share of the most volatile components (food and energy) in the consumption basket of the households' in the first quintile of the expenditure distribution is twice as much that in the fifth. When inflation is high due to the most volatile components, a large number of households may revise their inflation expectations more frequently and more strongly. Thus, the gap between inflation expectations of low and high income households widens.

Figure 14. Household inflation curve



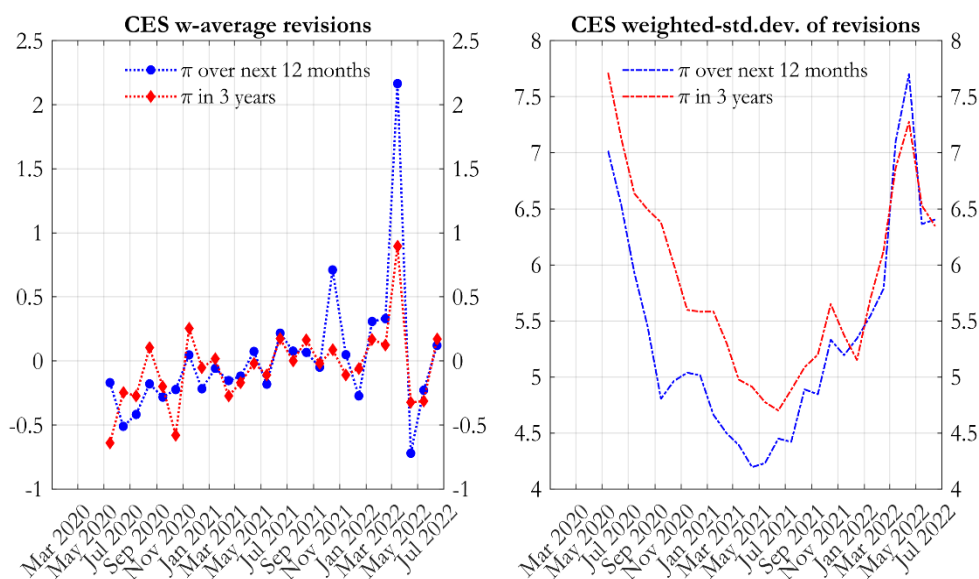
Source: authors' calculations on CES data. The grey shaded areas correspond to the interquartile range and the solid line represents the mean expectations. *Last observation:* June 2022.

The profile of the (average) expected inflation curve, which is typically upward sloping, has become downward sloping since the summer of 2021, and more markedly after the outbreak of the Ukrainian war in February 2022: the large upside revision of short-term inflation expectations was less reflected into those at longer horizon. Figure 14 displays the profile of the (average) inflation curve of households' expectations, which allows to infer the expected persistence of the current high inflation rates (see e.g. Crump et al., 2021). The inversion occurred when actual inflation in the euro area went above 3.0% for the first time in a long period, leading households to raise their expectations, especially at short-horizons.

Although households' long-term expectations are currently now above the ECB's 2 per cent inflation target, the fact that the curve is downward sloping is reassuring about the perceived temporary nature of inflation and the anchoring of long-term inflation expectations to values that are lower than the current inflation. We assess the exceptionality of this period by examining whether the inversion of the expected inflation curve characterizes the cross-section of households. In the last waves, almost 60% of the households display an inverted inflation curve, i.e. they expect inflation to be higher at the 12-month ahead horizon than at the 3-years one. This share has been increasing since the summer of 2021: it was around 30% at the beginning of 2021.

The sizeable upward bias of households' expectations makes it difficult to assess the level anchoring of these expectations. However, in order to gauge useful information in this regard, it is possible to monitor the revisions to long-term forecasts and their dispersion. After strong positive revisions in the first quarter of 2022, revisions have traced back somewhat. On this respect, the recent upward trend of long-term inflation expectations of euro area consumers is also noticeable looking at revisions by individual households, which are shown in Figure 15. The waves between January and March 2022 were characterized by average positive revisions to expectations at both horizons, although markedly larger at the short-term one. However, in the last waves (April to June 2022) the revisions have generally been negative or close to zero, reducing their degree of dispersion, which had peaked in March.

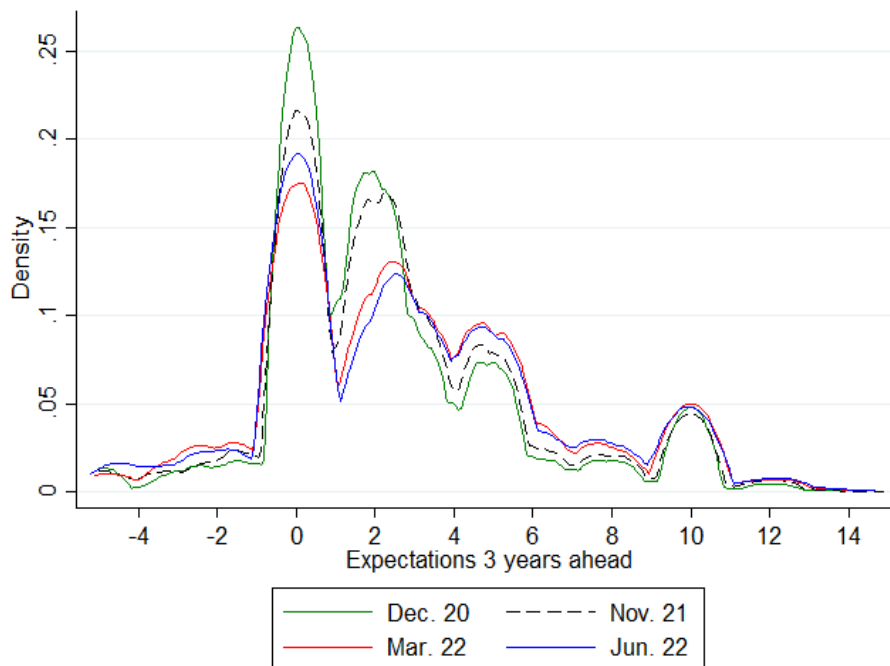
Figure 15. Weighted mean and std. dev. of revisions to quantitative inflation forecasts



Source: authors' calculations on CES data. Last observation: March 2022.

The probabilistic forecasts collected by the survey show a right-shift in the expected short-term distribution of inflation at the one year ahead horizon. The probability assigned by households to the event that inflation in 12 months would be higher than 8% was 31% in March 2022, increasing up to 33% in June 2022, while it was 14% at the end of 2020 and 20% in the wave during the initial phase of the Covid-19 pandemic. Additionally, the probability that prices will increase by between 0 and 2 per cent over the next 12 months, which was 26 per cent in December 2020, decreased to 10 in June 2022, as inflation surged due to raising energy prices.

Figure 16. Density of households' inflation expectations 3 years ahead



Source: authors' calculations on CES data. Last observation: June 2022.

Along with the marked shift of probability mass towards higher inflation outcomes in the short-term, the distribution of quantitative forecasts at the longer horizon move much less. At the end of 2020, a large share of households had longer term inflation expectations concentrated around zero (Figure 16); this share fell substantially since March 2022.¹³ The concentration of the replies between 2 and 4% looked very similar in all depicted waves, but resulted significantly lower in March and June 2022, pointing to a shift towards higher inflation outcomes. The share of households who foresee an inflation above 4 per cent in three years is significantly higher since March 2022

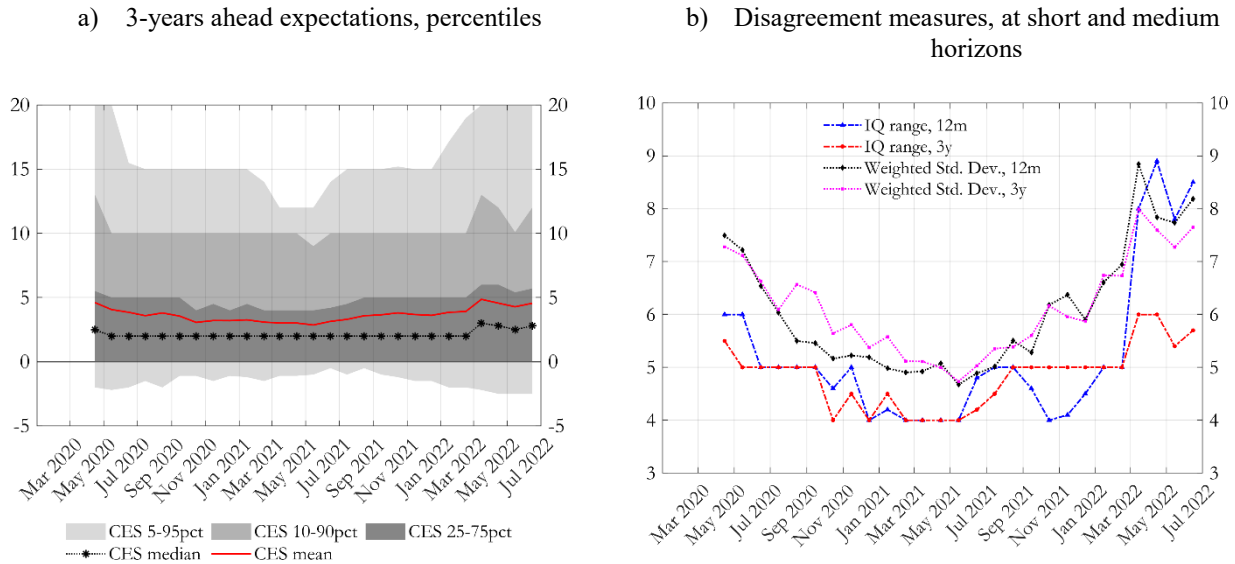
Figure 17 provides information on the disagreement among households over the various waves. Reiche and Meyler (2022) document that, when looking at consumers' responses of the ECCS, uncertainty and dispersion are positively associated to higher inflation perceptions and expectations.¹⁴ This evidence is also corroborated by the CES (Figure 17, panel a). Indeed, during the very uncertain times of mid-2020, when the first waves were collected, inflation expectations were highly dispersed. This is also evident, to a larger extent, in the survey rounds conducted since the surge in inflation in

¹³ The rounding of the consumer reply for the quantitative expectations is documented also in Reiche and Meyler (2022).

¹⁴ The disagreement, measured by the dispersion of point forecasts, could be considered also as proxy for the degree of uncertainty, even though it represents a lower bound estimate (Zarnowits and Lambros, 1987).

mid-2021 and after the invasion of Ukraine, as consumers started reporting higher perceived and expected, even at the medium term horizon (3-years). Nevertheless, the dispersion seems to have reached a plateau in the first quarter of 2022, remaining stable since April 2022.

Figure 17. Dispersion of the euro area consumers' inflation expectations



Source: authors' calculations on CES data. Last observation: March 2022.

The recently increased dispersion of household inflation expectations is associated with a rise in expected inflation at the available horizons (Figure 17, panel b). The empirical evidence, reported also in the literature, of a strong association between the level and the dispersion of consumers' expectations at both short and medium term horizons, casts some doubts about the possibility of a precise assessment of the level anchoring of consumers' expectations. Indeed, consumers may confound the central bank's ability to keep future inflation anchored to low levels for the degree of certainty and stability of the macroeconomic environment in which they live.

A more formal assessment of shock-anchoring can be made by measuring the responsiveness of long- to short-term inflation expectations in the spirit of Łyziak and Paloviita (2017) and Corsello et al. (2021). Exploiting the panel dimension of the CES, we estimate the following panel regression:

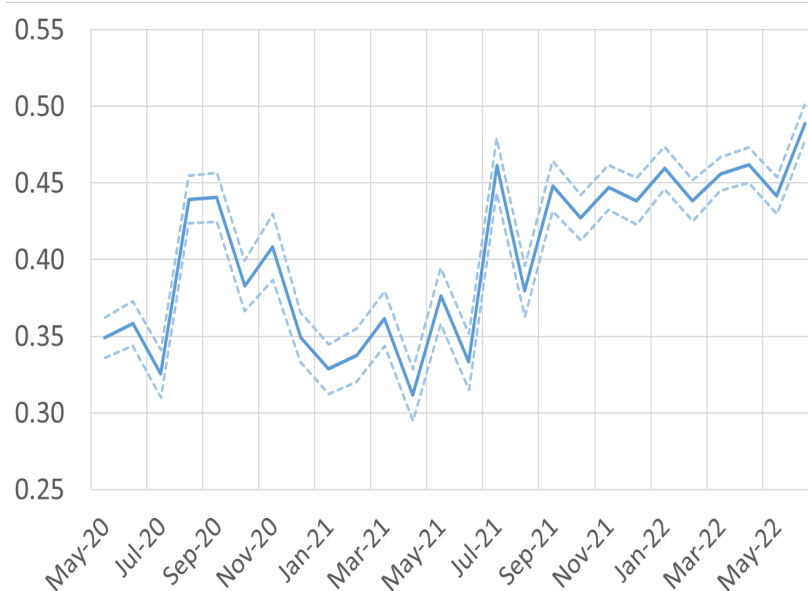
$$\pi_{i,t}^{3y} = \alpha_i + \gamma_t + \beta_t \cdot \pi_{i,t}^{12m} + \varepsilon_{i,t} \quad (2)$$

where $\pi_{i,t}^{3y}$ is the 3 years ahead inflation expectations formulated by household i at time t , $\pi_{i,t}^{12m}$ is the 1 year ahead expectation, γ_t are wave fixed effects, α_i are household fixed effects. The coefficient β_t measures the effect of short-term expectations on long-term ones.

Figure 18 shows the time-varying coefficient representing the evolution of the sensitivity over time. The coefficient is significantly positive over the sample, indicating that within the cross section of households short- and medium-term expectations are positively associated, both in period of low and high inflation. Nevertheless, this measure has slightly increased since mid-2021 and have stabilized around its highest levels since the end of 2021. This result may also be due to the empirical fact that most consumers in times of high inflation tend to revise all the expectations at the different horizons. Moreover, differently from similar analysis performed for other types of agents, the longest-term

available expectations for consumers are at 3-years ahead horizon, rather than at 5-years or more. These caveats attenuate the informational content of this pass-through in assessing the shock-anchoring of long-term inflation expectations.

Figure 18. Responsiveness of long- to short-term consumers' expectations



Source: authors' calculations on CES data. The dashed lines correspond to the 95% confidence bands. Last observation: June 2022.

6. Firms' inflation expectations in Italy

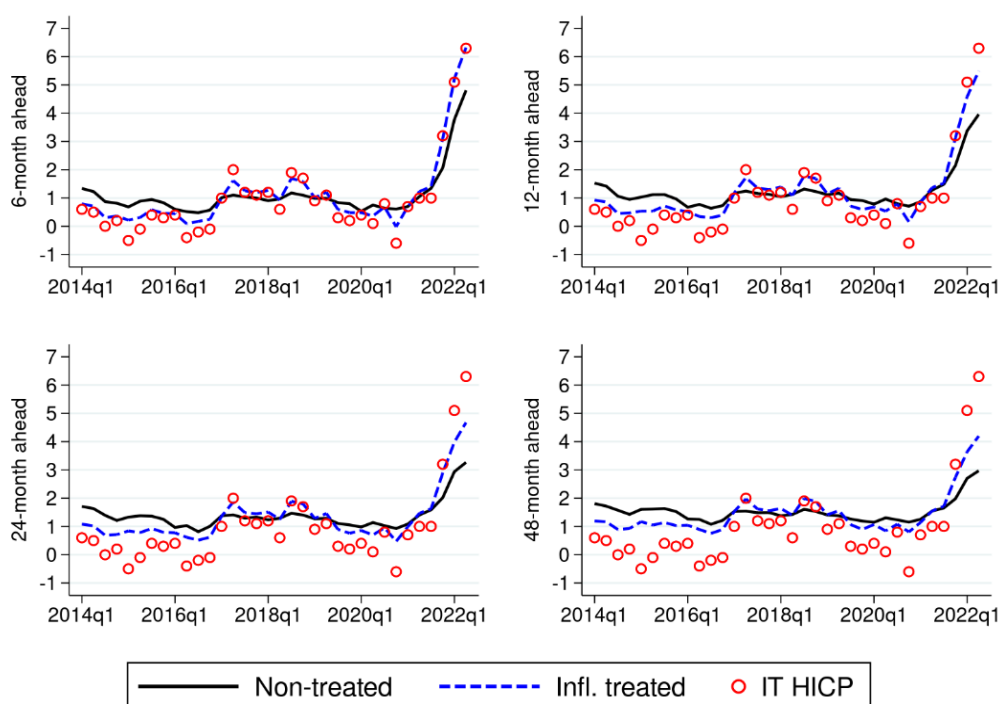
As documented in Section 2, the availability of quantitative measures of firms' inflation expectations is more limited than for professional forecasters. For the euro area, the European Commission only provides firms' qualitative assessment on their expected selling prices. In the case of Italian firms, Banca d'Italia's Survey of Inflation and Growth Expectations (SIGE, hereafter) can be exploited to study the anchoring of (Italian) firms' long-term inflation expectations, as it includes information on quantitative expectations at different horizons.¹⁵ Clearly, the results of this analysis must be taken with caution, as they apply to Italian firms, and not to euro-area firms.

Italian firms' observed inflation expectations, both at short and long horizon, are largely driven by current inflation. Figure 19 shows that expectations co-move with actual price dynamics at all horizons with a moderate upward bias, which remains, however, smaller than the one generally observed for consumers. The relationship between inflation and its expectations appears particularly strong for inflation-treated firms (blue dashed line)¹⁶, but it also characterizes firms that do not receive any information on last inflation figure (black solid line), although to a lesser extent.

¹⁵ The existing literature on SIGE has shown that firms' inflation expectations seem to be driven by several factors, including the awareness of news on current inflation (Coibion et al., 2020; Bottone et al., 2022), the dynamics of wages (Conflitti and Zizza, 2021) and the monetary policy stance (Bottone and Rosolia, 2019; Bottone et al., 2022).

¹⁶ The nominal anchor was provided to all respondents up to 2012:Q2. Since 2012:Q3 the question has been collected splitting the sample in two groups: about two out of three respondents ("informed/anchored firms") are provided a nominal anchor – the latest available official figure before the questionnaire is sent – while the remaining firms are not informed.

Figure 19. Firms' inflation expectations and the level of inflation



Source: authors' calculations on SIGE data. The blue dashed line represents the average inflation expectations for firms that received the inflation treatment (red circles), while the black solid line corresponds to the average of the non-treated firms. *Last observation:* 2022:Q2.

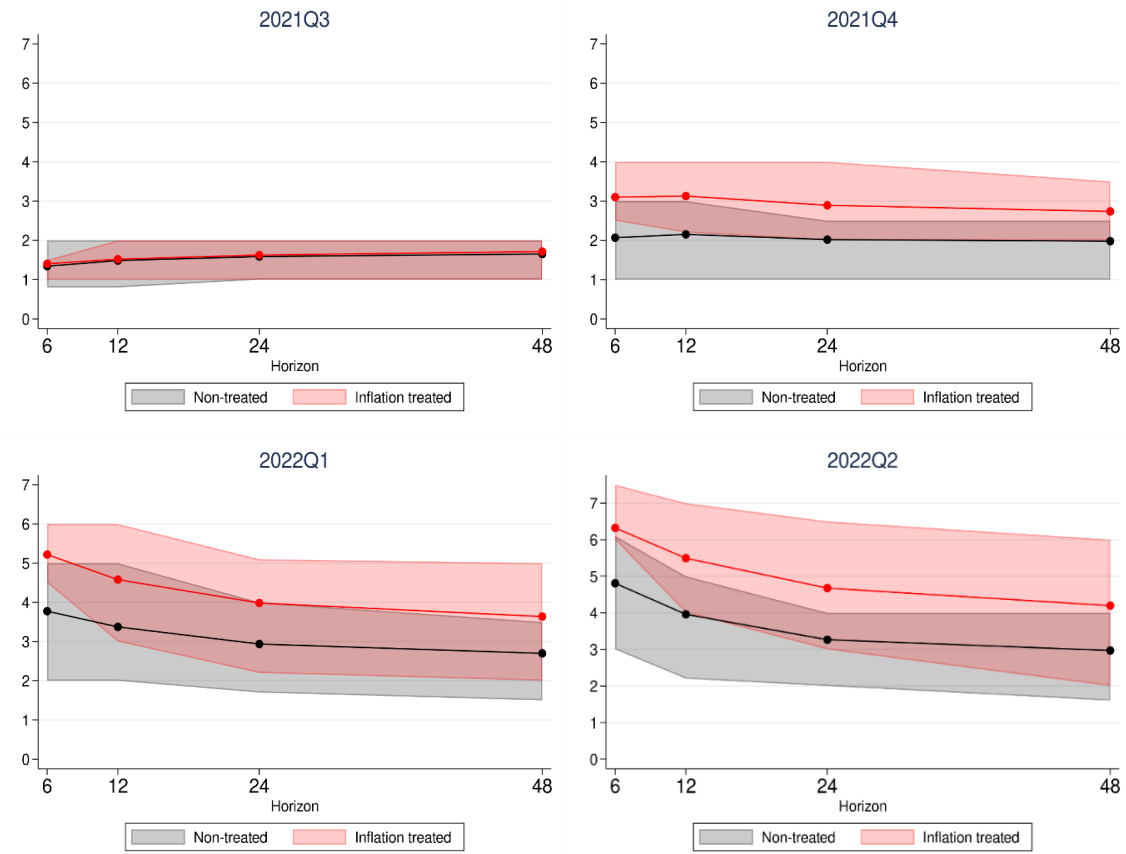
The time profile of the expected inflation curve, which has been upward sloping since 2014, became downward sloping in the first quarter of 2022, as the large upside revisions of short-term expectations were not reflected into those at longer horizon. This is the same profile observed for households (Section 5). The inversion of the expected inflation curve was diffuse across firms. The fact that firms' long-term inflation expectations are sensitive to current inflation data might be suggestive of a possible shock disanchoring (Ball and Mazumder, 2011).

A deeper analysis of the expectations collected in the last four waves provides some interesting findings that attenuate the concern that firms' long-term inflation may be de-anchored. Indeed, Figure 20 displays the profile of the (average) inflation curve derived from firms' expectations, which allows to infer the expected persistence of the current high inflation rates (Crump et al., 2021).

The inflation curve was upward sloping until 2021:Q3. Then, it was broadly flat in 2021:Q4, but subsequently became down-ward sloping in the following two quarters when actual inflation in Italy went above 5.0 per cent for the first time in a long period, leading firms to revise upward their expectations at short-horizons, with smaller revisions in long-term ones, which remained anchored to lower levels. Although long-term expectations appear now above the ECB's 2 per cent inflation target, the fact that the curve is downward sloping is reassuring about the perceived temporary nature of inflation and the anchoring of long-term inflation expectations to values that are lower than the ones observed in current actual data.

Moreover, since the beginning of 2017, the share of informed and non-informed respondents has been changed as follows (as documented in Bottone et al., 2022). For 3 out of 5 firms in the sample the standard nominal anchor is provided; for 1 out of 5 there is no nominal anchor and for the remaining fraction the information on the ECB inflation target is given.

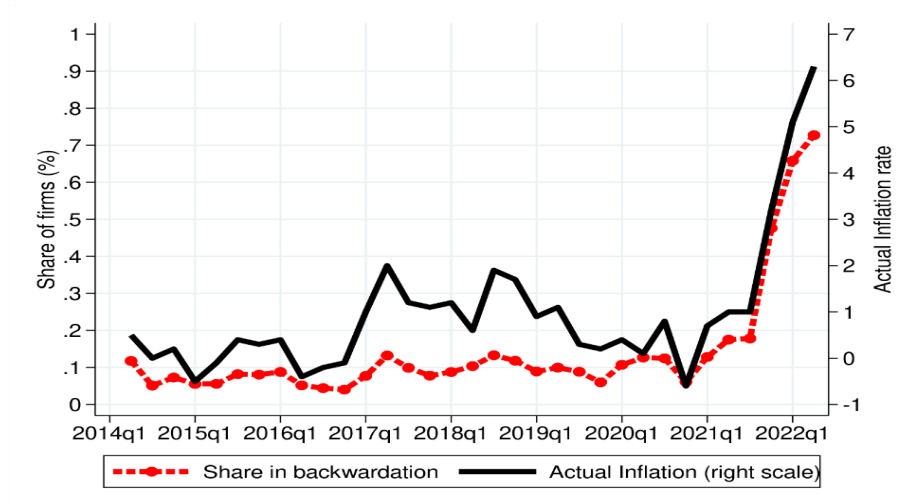
Figure 20. Inflation curve by information treatment



Source: authors' calculations on SIGE data. The colored shaded areas correspond to the interquartile range and the solid line represents the median expectations. Last observation: 2022:Q2.

We assess the exceptionality of the current inflation environment by examining whether the inversion of the expected inflation curve characterizes the cross-section of firms. We consider the inflation curve as inverted if $\pi_{i,t}^{t+48} < \pi_{i,t}^{t+6}$ and we then look at the share of firms that presents this feature with a comparison in historical terms. Figure 21 shows that more than 70% of the firms display an inverted inflation curve, representing a unique case in the history of SIGE.

Figure 21. Share of firms with the curve in backwardation and level of inflation



Source: authors' calculations on SIGE data. Last observation: 2022:Q2.

Firms' long-term inflation expectations are less influenced than those at shorter horizons by inflation surprises, further attenuating the concerns that long-term ones are disanchored. We assess more formally how the unexpected surprise in inflation data affects firms' inflation expectations, by considering their individual short-term forecast errors. Specifically, we compute the forecast error at the shortest horizon available, i.e. $FE_{i,t}^{t+6} = \pi_t - \pi_{i,t-6}^{e,t+6}$ and evaluate its impact on the revisions of inflation expectations. In more details, we estimate the following model:

$$\Delta \pi_{i,t}^{t+48} = c + \beta FE_{i,t}^{t+6} + \omega X_i + \epsilon_{i,t} \quad (3)$$

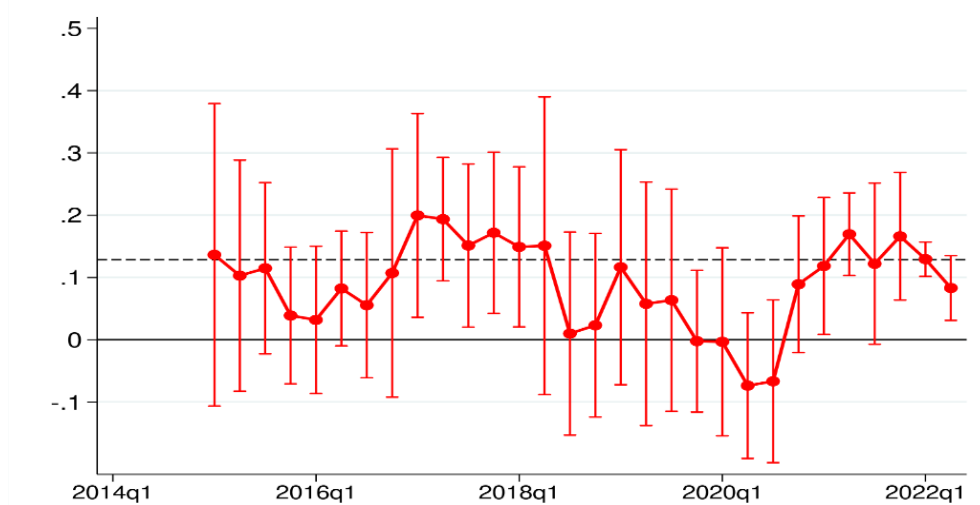
where $FE_{i,t}^{t+6}$ measures the forecast error at time t related to the forecast done two quarters before for the 6-month ahead horizon. This approach mimics the one used in sections 3, 4 and 5 but with the advantage of using *firm-specific* forecast errors on short-term inflation expectations, i.e. errors that are formed within this survey, rather than using data on inflation surprises from external sources. Table 1 presents the main findings for both non-treated and inflation treated firms. The positive relation between forecast errors and revisions to inflation expectations is statistically significant at all horizons. Importantly, this sensitivity is a decreasing function of the horizon, confirming the evidence that long-term inflation expectations are less influenced by short-term inflation surprises.

Table 1: Current forecast errors and changes to inflation expectations

	Non-treated				Inflation-treated			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	D.it6	D.it12	D.it24	D.it48	D.it6	D.it12	D.it24	D.it48
β	0.197*** (0.019)	0.153*** (0.018)	0.109*** (0.018)	0.084*** (0.017)	0.321*** (0.015)	0.252*** (0.016)	0.193*** (0.015)	0.162*** (0.015)
N	6385	6385	6385	6385	14523	14523	14523	14523
adj. R^2	0.035	-0.005	-0.027	-0.049	0.155	0.081	0.038	0.018

Source: authors' calculations on SIGE data. Inference is conducted using robust standard errors. Last observation: 2022:Q2.

Figure 22. Sensitivity of long-term expectations to short-term forecast errors



Source: authors' calculations on SIGE data. The coefficients are estimated using a four-quarter moving window and considering standard time-invariant fixed effects for firm characteristics. The black dotted horizontal line represents the estimate over the entire sample period. Last observation: 2022:Q2.

The peculiarity of the current inflationary period might suggest to consider time-variation in the sensitivity of long-term inflation expectations to short-term forecast errors. To this end, we estimate equation (3) using a four-quarter moving-window to capture possible changes in this sensitivity (Figure 22). While this sensitivity appears to vary over time, it is interesting to note that it now stands below its historical average (black dotted line). This attenuates the concerns about the possible spillovers of recent high inflation data on long-term inflation expectations.

7. Concluding remarks

The anchoring of long-term inflation expectations to the central bank's inflation target is a necessary condition for central banks to maintain price stability, as it prevents temporary shocks from having persistent effects on inflation. In the euro area, the current elevated inflationary pressures make the anchoring of expectations an essential feature of the on-going normalization of the ECB's monetary policy.

Long-term inflation expectations in the euro area are re-anchoring from below to the ECB's 2 per cent symmetric inflation target. For the time being, this reassuring message emerges from different measures of long-term inflation expectations and methodologies employed to assess their anchoring.

The risk of upward de-anchoring of long-term inflation expectations from the target is, however, non-negligible and deserves close monitoring in order to assess the appropriate pace of monetary policy normalization. Preventing the de-anchoring of expectations is a priority for the ECB in order to preserve the credibility of the new monetary policy strategy.

References

- Aastveit, K. A., Bjørnland, H. C., and Cross, J. C. (2020). "Inflation expectations and the pass-through of oil prices", Centre for Applied Macro and Petroleum economics (CAMP) Working Papers, No. 3.
- Abildgren, K. and Kuchler, A. (2021, March). "Revisiting the inflation perception conundrum". *Journal of Macroeconomics*, Vol. 67, 103264
- Arioli R., C. Bates, H. Dieden, I. Duca, R. Friz, C. Gayer, G. Kenny, A. Meyler, I. Pavlova (2017) "EU consumers' quantitative inflation perceptions and expectations: an evaluation", ECB Occasional paper, No. 186.
- Andre, P., Pizzinelli, C., Roth, C., and Wohlfart, J. (2019). "Subjective Models of the Macroeconomy: Evidence from Experts and a Representative Sample", SSRN Electronic Journal. Retrieved from <https://ssrn.com/abstract=3355356>.
- Bai, J. (2010). "Common breaks in means and variances for panel data", *Journal of Econometrics*, Vol. 157(1), pp. 78-92.
- Bai, J., & Perron, P. (2003). "Computation and analysis of multiple structural change models". *Journal of applied econometrics*, Vol. 18(1), pp. 1-22.
- Ball, L. and S. Mazumder (2011). "Inflation Dynamics and the Great Recession", *Brookings Papers on Economic Activity, Economic Studies Program, The Brookings Institution*, Vol. 42, pp. 337-405.
- Baumann, Ursel, Matthieu Darracq Paries, Thomas Westermann, Marianna Riggi, Elena Bobeica, Aidan Meyler, Benjamin Bönninghausen, Friedrich Fritzer, Riccardo Trezzi, Jana Jonckheere (2021). "*Inflation expectations and their role in Eurosystem forecasting*", ECB Occasional paper, No. 264.
- Bauer, M. and J. Christensen (2014). "Financial market outlook for inflation", FRBSF Economic Letter.
- Binder, C. (2020). "Long-run inflation expectations in the shrinking upper tail" *Economics Letters*, Vol. 168, 108867.
- Binder, C. (2015) "Whose expectations augment the Phillips curve?", *Economics Letters*, Vol. 136(C), pp. 35-38.
- Bryan, M., and Venkatu, G. (2001). "The Demographics of Opinion Surveys", Federal Reserve Bank of Cleveland.
- Bottone, M. and A. Rosolia (2019). "Monetary policy, firms' inflation expectations and prices: causal evidence from firm-level data", Banca d'Italia Working Paper, No. 1218.
- Bottone, M., A. Tagliabracchi, and G. Zevi (2022). "Inflation expectations and the ECB's perceived inflation objective: novel evidence from firm-level data", *Journal of Monetary Economics*, forthcoming.
- Bulligan, G., Corsello, F., Neri, S., & Tagliabracchi, A. (2021). "De-anchored long-term inflation expectations in a low growth, low rate environment", Bank of Italy Occasional Paper, No. 624.
- Busetti, F., Delle Monache, D., Gerali, A., & Locarno, A. (2017). "Trust, but verify. De-anchoring of inflation expectations under learning and heterogeneity", ECB working paper No. 1994.
- Camba-Méndez, G., and Werner, T. (2017). "The inflation risk premium in the post-Lehman period", ECB working paper, No. 2033.

- Candia, B., Coibion, O. and Y. Gorodnichenko (2020). “Communication and beliefs of economic agents”, NBER Working Paper, No. 27800.
- Carvalho, C., Eusepi, S., Moench, E., Preston, B. (2022). “Anchored Inflation Expectations”, American Economic Journal: Macroeconomics, forthcoming.
- Cecchetti, S., Grasso, A., and Pericoli, M. (2022). “An analysis of objective inflation expectations and inflation risk premia”, Banca d’Italia Working Paper, No. 1380.
- Cecchetti, S., Fantino, D., Riggi, M., Notarpietro, A., Tagliabracci, A., Tiseno, A., and Zizza, R. (2021). “Inflation expectations in the euro area: indicators, analyses and models used at Banca d’Italia”, Banca d’Italia, Occasional Paper, No. 612.
- Cecchetti, S., Natoli, F., and Sigalotti, L. (2015). “Tail comovement in option-implied inflation expectations as an indicator of anchoring”, Banca d’Italia Working paper, No. 1025.
- Cochrane, J. (2009). “Asset Pricing”, Princeton University Press.
- Coibion, O. and Y. Gorodnichenko (2015) “Is the Phillips curve alive and well after all? Inflation expectations and the missing disinflation”, American Economic Journal: Macroeconomics, Vol. 7, pp. 197-232.
- Coibion, O., Y. Gorodnichenko, and T. Ropele (2020): “Inflation Expectations and Firm Decisions: New Causal Evidence”, The Quarterly Journal of Economics, Vol. 135, 165-219.
- Conflitti, C. and R. Zizza (2021): “What’s behind firms’ inflation forecasts?” Empirical Economics, Vol. 61, pp. 2449-2475.
- Conflitti, C., and Cristadoro, R. (2018). “Oil prices and inflation expectations”, Banca d’Italia Occasional Paper, No. 423.
- Corsello, F., Neri, S., and A. Tagliabracci (2021). “Anchored or de-anchored? That is the question”, European Journal of Political Economy, Vol. 69, 102031.
- Crump, R. K., Eusepi, S., Moench, E. and Preston, B. (2021). “The Term Structure of Expectations”, FRB of New York Staff Report, No. 992.
- D’Acunto, F. Malmendier, U. Ospina, J. And Weber, M. 2021. “Exposure to Grocery Prices and Inflation Expectations”, Journal of Political Economy, Vol. 129(5), pp. 1615-1639.
- Del Giovane, P., Fabiani S., and R. Sabbatini (2009). “What’s Behind Inflation Perceptions? A Survey- Based Analysis of Italian Consumers”, Giornale degli Economisti, Vol. 68, pp. 25-52.
- Ehrmann, M., Pfajfar, D., and Santoro, D. (2017). “Consumers’ Attitudes and their Inflation Expectations”, International Journal of Central Banking, Vol. 13, pp. 225-259.
- Fanari, M., & Di Iorio, A. (2022): “Break-even inflation rates: the Italian case”, Studies in Economics and Finance.
- Gáti, L. (2022). “Monetary Policy & Anchored Expectations: An Endogenous Gain Learning Model”, Manuscript.
- Georganas, S., Healy, P. and N. Li (2014). “Frequency Bias in Consumers’ Perceptions of Inflation: An Experimental Study”, European Economic Review, Vol. 67, pp. 144-158.
- Hilscher, Jens, Alon Raviv and Ricardo Reis (2022). “How Likely is an Inflation Disaster?”, CEPR discussion paper No. 17244.

- Joslin, S., Singleton, K., & Zhu, H. (2011). "A new perspective on gaussian dynamic term structure models", *Review of Financial Studies* Vol. 24, pp. 926-970.
- Kamdar, R. (2019). "The Inattentive Consumer: Sentiment and Expectations", Meeting Papers. Retrieved from https://rupalkamdar.github.io/pdfs/Inattentive_Consumer.pdf.
- Kocherlakota, N. (2013). "Optimal outlooks", speech at the Conference on Extracting and Understanding the Risk Neutral Probability Density from Option Prices, NYU Stern School of Business.
- Kumar, S., Afrouzi, H., Coibion, O., and Gorodnichenko, Y. (2015). "Inflation Targeting Does Not Anchor Inflation Expectations: Evidence from Firms in New Zealand", *Brookings Papers on Economic Activity*, Vol. 46, pp. 151-225.
- Łyziak, T. and Paloviita, M. (2017). "Anchoring of inflation expectations in the euro area: Recent evidence based on survey data", *European Journal of Political Economy*, Vol. 46, pp. 52-73.
- Malmendier U. and S. Nagel (2016). "Learning from inflation experiences", *The Quarterly Journal of Economics*, Vol. 131, pp. 53-87.
- Menz, J-O. and P. Poppitz (2013). "Households' disagreement on inflation expectations and socioeconomic media exposure in Germany", *Deutsche Bundesbank Discussion Papers*, No. 27.
- Miccoli, M., and Neri, S. (2019). "Inflation surprises and inflation expectations in the euro area", *Applied Economics*, Vol. 51, pp. 651-662.
- Panetta, F. (2022). "Normalising monetary policy in non-normal times", speech at a policy lecture hosted by the SAFE Policy Center at Goethe University and the Centre for Economic Policy Research (CEPR)
- Pfajfar D. and E. Santoro (2008). "Asymmetries in Inflation Expectation Formation Across Demographic Groups," *Cambridge Working Papers in Economics*, Vol. 24.
- Reiche, L. and M., Aidan (2022). "Making sense of consumer inflation expectations: the role of uncertainty", *European Central Bank Working Paper Series*, No. 2642.
- Rondinelli, R. and R. Zizza (2020) "Spend today or spend tomorrow? The role of inflation expectations in consumer behavior", *Banca d'Italia Working paper*, No.1276.
- Rostagno, M., C. Altavilla, G. Carboni, W. Lemke, R. Motto, A. S. Guilhem and J. Yiangou (2021). *A tale of two decades: the ECB's monetary policy at 20*. Oxford University Press.
- Speck, C. (2017). "Inflation anchoring in the euro area", *ECB Working Paper*, No. 1998.
- Taboga, M. (2016). "Option-Implied Probability Distributions: How Reliable? How Jagged?" *International Review of Economics and Finance*, Vol. 45, pp. 453-469.