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* Views expressed are those of the authors and do not necessarily reflect official positions
of De Nederlandsche Bank.

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Reactions of household inflation expectations to a symmetric inflation target and high inflation*

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Abstract

We provide evidence on the reactions of the level and probability distribution of households' expectations of inflation in the euro area to the ECB's monetary strategy change to a symmetric inflation target in July 2021, and to the subsequent strong rise in euro area inflation above target. We use a randomised control trial within a monthly representative Dutch household survey of short- and long-term euro area inflation expectations, where half of respondents receive information about the ECB's inflation target and actual inflation. The survey responses give rise to three main findings. First, we find that the introduction of a symmetric inflation target by the ECB did not have a significant immediate upward effect on the level of either long-term or short-term euro area inflation expectations of consumers, both for the group with information treatment and for the control group. Second, and by contrast, euro area long-term and short-term inflation expectations increased significantly in the period when inflation increased strongly above target. Taken together, the results document that the ECB strategy revision itself did not have a material impact on household inflation expectations, but the high realisations of actual inflation did. These findings suggest that when it comes to household inflation expectations and central bank credibility, inflation outcomes speak louder than words. The third finding is that households' expected probabilities of high euro area inflation (4% or higher) also increased significantly in response to high above-target inflation at both the long- and short-term horizons, and both for the group with information treatment and for the control group. These results suggest that long-term euro area inflation expectations of households have become less well anchored as inflation has increased strongly above target.

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1. Introduction

We provide evidence on the changes in the level and probability distribution of consumers' expectations of inflation in the euro area following the announcement of the ECB's new monetary strategy on 8 July 2021, and following the subsequent strong rise in euro area inflation above target in the wake of the pandemic (Figure A1). On that date, the ECB announced a change to a symmetric 2% inflation target, from a previous inflation aim of below but close to 2%, following a strategy review that had started in early 2020 (ECB, 2021).

Our motivation is twofold. First, over the past decade, the credibility of monetary authorities in advanced economies has been challenged by persistently low inflation, motivating a review of their monetary strategies. A crucial element of this review has been the effort to better anchor inflation expectations (ECB, 2021). In this effort, central banks have increasingly focused on inflation expectations held by households. In parallel, a growing research literature has documented the importance of household expectations and their different properties compared to expectations by financial markets and professional forecasters.¹ Second, since mid-2021, global inflation has been persistently high. While the focus has initially been on the role of supply factors, such as supply bottlenecks related to the Covid-19 pandemic, continuing upside surprises of inflation data have led to raising concerns about a de-anchoring of inflation expectations on the upside (Reis, 2021b, 2022).

We use a randomised control trial within a monthly representative Dutch household survey of short- and long-term inflation expectations, where half of respondents receive information about the ECB's inflation target and realised inflation. That is, half of respondents receive information about the ECB's inflation target and inflation directly in the survey. In our monthly survey, we can distinguish the effects on median euro area inflation expectations of the announcement of the new symmetric inflation target from the effect of the strong rise in inflation above target. In fact, the September survey was

¹ See e.g. Reis (2021a) and Hilscher et al. (2022). D'Acunto et al. (2022) and Weber et al. (2022) provide an overview of the main findings of the growing literature on the properties and drivers of household expectations and their impact on economic decisions.

held after the publication of the flash estimate for the August HICP inflation which became available on 31 August 2021 and marked a strong increase in inflation up to 1 percentage point (pp) above target (Figure A1). The August 2021 DHS satellite survey was conducted after the announcement of the ECB's symmetric inflation target on 8 July 2021 and well before the publication of the HICP inflation data for August 2021.

Throughout the paper, we refer to anchored inflation expectations in the sense of 'level anchoring', according to which long-term inflation expectations are well anchored if they are tied to the target of monetary policymakers (see e.g. Grishchenko et al., 2019).² In particular, we measure anchoring in terms of the deviation of the level of long-term inflation expectations from the ECB's inflation target, or the expected probability of inflation being close to target ten years ahead.

We find that the introduction of a symmetric inflation target by the ECB did not have a significant immediate upward effect on the level of either long-term or short-term euro area inflation expectations of consumers, both for the group with information treatment and for the control group. By contrast, euro area long-term and short-term inflation expectations increased significantly in the period when inflation increased strongly above target. Moreover, households' expected probabilities of high inflation (4% or higher) increased significantly in response to high above-target inflation, both for the long- and short-term horizons. These results suggest that long-term euro area inflation expectations became less well anchored when inflation increased strongly above target in the wake of the pandemic. The expectations both of the group who received information and of the one who did not became less well anchored with inflation rising strongly above target.

Coibion et al. (2020a) find that communication about the introduction of the average inflation targeting framework by the Federal Reserve did not affect household inflation expectations in the United States. Our results that consumers' long-term euro area inflation expectations did not respond to the introduction of a symmetric inflation target by the ECB as part of its monetary policy strategy review, and that short-term

² The definition of level anchoring goes back to Ball and Mazumder (2011). For a recent discussion of alternative definitions of anchoring, see Cecchetti et al. (2021) and Corsello et al. (2021).

expectations changed only little, are consistent with these survey results. Our conclusions and those of Coibion et al. (2020a) are in line with D'Acunto et al. (2021), who highlighted that households tend not to react to the ECB's forward guidance, arguably because its implications are harder to grasp for agents with less sophisticated knowledge of economic matters. More generally, evidence for a number of countries reviewed in Coibion et al. (2020b) reveals that households tend to be inattentive to monetary policy.

Notably, our conclusions and those of Coibion et al. (2020a) differ from those based on a hypothetical experiment, where respondents were given hypothetical questions about how their German inflation expectations would change if there was an average inflation target, in which experiment the information provided about hypothetical average inflation targeting affected household inflation expectations for German inflation (Hoffmann et al., 2022a). They also differ from the results of the hypothetical experiment of Hoffmann et al. (2021,2022b), where respondents were provided with hypothetical inflation numbers, and their reported medium-term (2-3 years ahead) inflation expectations in response to these hypothetical numbers were found to be affected by knowledge of the symmetric inflation target.

Using an experimental survey, Coibion et al. (2022) find that giving US households simple statistics about inflation has an impact on their inflation expectations that is far larger than the estimated effect of forward guidance. Andrade et al. (2020) find that consumers' inflation expectations depend on the inflation regime (high versus low inflation). Our results that consumers' euro area median inflation expectations increased when inflation rose strongly in the euro area are consistent with the results from these two papers.

In other related literature, the Fed's announcement of a 2% inflation target led to the effect that inflation expectations of relatively more informed households got anchored more than those of relatively less informed ones (Binder, 2017). Coibion et al. (2022) find that reading an FOMC statement has about the same average effect on household inflation expectations as simply being told about the Federal Reserve's inflation target. Haldane and McMahon (2017) find that more straightforward central bank communication boosts the chances that household inflation expectations move more closely into alignment with the Bank of England's inflation forecasts. This is consistent

with models in which agents have constrained capacity to collect and process information (Coibion et al., 2020b).

We use a randomised control trial where half of respondents receive information about the ECB's inflation target and actual inflation directly preceding the inflation expectations questions in the survey. Information channels can matter for how consumers react to information. Households consuming traditional media have lower and more accurate inflation perceptions, whereas households which inform themselves about monetary policy via social media display greater uncertainty in their inflation expectations (Conrad et al., 2022). Central bank communication about monetary policy decisions via conventional mass media appears to be more effective in improving the quality of household inflation expectations than via Twitter (Lamla and Vinogradov, 2021).

How well informed households are matters for their inflation expectations. Central bank communication in the form of FOMC press conferences from December 2015 to June 2018 had no direct effect on household mean inflation expectations, but they made households more likely to receive news about the central bank's policy (Lamla and Vinogradov, 2019). Informed households tend to have lower inflation expectations, higher confidence in their expectations and, at least for perceived inflation, smaller errors (Lamla and Vinogradov, 2019). Hoffmann et al. (2022c) find that consumers who are shown ECB communication on the inflation outlook significantly reduce their inflation expectations, and that explaining the outlook verbally has an even stronger effect. The Bank of England was the first central bank to adopt accessible language, simplified messages, and new forms of communication via Twitter. Based on about 10 000 household responses from 2018 to 2019, there is no significant effect of monetary policy announcements on household inflation expectations, but respondents who receive news have more accurate inflation expectations. Policy announcements lead to an increase in the share of households who receive monetary policy news (Lamla and Vinogradov, 2021).

The remainder of the paper is organized as follows. Section 2 introduces the data from the DHS inflation expectations survey of consumers in the Netherlands. Section 3 presents the results, and Section 4 concludes.

2. Survey of consumers' inflation expectations

We present new results from the DHS satellite survey conducted since shortly before and during the pandemic (from December 2019) until March 2022, in which household members in the DHS panel for the Netherlands were asked about the level and probability distribution of their short-term (one year ahead) and long-term (ten years ahead) euro area inflation expectations.³ The survey questions about inflation levels were fielded each month. The survey questions about probability distributions were included once every three months, starting in December 2019. In the last wave of the survey in June 2022 included, of 2989 household members selected, 2140 provided complete survey responses (71.6% of all respondents), and 30 provided incomplete survey responses (1.0% of all respondents); total response rates in other waves were similar.⁴

Respondents in the DHS satellite survey were randomly assigned to four different groups. The first and second groups were asked about inflation expectations for the Netherlands, while the third and fourth groups were asked about inflation expectations for the euro area. The second group was provided with information about actual inflation in the Netherlands and the ECB's price stability aim. The fourth group was provided with information about actual inflation in the euro area and the ECB's price stability aim. The first and third groups were not provided with information about actual inflation or the ECB's price stability aim. Members of these two groups were asked about their perception of current inflation. The information on actual inflation provided to groups 2 and 4 referred to the latest available inflation number. In addition, members of these two groups were provided with a time series plot of inflation developments over the last 20 years in the Netherlands and the euro area, respectively. More details on this survey are provided in Galati et al. (2021, 2022). In this paper we analyse the survey responses for euro area inflation expectations, ie from groups 3 and 4, since these expectations are most relevant for the ECB's monetary policy.

³ The DNB Household Survey is a longitudinal database of economic and psychological aspects of financial behaviour of Dutch households, which started in 1993. It is run at CentERdata, Tilburg University and is sponsored by De Nederlandsche Bank. The survey is publicly available and used regularly for both academic research and policy analysis. Teppa and Vis (2012) provide detailed information on the DHS, its use and the selection of household panel members.

⁴ These response rates for the DHS satellite survey are similar to those of surveys of consumers' inflation expectations conducted in other countries.

Our randomised control trial survey design with a high monthly frequency is well suited to study the effects of the change by the ECB to a symmetric inflation. In August 2021, the first survey month when the announcement of the ECB's symmetric inflation target was known, we provided respondents of group 4 with information about the ECB's change to this symmetric inflation target, without needing to make any other changes to our survey design. Respondents of group 4 were given the following adjusted information in the August 2021 survey, which highlighted the change in the ECB's inflation target in bold as follows, based on the ECB's press release (ECB, 2021):

"The primary objective of the European Central Bank (ECB) is to maintain price stability. **The ECB has recently changed the definition of price stability. Starting in July 2021, the ECB aims to achieve inflation of 2% in the euro area. This target is symmetric, meaning that negative and positive deviations of inflation from this target are equally undesirable.**" (English translation)

This was a change from the information provided in earlier surveys to group 4 about the ECB's previous inflation aim of below but close to 2% as follows (see Galati et al., 2022):

"The primary objective of the European Central Bank (ECB) is to maintain price stability. The ECB has defined price stability as inflation in the euro area below but close to 2%."

From September 2021 onwards, respondents in group 4 were given the following adjusted information, which mentioned the ECB's symmetric inflation target, but no longer highlighted that it had been changed recently as follows:

"The primary objective of the European Central Bank (ECB) is to maintain price stability. The ECB therefore aims to achieve inflation of 2% in the euro area. This target is symmetric, meaning that negative and positive deviations of inflation from this target are equally undesirable" (English translation)

Note that in August 2021 and all survey months thereafter, respondents of group 4 continued to receive information about actual inflation, as they did in previous months. Respondents in group 3 continued not to receive any information about the ECB's inflation target or actual inflation.

2.1 Distinctive features of our euro area inflation expectations survey

Compared to other existing household surveys in the euro area, our survey has several distinctive features that allow assessing the anchoring of household expectations following the ECB's monetary strategy change and the rise in inflation since 2021. First, to assess the anchoring of consumers' euro area inflation expectations it is crucial to consider long-term inflation expectations, as we do in our survey. The DHS satellite survey which we use in this paper (see Galati et al., 2022) is the only existing regular survey of long-term euro area inflation expectations (ten years ahead). By contrast, existing surveys of consumers' euro area inflation expectations do not have data on long-term inflation expectations, but only on short- or medium-term expectations (the European Commission consumer survey and the ECB Consumer Expectations survey, CES). The CES, for example, asks survey participants about their inflation expectations over the next 12 months and from two to three years ahead.

In addition, respondents in the DHS satellite survey were randomly assigned to four different groups, with two groups being asked about inflation expectations for the Netherlands, while the other two groups were asked about inflation expectations for the euro area. By contrast, those few surveys of long-term inflation expectations conducted in euro area member countries only ask for expectations of inflation in that country, rather than for inflation in the euro area as a whole, eg for inflation in Germany (Bundesbank Online Panel Household survey) or for inflation in Italy (Bank of Italy Survey of Households, see Rondinelli and Zizza (2021)).⁵

Moreover, the high regular quarterly frequency of our survey of long-term expected probabilities of euro area inflation allows to estimate panel times series regressions for the determinants of long-term expected probabilities of inflation. By contrast, those few surveys of long-term expected probabilities of inflation in an individual euro area member country have been conducted only irregularly (Bundesbank Online Panel Household survey for German inflation, eg Hoffmann et al. (2022b)) or at much lower frequency (Bank of Italy Survey of Households for inflation in Italy). Surveys of long-term

⁵ Detailed information on German households' inflation expectations can be found under <http://www.bundesbank.de/en/bundesbank/research/survey-on-consumer-expectations/inflation-expectations-848334>

expected probabilities of inflation at high regular frequency exist in only a few countries outside the euro area (eg the United States and the United Kingdom).

Finally, since our survey has been conducted regularly at monthly and quarterly frequency since December 2019, including before and after the ECB's strategy review, and before and during the period of high inflation, and since our survey has been conducted as a randomised control trial, where half of respondents are provided with information about the ECB's inflation target and actual euro area inflation in each survey wave since its start, we can assess the effects of the ECB's strategy review and of high inflation on long-term euro area inflation expectations and expected probabilities by studying expectations of actual inflation, without having to resort to hypothetical questions (as eg in the Bundesbank Online Panel survey, see Hoffmann et al., 2022a and 2022b)⁶, and without having to modify the setup of the survey, so that it is consistent over time.

3. Development of household inflation expectations

Consumers' median expectations of euro area inflation ten years and one year ahead are shown in Figures 1 and 2. We find that consumers' median expectations of euro area inflation ten years ahead showed no reaction to the introduction of a symmetric inflation target by the ECB, which was announced on 8 July 2021. In August 2021, the first survey month when the announcement of the ECB's symmetric inflation target was known, there was no change in consumers' median expectations of euro area inflation ten years ahead, both for respondents who were provided with information about the symmetric inflation target and by those who did not receive such information (Figures 1 and 3). For short-term expectations, there was little or no change in August 2021: the median both for the groups with and without information was unchanged (Figures 2 and 3).

Some respondents may have heard by themselves in the news about the change to a symmetric inflation target by the ECB on 8 July between receiving the July survey (prior

⁶ For example, the ad hoc additional survey questions for medium-term expected probabilities added to the Bundesbank survey by Hoffmann et al. (2022b) were only inserted after the change to the ECB's inflation target, in August 2021 and October 2021, but not before the strategy change.

to 8 July and completing the July survey (which may have been after 8 July for some respondents). But median long-term inflation expectations were unchanged in July 2021, both for the groups with and without information, so that even if this should have been the case, it did not lead to a change in median long-term expectations. At the short-term horizon, median inflation expectations were unchanged in July 2021 for the group without information, but they decreased by 0.3pp for the group with information.

Inflation started to increase strongly above the ECB's inflation target from 2.2% in July to 3.0% in August 2021, i.e. 1 percentage point (pp) above target, and rose steadily further to 8.6%, or 6.6pp above target, by June 2022 (Figure A1). Data on August 2021 inflation was published by Eurostat in September 2021, with a preliminary flash estimate published on 31 August 2021. Since this is after our August survey was conducted, the information about high inflation was first available to the public in the September 2021 survey (see also Table A1). Thus in the August 2021 survey, compared to the July 2021 survey, there was a change in the ECB's inflation target (with a small increase in recent available inflation data from 1.9% to 2.2%). In the September and the October surveys, compared to the August 2021 survey, there was no change in the ECB's inflation target but a strong increase in recent available inflation data to a recent inflation realisation of 3.0% in the September survey and a recent inflation realisation of 3.4% in the October survey (see Table A1).

Consumers' median euro area expectations rose in response to inflation increasing strongly above target, both for short- and long-term expectations (Figures 1 to 3). In the September 2021 survey, median euro area expectations of consumers without information provision rose by 0.5pp for the short-term horizon compared to the August 2021 survey, and by 0.2pp for the long-term horizon (Figure 3). In the September 2021 survey, median euro area expectations of consumers with information provision rose by 0.35pp for the short-term horizon compared to the August 2021 survey, but were unchanged at the long-term horizon (Figure 3).

As inflation continued to increase strongly above target up to June 2022, both short- and long-term median inflation expectations increased further. Long-term median expectations of respondents without information provision increased by a total of 2pp during the period of September 2021 to June 2022, and those of respondents with

information provision increased by the same amount, all compared to the August 2021 survey (Figure 4). This suggests that the strong increase in inflation above target up to June 2022 led to a similar de-anchoring of long-term expectations for households who received information about the target and actual inflation, even if it occurred somewhat later (Figure 1). Short-term inflation expectations rose slightly more for the informed group, by 4.8pp compared with 4.5pp for the group without information (Figure 4).

Moreover, consumers' expected probabilities of high inflation (4% or higher) rose to much higher levels in June 2022 compared with June 2021, both for the short- and long-term horizons (Figures 5 to 8). Consumers' long-term expected probabilities of high inflation increased by 20pp over this period for the group without information, and by 22pp for the group with information (Figures 5 and 7). This shows that during the period of high and rising inflation, long-term inflation expectations also became less well anchored based on this measure. Consumers' short-term expected probabilities of high inflation increased even more, by 46pp between June 2021 and June 2022 for the group without information, and by 52pp for the group with information (Figures 6 and 8).

Since the survey of probabilities is only quarterly, we cannot separately identify the effect of the change to the symmetric inflation target in July 2021 based on it. But we can identify the effect of the strong increase in inflation by considering changes in the expected probability of high inflation in the June 2022 survey compared with the September 2021 survey, during which period inflation rose strongly further, to 8.6% in June 2022, but which started after the change to the inflation target. In the June 2022 survey compared with the September 2021 survey, long-term expected probabilities of high inflation increased by 18.5pp and 18.2pp for the group without information and with information, respectively. Short-term expected probabilities of high inflation increased even more in the June 2022 survey compared with the September 2021 survey, by 46pp for the group without information, and by 49pp for the group with information. This shows that long-term expectations of high inflation increased substantially in response to the strong increase in inflation above target, implying that long-term expectations became less well anchored also on this measure.

We therefore find that long-term euro area inflation expectations have become less well anchored as inflation has increased strongly above target in the wake of the

pandemic. The long-term expectations both of the group who received information in the randomised control trial and of the group who did not became less well anchored with inflation strongly rising above target (Figures 1, 4, 5 and 7).

4. Regression analysis

The Figures presented in the previous section show that there was no visible immediate effect of the ECB strategy revision on median short- and long-term euro area inflation expectations. Yet, median inflation expectations and average expected probabilities of high inflation clearly rose once actual inflation increased strongly above the ECB's inflation target. In this section, we investigate the determinants of inflation expectations with regression analysis.

4.1 Methodology

The Figures presented above document overall developments based on the median or average respondent, while individual respondents may each react in their own unique way. In the regression analysis, we investigate how individual respondents react to the strategy revision and to the period of high realised inflation. Specifically, we estimate panel times series regressions allowing for heterogeneous slope coefficients across respondents. We report the Pesaran and Smith (1995) mean group estimates based on robust regressions which give lower weight to outliers. The advantage in using this approach is that we do not have to make assumptions on how to distinguish valid observations from outliers by excluding extreme observations, or by adjusting observations based on certain assumptions, which is often done in empirical investigations of consumer inflation expectations (eg Binder et al., 2022; Ryngaert, 2022).

4.2 Changes in inflation expectations immediately after the strategy revision

Table 1 reports the mean group estimates of a regression of individual inflation expectations on a strategy revision dummy variable which equals 1 in the month directly after the announcement of the monetary strategy revision, and 0 in the other months.

The mean group estimate for the coefficient on the strategy revision dummy in the regression of long-term inflation expectations for the control group without information treatment equals -0.3 and is strongly significant, suggesting that the typical respondent decreased inflation expectations 10 years ahead by 0.3 percentage points in the month following the monetary strategy revision (column 1 in Table 1). This is a surprising outcome since, if anything, the change to a new symmetric 2% inflation target from the old one of close to but below 2% after a long period of inflation below target would be expected to lead to an upward revision in inflation expectations.

A possible explanation is that other macroeconomic developments may have led to a downward revision in inflation expectations. Such a downward revision may dominate a possible upward effect of the monetary policy strategy revision. Also, consumers may not have noticed the announcement of the monetary strategy revision at all. A study for Germany by Hoffmann et al. (2022b) finds that in October 2021 only around one third of respondents was aware of the ECB's monetary policy strategy revision. The fact that for long-term inflation expectations the mean group estimate for the coefficient on the strategy revision dummy for the information treatment group is very similar (i.e. -0.27; see column 2 in Table 1) to the mean group estimate for the control group suggests the following. Either respondents in the control group were aware of the strategy revision, or respondents in the control group were not aware of it, but the information treatment making respondents aware of the strategy revision did not have much impact on long-term inflation expectations. Based on the difference in these two coefficients, the impact of the information treatment can be calculated as an upward revision of inflation expectations which is very small at only 3 basis points.

One year ahead inflation expectations in the month following the announcement of the strategy revision did not increase either. In fact, respondents report on average 29 basis points lower short-term inflation expectations (column 3 in Table 1) for the control group, and 26 basis points lower ones for the information treatment group (column 4 in Table 1). The difference between the control group and the information treatment group is again very small (only 3 basis points). Thus, the monetary policy strategy revision did not have a significant immediate upward effect on the level of either short-term or long-term inflation expectations of consumers.

A related question is whether the strategy revision had a direct impact on the probability distribution of expected inflation by consumers. Table 2 reports the mean group estimates of a regression of the individual expected probability of high inflation (i.e. an inflation rate of 4% or more) on a wave dummy which equals 1 directly after the announcement of the monetary strategy revision and 0 in the other months. The probability questions have a quarterly frequency, which means that these questions are asked in September, and this wave dummy therefore refers to the second month after the announcement of the strategy revision. With this in mind, Table 2 shows that respondents on average reduced the expected probability of high inflation both 10 years ahead and 1 year ahead in the first probability survey after the strategy revision (i.e. comparing the expected probability of high inflation in September 2021 to that in June 2021). Specifically, the probability of high 10 year ahead inflation and the probability of high 1 year ahead inflation are 2 and 7 percentage points lower, respectively, and the effects are the same for the control group and the treatment group. If the strategy revision would impact the probability of high inflation, an increase would be expected to be more likely since the new symmetric 2% inflation target provides more leeway for inflation to rise above 2% than the old target of close to but below 2%, following a long period of inflation below target. Nevertheless, the reduction is consistent with the reduction in individual inflation expectations visible in the mean group estimates of level inflation expectations in Table 1 following the strategy review. We conclude that the lower probabilities of high inflation result from other changes in the macroeconomic environment, and the strategy revision itself had no material impact on the probability distribution of expected inflation held by consumers. This is corroborated by the finding that the information treatment which highlighted the strategy revision to the treatment group did not lead to different results compared to the control group without information treatment.

4.3 Changes in inflation expectations during a period of high inflation

Table 3 reports the mean group estimates of a regression of individual inflation expectations on a dummy which equals 1 during the months in which the most recent realised inflation rate equalled 3% or higher, i.e. at least 1 percentage point above the 2%

inflation target. This boils down to comparing mean perceived and expected inflation as reported by respondents for the survey subperiod from December 1999 – August 2021 (waves 1-21) to the survey subperiod from September 2021 – June 2022 (waves 22-31). The robust regression approach for the mean group estimator reduces the impact of outliers by given them less weight without ex-ante deleting or adjusting extreme survey responses based on arbitrary assumptions.

The results show that long-term inflation expectations, short-term inflation expectations and perceived inflation in the period of high realised inflation are significantly higher than in the period preceding high inflation. During the period of high inflation, individual consumers on average expected 41-55 basis points higher inflation 10 years ahead than they did during the period without high inflation realisations (columns 1 and 2 in Table 3). In the same period, individual consumers on average expected 201-228 basis points higher one year ahead inflation (columns 3 and 4 in Table 3). While the impact on long-term inflation expectations is considerably smaller than on short-term inflation expectations, the difference suggests that long-term inflation expectations of consumers are not (or at least not fully) anchored. An impact of realised inflation on short-term inflation expectations is not inconsistent with anchored inflation expectations given that inflation typically shows some persistence over time and the inflation target refers to the medium term. To assess the anchoring of consumers' euro area inflation expectations it is crucial to consider long-term inflation expectations, as we do in our survey.

Notably, the results for the information treatment group do not differ much from the results of the control group in terms of the size of the rise in average inflation expectations between the first and second period of the sample split. This could suggest that consumers are very well aware of recent inflation developments and treating them with this info does not add much to their information set. However, a more nuanced picture emerges once we focus attention on the mean group estimates for the intercept. Both short- and long-term mean inflation expectations were considerably higher to begin with for the control group. Indeed, combining the intercept and the high inflation dummy reveals that on average consumers in the control group still expected higher inflation than in the information treatment group, although the differences have become smaller.

Direct information on how well ordinary consumers follow inflation developments can be derived from their answers to the question on perceived inflation for respondents in the control group. The mean group estimates for the intercept and the high inflation dummy coefficient show that mean perceived inflation in the first sample period equals 2 percent versus 4.5 percent in the high inflation period (column 5 in Table 3). Comparing these numbers to actual mean inflation of 0.8 percent and 5.6 percent in the first and second part of the sample period, respectively, reveals that average respondents overestimated actual inflation when inflation was below or close to the inflation target, and underestimated inflation in the period when inflation was clearly above target.⁷ This shows that ordinary consumers do not have perfect knowledge of actual inflation developments. Yet, the average increase in the high inflation period of perceived inflation of individual consumers in the control group is substantial, at 247 basis points. This shows that respondents in the control group – while missing the detailed knowledge on recent inflation developments that respondents in the information treatment group receive – did notice that inflation increased strongly.

Tables 4 and 5 shed more light on the impact of actual inflation on short- and long-term inflation expectations. The tables show mean group estimates for regressions of inflation expectations on one month lagged actual inflation. For instance, inflation expectations provided by respondents in the April 2022 survey are regressed on actual inflation in March 2022. The motivation for this specification is that lagged actual information is public knowledge at the moment that respondents respond to the survey. Typically surveys are held in the first two weeks of a calendar month, when the realisation of inflation in the previous month has been published by Eurostat, so that this information is publicly available (and reported in the media). This first release by Eurostat is the so-called flash estimate for realised inflation. The final number for realised inflation is published two to three weeks later, and while this number can deviate from the flash estimate, such revisions are rare and typically not larger than 0.1 percentage points. Therefore, respondents in the control group can be aware of the actual inflation rate in

⁷ It is noticeable that the typical finding in the literature that consumers tend to perceive inflation as higher than it actually is (see eg De Fiore et al., 2022) does not automatically extend to an area of higher inflation.

the month preceding the survey, and respondents in the treatment group are in fact told what the last known actual inflation rate is.⁸

Table 4 shows that long-term inflation expectations are not insensitive to actual inflation. For the whole sample period, a 1 percentage point higher inflation rate feeds into an about 0.2 percentage points higher expectation for the 10-year-ahead inflation rate for an average consumer. For the information treatment group this effect is somewhat larger than for the control group: 0.21 versus 0.17 percentage points (columns 1 and 2 in Table 4).

Next, we extend the regression specification with an interaction term between lagged actual inflation and a high inflation period dummy to allow the response to actual inflation developments to differ between the first 21 waves in the sample and the last 10 waves, in which inflation was clearly above the ECB's inflation target. The motivation for this specification is that the Figures in the previous section suggest that inflation expectations have become more responsive to actual inflation developments once inflation started to increase strongly above target. Indeed, the interaction term is strongly significant, showing that long-term inflation expectations react more strongly to actual inflation in a period of high inflation (columns 3 and 4 in Table 4).

The total increase in long-term inflation expectations in response to a 1 percentage point higher actual inflation rate in the high inflation period is 0.48 percentage point within the control group and 0.45 percentage points within the treatment group. The difference between the groups is small, suggesting that the impact of the information treatment is small. Behind the total impact of the information treatment, there may be two countervailing mechanisms at work. On the hand, showing the most recent inflation realisation to respondents may induce a stronger reaction of inflation expectations to actual inflation. On the other hand, reminding respondents of the ECB's target and showing a Figure with historical inflation developments (since 1999) may mitigate the response of 10 year ahead inflation expectations to recent changes in actual inflation.

⁸ In a small number of waves, the survey was fielded before the flash estimate was published, and respondents in the treatment group were provided with the final estimate of inflation one month earlier.

The strong response of long-term inflation expectations to actual inflation developments is evidence of a lack of anchoring of inflation expectations of consumers.

One year ahead inflation expectations respond to actual inflation developments as well, and as is to be expected, actual inflation is more important for short-term inflation expectations than for long-term inflation expectations. For the whole sample period, a 1 percentage point higher inflation rate feeds into 0.53 and 0.59 percentage points higher 1-year-ahead inflation rate expectations for an average consumer in the control group and the treatment group, respectively (columns 1 and 2 in Table 5), compared to an effect of about 0.2 percentage point on 10-year-ahead inflation expectations.

The strongly significant coefficient for the interaction between lagged actual inflation and a high inflation period dummy highlights that the relation between short-term expected inflation and actual inflation is clearly different between the first and second part of period (columns 3 and 4 of Table 5). For the first 21 waves of the sample period, the response of short-term inflation expectations to actual inflation is much more muted than for the following 10 waves, showing that respondents are more responsive to inflation developments in a period of high inflation.

The higher response of short-term inflation expectations in the group that receives the information treatment compared to the control group (a coefficient of 0.21 versus 0.09) in the first period of the sample split can be seen as a reflection of consumers in the treatment group having better knowledge of actual inflation. The total increase in short-term inflation expectations in response to a 1 percentage point higher actual inflation rate in the high inflation period is 0.85 percentage point within the control group, and 0.76 percentage points within the treatment group. Thus, while the treatment group is better informed on actual inflation developments, the 1 year ahead inflation expectations in the control group are more responsive in a period of strongly increasing inflation. This may be related with the information treatment not only showing the last inflation realisation but also reminding the respondent of the ECB's 2% symmetric inflation target and showing the historical development of inflation. A realisation that high inflation is exceptional and an expectation that the ECB will react to inflation may explain the less aggressive updating of inflation expectations by the treatment group in the high inflation

period. Note that the response of short-term inflation expectations in the period of high inflation is much more pronounced than that of long-term inflation expectations for both the treatment and the control group.

4.4 Robustness analysis and additional results

The previous two sections discussed mean group estimates for the direct effect of the strategy revision and for the high inflation period separately (see Tables 1 and 5). Table 6 shows mean group estimates for a regression analysis that includes the strategy revision dummy, i.e. the wave dummy for the first survey after the monetary strategy revision, and the interaction term for the high inflation period simultaneously. By and large the results are qualitatively quite similar. The most notable difference is that for 1 year ahead inflation expectations the strategy revision dummy becomes positive instead of negative, although the coefficient is quite small at 4 to 5 basis points. This coefficient would be consistent with consumers viewing the ECB as being somewhat more comfortable with short-term inflation developments above 2% after the introduction of the symmetric 2% inflation target than under the old regime of an inflation target of close to but below 2%. The coefficient for the strategy revision dummy in the mean group estimates for long-term inflation expectations becomes somewhat smaller as well, but remains negative. The responses of short and long-term inflation expectations to realised inflation during the high inflation period even become somewhat stronger, but overall the difference to the baseline results is small.

So far, we have investigated the impact of euro area inflation realisations for the development of short and long-term euro area inflation expectations by consumers differentiating between respondents who receive an information treatment and respondents in the control group who are not treated. Respondents who are treated are informed about the most recent inflation realisation. Respondents in the control group are asked what they think the current rate of inflation is. One would expect that for respondents in the control group the perceived rate of inflation rather than the actual rate of inflation feeds into expected 1-year-ahead and 10-year-ahead inflation. Therefore, we repeat the mean group estimation procedure for short and long-term inflation

expectations using perceived inflation rates - which may or may not be the same as realised inflation rates - instead of the inflation realisations.

Table 7 shows that inflation expectations indeed respond strongly to perceived inflation, and more so for 1-year-ahead expectations than for 10-year-ahead expectations (columns 1 and 2). A striking difference with earlier results is that the interaction term of perceived inflation with the high inflation period dummy is insignificant or small for long-term and short-term inflation expectations, respectively. An explanation can be found in the way inflation perceptions respond to actual inflation, which is shown in column 3 of Table 7. The results are very similar to the other findings, in that perceived inflation reacts much more strongly to actual inflation during the period of high inflation than it did during the period when inflation was below or close to target. Actually, the total effect during the high inflation period is somewhat above 1, suggesting that upward adjustments in perceived inflation have been somewhat stronger than the actual increase in realised inflation for the average consumer.

A final observation is that perceived inflation in the month after the strategy revision is somewhat higher (by 5 basis points) than before, with the difference statistically significant at the 1% significance level. This may contribute to the finding that this strategy revision dummy was positive, albeit small, and significant in the regression for short-term inflation expectations when actual inflation is included as an independent variable, but not when perceived inflation is included as an independent variable. In conclusion, perceived inflation is an important explanatory variable for the development of short and long-term inflation expectations. And respondents seem to be quite well aware of (and responsive to) inflation development in the high inflation period, while the results suggest that they pay less attention to inflation developments in the period of lower inflation.

4.5 Changes in expected probabilities of high inflation during a period of high inflation

In line with the structure of the probability distribution questions, we analyse the probability that inflation is higher than 4% as reported by the respondents. While 4% is obviously above the 2% inflation target, the current period has confirmed that inflation

rates of more than 4% are very well feasible. Table 8 shows that in the period of high inflation respondents report a significantly higher (by 10-11 percentage points) expected probability of 10 year ahead inflation exceeding 4% on average (columns 1 and 2). This confirms that the subjective probability distribution of inflation expectations of consumers is not insensitive to realised inflation rates. As to be expected, the period of high inflation also coincides with a significantly higher probability of 1 year ahead inflation being higher than 4% as expected by an average consumer, which is much higher by 28-31 percentage points (columns 3 and 4 in Table 8). For short and long-term inflation expectations the coefficients for the information treatment group – while being slightly higher – are not that much different from the coefficients for the control group.

Table 9 shows that the effect of realised inflation on the expected probability of high inflation is mainly due to the high inflation period. In the first period, in which inflation realisations were (clearly) below or close to target, inflation realisations did not have much of an impact on the expected probability of high inflation in the short or long run, as perceived by consumers. This effect is only significant – albeit small in magnitude - for short term-inflation expectations in the treatment group. The interaction term between actual inflation and the high inflation dummy is strongly significant. The results show that a 1 percentage point higher inflation realisation coincides with a 2-3 percentage points higher expected probability of high inflation 10 years ahead, and an 8-10 percentage points higher expected probability of high inflation 1 year ahead, for an average respondent. Differences between the control group and the information treatment group are small.

5. Conclusions

We provide evidence on the reactions of the level and probability distribution of consumers' expectations of inflation in the euro area to the ECB's change to a symmetric inflation target in July 2021, and to the subsequent strong rise in euro area inflation above target. We use a randomised control trial within a monthly representative Dutch survey of short- and long-term euro area inflation expectations, where half of respondents receive information about the ECB's inflation target and realised inflation.

We find that the introduction of a symmetric inflation target by the ECB did not have a significant immediate upward effect on the level of either long-term or short-term euro area inflation expectations of consumers, both for the group with information treatment and for the control group. By contrast, euro area long-term and short-term inflation expectations increased significantly in the period when inflation increased strongly above target. Moreover, households' expected probabilities of high euro area inflation (4% or higher) also increased significantly in response to high above-target inflation at both the long- and short-term horizons, and both for the group with information treatment and for the control group.

Our results suggest that the ECB strategy revision itself did not have a material impact on household inflation expectations. On the other hand, inflation expectations did react to high realisations of actual inflation. Thus when it comes to household inflation expectations and central bank credibility, inflation outcomes speak louder than words. In addition, the results suggest that long-term euro area inflation expectations have become less well anchored as the level of inflation has increased strongly above target in the wake of the pandemic, and the average probability distributions of expected long-term euro area inflation expectations have clearly shifted to the right as well. The expectations both of the group who received information and of the one who did not became less well anchored in a period with actual inflation rising strongly above target.

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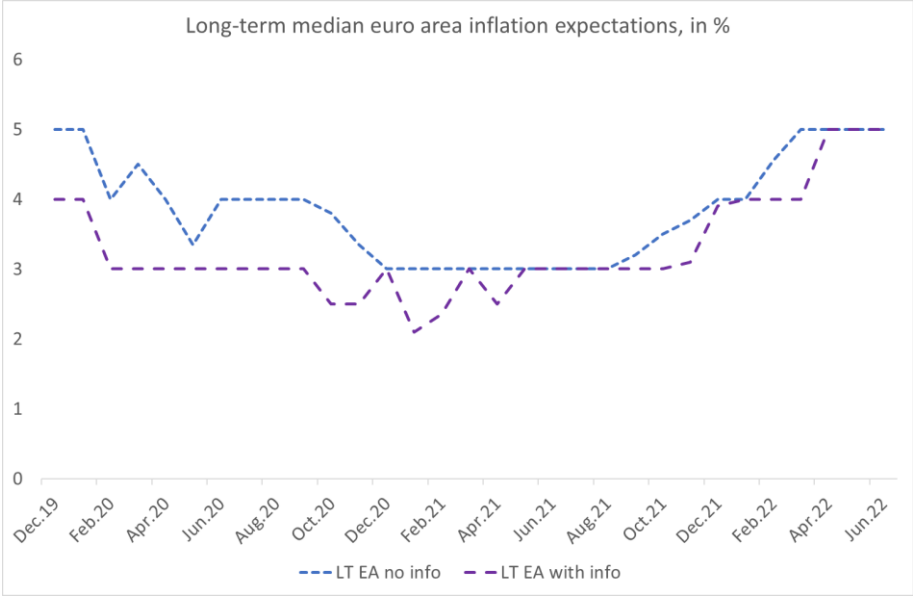
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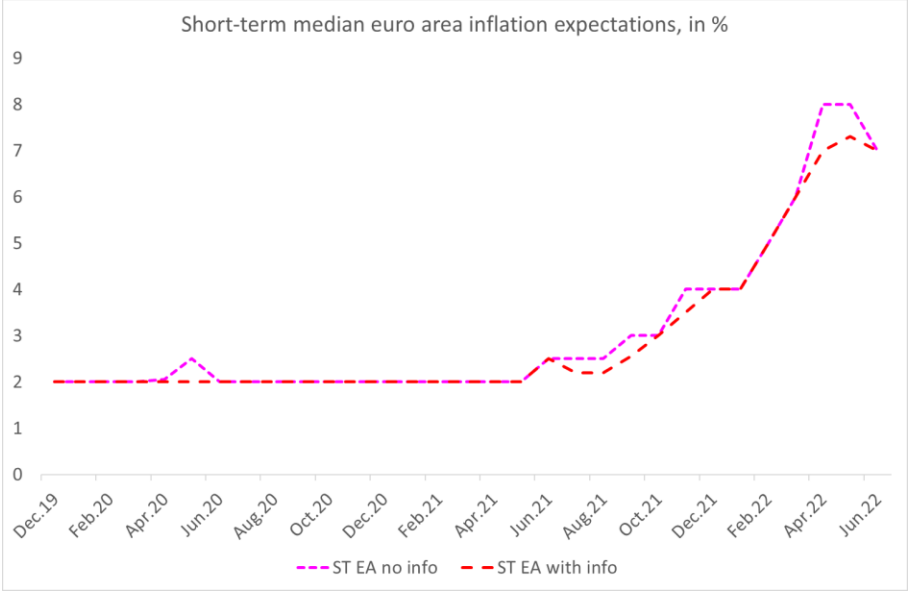
Figures

Figure 1: Euro area long-term median inflation expectations



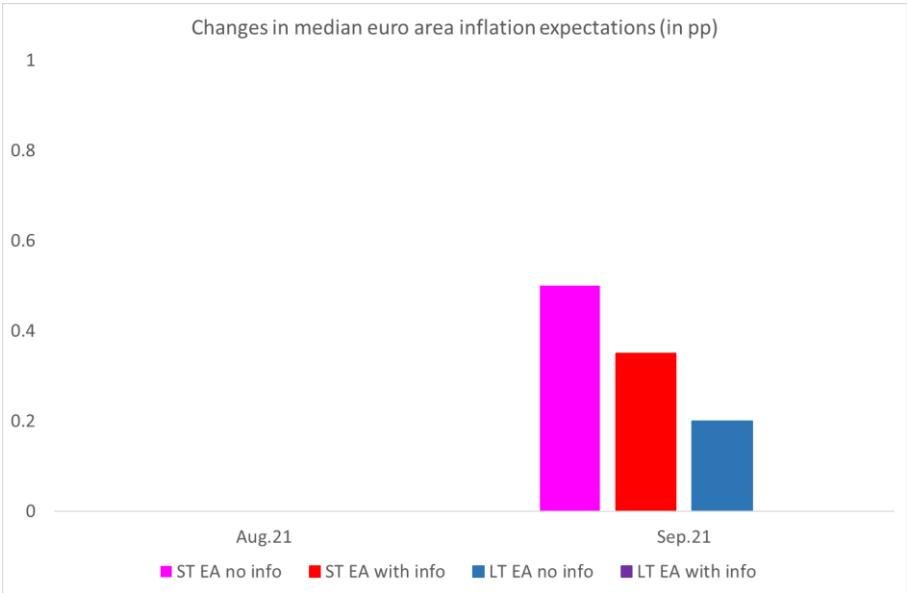
Source: DHS satellite survey.

Figure 2: Euro area short-term median inflation expectations



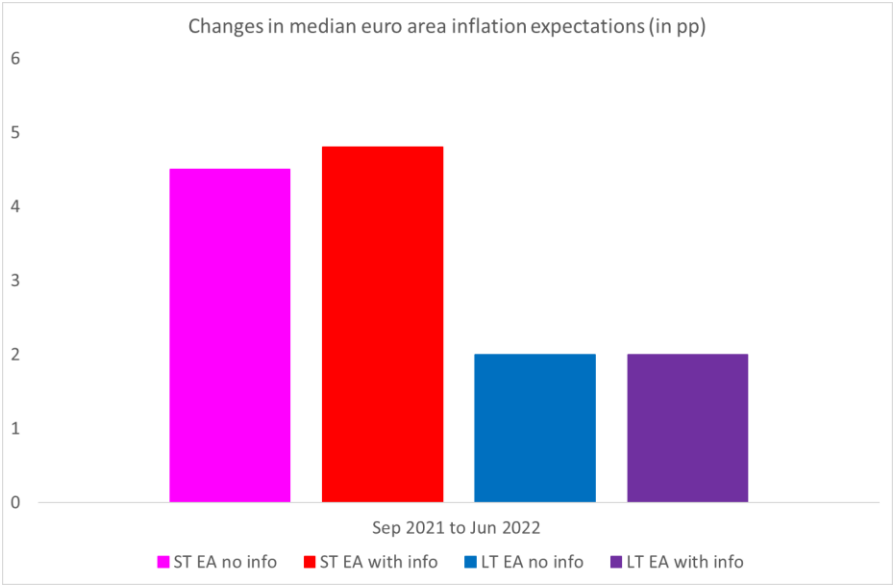
Source: DHS satellite survey.

Figure 3: Changes in euro area median inflation expectations



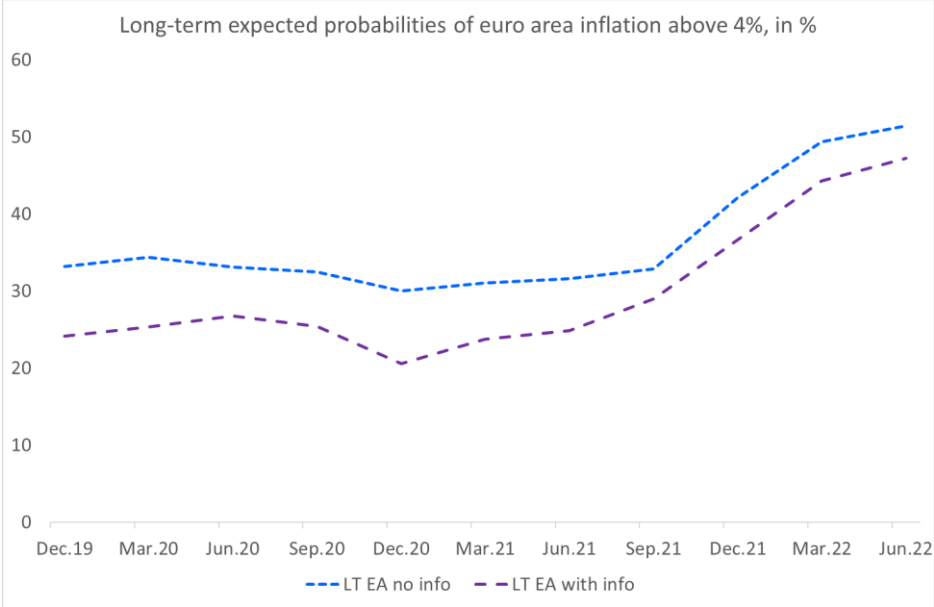
Source: DHS satellite survey.

Figure 4: Changes in euro area median inflation expectations



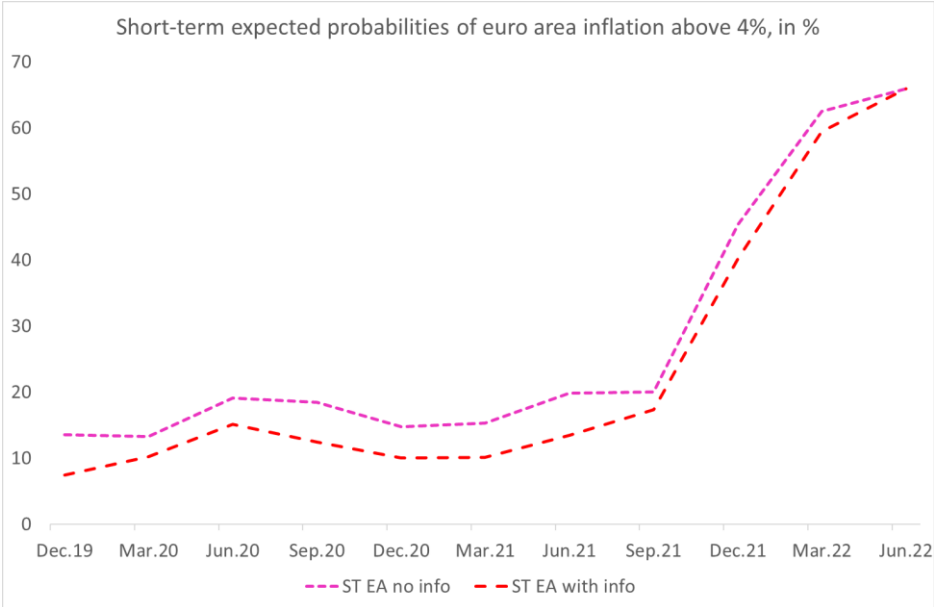
Source: DHS satellite survey.

Figure 5: Long-term expected probabilities of high euro area inflation



Source: DHS satellite survey.

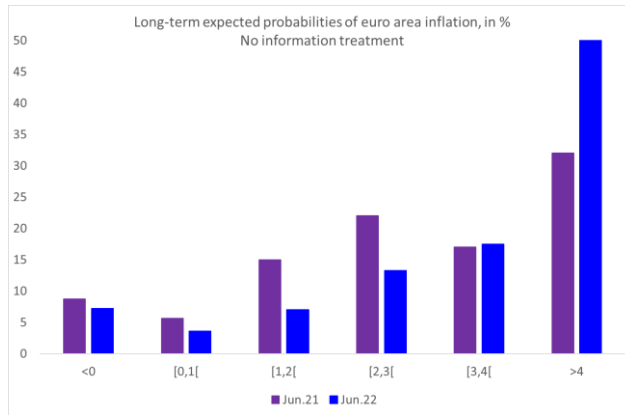
Figure 6: Short-term expected probabilities of high euro area inflation



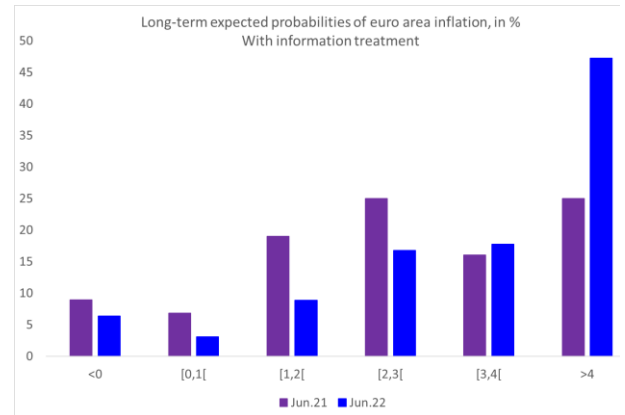
Source: DHS satellite survey.

Figure 7: Long-term expected probabilities of euro area inflation

Without information treatment



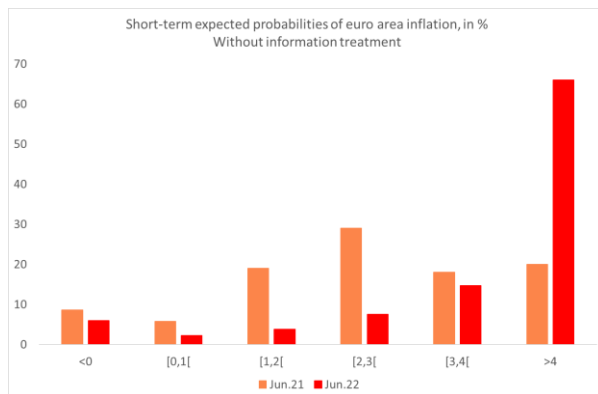
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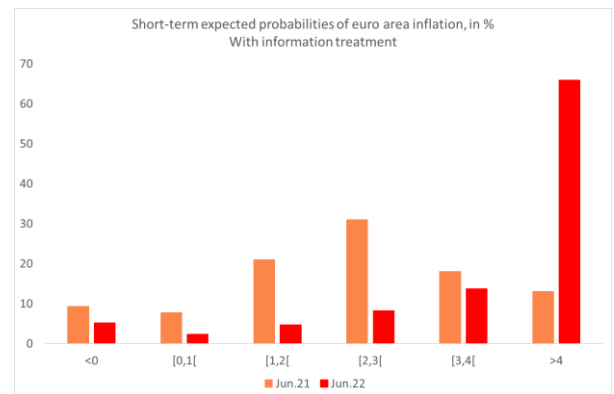
Source: DHS satellite survey.

Figure 8: Short-term expected probabilities of euro area inflation

Without information treatment



With information treatment



Source: DHS satellite survey.

Tables

Table 1: Direct effect of strategy revision on household inflation expectations

	(1)	(2)	(3)	(4)
Sample		info		info
	control	treatment	control	treatment
	group	group	group	group
Dependent variable	π^{LT}	π^{LT}	π^{ST}	π^{ST}
Strategy revision dummy (August '21 survey)	-0.30*** (-10.0)	-0.27*** (-9.3)	-0.29*** (-11.3)	-0.26*** (-11.3)
Intercept	5.64*** (38.0)	4.78*** (40.0)	3.35*** (55.1)	2.93*** (59.5)
No. of observations	18055	19488	18163	19688
No. of groups	837	861	839	865

Notes: This table reports outlier robust mean parameter coefficients across groups (respondents) for regressions of inflation expectations held by individual respondents; t-statistics in parentheses; stars denote significance levels (* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$). Dependent variables: π^{LT} = 10 year ahead inflation expectations, π^{ST} = 1 year ahead inflation expectations. Independent variables: a 0-1 dummy equalling 1 for responses in the August '21 survey (the first survey after the monetary strategy revision).

Table 2: Direct effect of strategy revision on expected probability of high inflation

	(1)	(2)	(3)	(4)
Sample		info		info
	control	treatment	control	treatment
	group	group	group	group
Dependent variable	Pr_high_ π^{LT}	Pr_high_ π^{LT}	Pr_high_ π^{ST}	Pr_high_ π^{ST}
Strategy revision dummy (September '21 survey)	-1.66** (-3.1)	-1.94*** (-4.7)	-7.70*** (-12.8)	-7.17*** (-13.4)
Intercept	35.68*** (29.9)	25.04*** (26.9)	25.26*** (36.3)	20.63*** (38.7)
No. of observations	6125	6619	6146	6641
No. of groups	699	750	701	752

Notes: This table reports outlier robust mean parameter coefficients across groups (respondents) for regressions of the expected probability of inflation above 4% held by individual respondents; t-statistics in parentheses; stars denote significance levels (* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$). Dependent variables: Pr_high_ π^{LT} = expected probability of 10 year ahead inflation above 4%, Pr_high_ π^{ST} = expected probability of 1 year ahead inflation above 4%. Independent variables: a 0-1 dummy equalling 1 for responses in the September '21 survey (the first survey after the monetary strategy revision including probability questions).

Table 3: Difference in mean expected inflation due to high inflation period

	(1)	(2)	(3)	(4)	(5)
Sample		info		info	
	control group	treatment group	control group	treatment group	control group
Dependent variable	π^{LT}	π^{LT}	π^{ST}	π^{ST}	π^{perc}
High inflation dummy (Sept '21 – June '22)	0.41*** (4.5)	0.55*** (6.4)	2.01*** (24.6)	2.28*** (29.7)	2.47*** (31.5)
Intercept	5.19*** (37.1)	4.26*** (39.5)	2.51*** (50.4)	2.02*** (51.2)	2.03*** (51.1)
No. of observations	18055	19488	18163	19688	18177
No. of groups	837	861	839	865	840

Notes: This table reports outlier robust mean parameter coefficients across groups (respondents) for regressions of inflation expectations and perceptions held by individual respondents; t-statistics in parentheses; stars denote significance levels (* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$). Dependent variables: π^{LT} = 10 year ahead inflation expectations, π^{ST} = 1 year ahead inflation expectations, π^{perc} = perception of current inflation rate. Independent variables: a 0-1 dummy equalling 1 for responses in the September '21 – June '22 surveys (the surveys in the period that realized inflation exceeded 3%).

Table 4: Long-term inflation expectations explained by actual inflation

	(1)	(2)	(3)	(4)
Sample		info		info
	control group	treatment group	control group	treatment group
Dependent variable	π^{LT}	π^{LT}	π^{LT}	π^{LT}
Lagged actual inflation	0.17*** (5.3)	0.21*** (8.2)	0.26*** (4.5)	0.26*** (6.7)
Lagged actual inflation * high inflation dummy			0.22*** (3.7)	0.19*** (4.1)
High inflation dummy (Sept '21 – June '22)			-1.47*** (-9.8)	-1.01*** (-8.2)
Intercept	4.82*** (33.5)	3.84*** (36.0)	4.79*** (33.3)	3.82*** (36.3)
No. of observations	18055	19488	17829	19359
No. of groups	837	861	771	825

Notes: This table reports outlier robust mean parameter coefficients across groups (respondents) for regressions of inflation expectations held by individual respondents; t-statistics in parentheses; stars denote significance levels (* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$). Dependent variable: π^{LT} = 10 year ahead inflation expectations. Independent variables: lagged inflation, a 0-1 dummy equalling 1 for responses in the September '21 – June '22 surveys (the surveys in the period that realized inflation exceeded 3%), and an interaction term between these two variables.

Table 5: Short-term inflation expectations explained by actual inflation

	(1)	(2)	(3)	(4)
Sample	control group	info treatment group	control group	info treatment group
Dependent variable	π^{ST}	π^{ST}	π^{ST}	π^{ST}
Lagged actual inflation	0.53*** (27.0)	0.59*** (34.2)	0.08*** (3.6)	0.21*** (10.6)
Lagged actual inflation * high inflation dummy			0.77*** (19.0)	0.55*** (18.1)
High inflation dummy (Sept '21 – June '22)			-2.09*** (-16.4)	-1.56*** (-16.1)
Intercept	2.01*** (36.4)	1.51*** (34.2)	2.40*** (41.9)	1.84*** (39.1)
No. of observations	18163	19688	17954	19555
No. of groups	839	865	778	828

Notes: This table reports outlier robust mean parameter coefficients across groups (respondents) for regressions of inflation expectations held by individual respondents; t-statistics in parentheses; stars denote significance levels (* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$). Dependent variable: π^{ST} = 1 year ahead inflation expectations. Independent variables: lagged inflation, a 0-1 dummy equalling 1 for responses in the September '21 – June '22 surveys (the surveys in the period that realized inflation exceeded 3%), and an interaction term between these two variables.

Table 6: Inflation expectations vs. actual inflation and strategy revision dummy

	(1)	(2)	(3)	(4)
Sample	control group	info treatment group	control group	info treatment group
Dependent variable	π^{LT}	π^{LT}	π^{ST}	π^{ST}
Strategy revision dummy (August '21 survey)	-0.27*** (-5.3)	-0.19*** (-5.3)	0.04* (2.1)	0.05* (2.5)
Lagged actual inflation	0.33*** (5.3)	0.33*** (7.4)	0.07** (3.3)	0.21*** (10.2)
Lagged actual inflation * high Inflation dummy	0.21** (2.8)	0.16** (3.1)	0.84*** (19.3)	0.57*** (17.9)
High inflation dummy (Sept '21 – June '22)	-1.54*** (-9.5)	-1.00*** (-7.9)	-2.28*** (-16.9)	-1.61*** (-16.2)
Intercept	4.69*** (33.5)	3.77*** (36.1)	2.41*** (41.6)	1.84*** (39.3)
No. of observations	17654	19259	17759	19455
No. of groups	736	805	739	808

Notes: This table reports outlier robust mean parameter coefficients across groups (respondents) for regressions of inflation expectations held by individual respondents; t-statistics in parentheses; stars denote significance levels (* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$). Dependent variables: π^{LT} = 10 year ahead inflation expectations, π^{ST} = 1 year ahead inflation expectations. Independent variables: a 0-1 dummy equalling 1 for responses in the August '21 survey (the first survey after the monetary strategy revision), lagged inflation, a 0-1 dummy equalling 1 for responses in the September '21 – June '22 surveys (the surveys in the period that realized inflation exceeded 3%), and an interaction term between these two variables.

Table 7: Investigating the role of perceived inflation

	(1)	(2)	(3)
Sample	control group	control group	control group
Dependent variable	π^{LT}	π^{ST}	π^{perc}
Strategy revision dummy (August '21 survey)	-0.27*** (-6.8)	-0.02 (-1.5)	0.05** (2.7)
Perceived inflation	0.53*** (13.1)	0.69*** (42.0)	
Perceived inflation * High inflation dummy	0.00 (0.1)	0.06** (3.2)	
Lagged actual inflation			0.19*** (9.4)
Lagged actual inflation * high inflation dummy			0.89*** (23.1)
High inflation dummy (Sept '21 – June '22)	-0.22 (-1.8)	0.14* (2.5)	-2.83*** (-23.5)
Intercept	3.47*** (26.1)	1.01*** (26.4)	1.91*** (41.5)
No. of observations	17654	17759	17768
No. of groups	736	739	739

Notes: This table reports outlier robust mean parameter coefficients across groups (respondents) for regressions of inflation expectations and perceptions held by individual respondents; t-statistics in parentheses; stars denote significance levels (* = $p < 0.05$, ** = $p < 0.01$, *** = $p < 0.001$). Dependent variables: π^{LT} = 10 year ahead inflation expectations, π^{ST} = 1 year ahead inflation expectations, π^{perc} = perception of current inflation rate. Independent variables: a 0-1 dummy equalling 1 for responses in the August '21 survey (the first survey after the monetary strategy revision), lagged inflation, perceived inflation, a 0-1 dummy equalling 1 for responses in the September '21 – June '22 surveys (the surveys in the period that realized inflation exceeded 3%), and interaction terms between this dummy with lagged inflation and perceived inflation, respectively.

Table 8: Difference in mean expected probability of high inflation due to high inflation period

	(1)	(2)	(3)	(4)
Sample	control group	info treatment group	control group	info treatment group
Dependent variable	Pr_high_π ^{LT}	Pr_high_π ^{LT}	Pr_high_π ST	Pr_high_π ST
High inflation dummy (Sept '21 – June '22)	10.41*** (11.8)	10.90*** (13.9)	28.35*** (27.3)	30.77*** (30.1)
Intercept	29.41*** (23.8)	17.66*** (22.1)	11.55*** (22.1)	6.09*** (20.7)
No. of observations	6125	6619	6146	6641
No. of groups	699	750	701	752

Notes: This table reports outlier robust mean parameter coefficients across groups (respondents) for regressions of the expected probability of inflation above 4% held by individual respondents; t-statistics in parentheses; stars denote significance levels (* = p < 0.05, ** = p < 0.01, *** = p < 0.001). Dependent variables: Pr_high_π^{LT} = expected probability of 10 year ahead inflation above 4%, : Pr_high_πST = expected probability of 1 year ahead inflation above 4%. Independent variables: a 0-1 dummy equalling 1 for responses in the September '21 – June '22 surveys (the surveys in the period that realized inflation exceeded 3%).

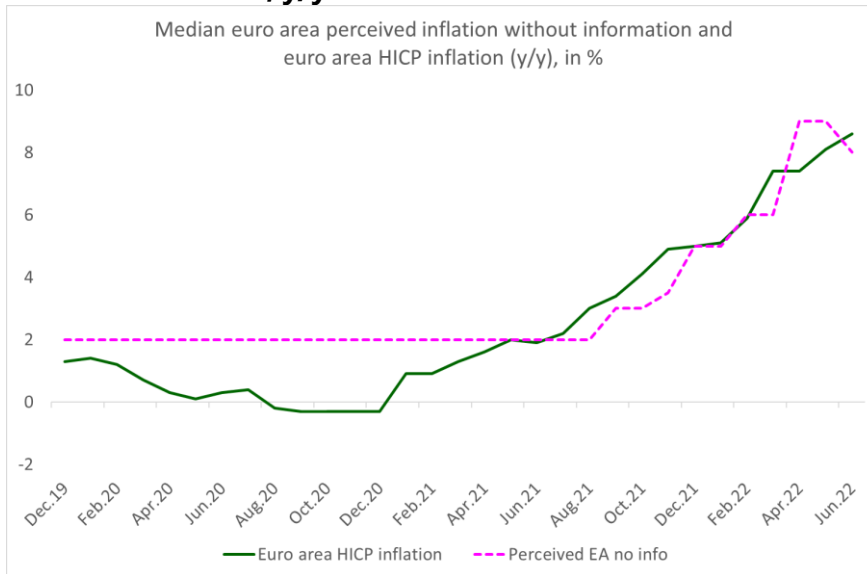
Table 9: Expected probability of high inflation explained by actual inflation

	(1)	(2)	(3)	(4)
Sample	control group	info treatment group	control group	info treatment group
Dependent variable	Pr_high_π ^{LT}	Pr_high_π ^{LT}	Pr_high_π ST	Pr_high_π ST
Lagged actual inflation	0.35 (0.8)	0.28 (0.9)	0.16 (0.7)	0.38** (2.8)
Lagged actual inflation * high inflation dummy	2.41*** (4.5)	2.38*** (5.0)	8.47*** (15.0)	9.43*** (19.8)
High inflation dummy (Sept '21 – June '22)	-3.83** (-2.7)	-3.80** (-2.9)	-16.17*** (-9.6)	-18.61*** (-11.4)
Intercept	26.97*** (19.2)	14.87*** (18.4)	7.92*** (15.9)	4.01*** (15.8)
No. of observations	5879	6383	5892	6397
No. of groups	631	683	631	683

Notes: This table reports outlier robust mean parameter coefficients across groups (respondents) for regressions of the expected probability of inflation above 4% held by individual respondents; t-statistics in parentheses; stars denote significance levels (* = p < 0.05, ** = p < 0.01, *** = p < 0.001). Dependent variables: Pr_high_π^{LT} = expected probability of 10 year ahead inflation above 4%, : Pr_high_πST = expected probability of 1 year ahead inflation above 4%. Independent variables: lagged inflation, a 0-1 dummy equalling 1 for responses in the September '21 – June '22 surveys (the surveys in the period that realized inflation exceeded 3%), and an interaction term between these two variables.

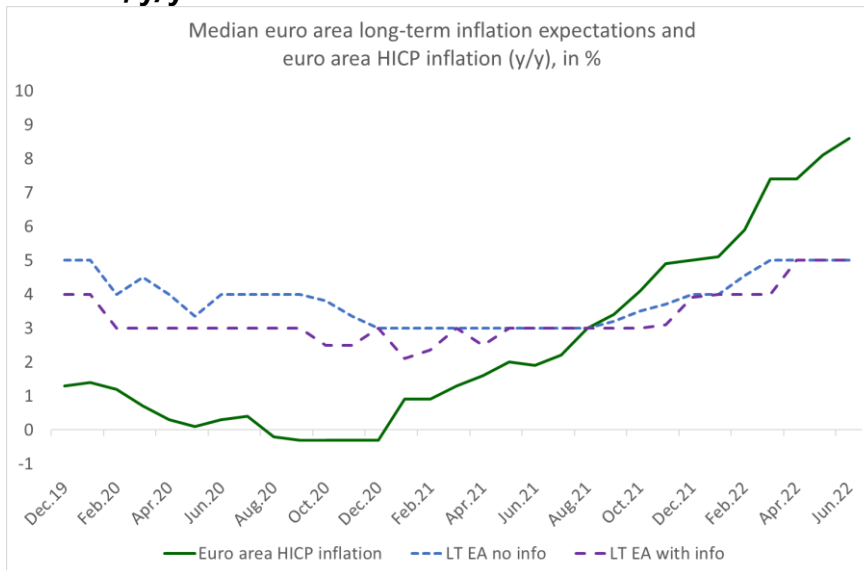
Appendix

Figure A1: Median euro area perceived inflation without information and euro area HICP inflation, y/y in %



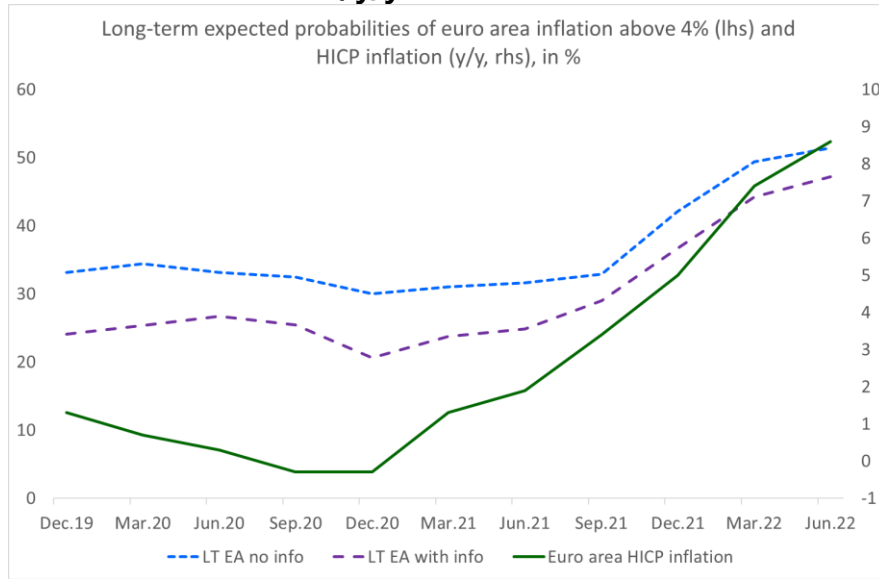
Source: Eurostat.

Figure A2: Euro area long-term median inflation expectations and euro area HICP inflation, y/y in %



Source: DHS satellite survey, Eurostat.

Figure A3: Long-term expected probabilities of high euro area inflation and euro area HICP inflation, y/y in %



Source: DHS satellite survey, Eurostat.

Table A1: Information for treatment group 4 respondents, July-October 2021

Survey Month	July	August	September	October
Recent inflation info	1.9%	2.2%	3.0%	3.4%
ECB target info	Close to but below 2%	Symmetric 2%	Symmetric 2%	Symmetric 2%

Notes: Recent inflation info refers to the flash estimate of realised inflation in the previous month. This information is provided along with a graph of HICP inflation developments as of January 1999. In August (and only in August), the information treatment mentions in bold that this is a new target.

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