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Responsiveness of consumers' medium-term inflation expectations: evidence from a new euro area survey*

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Abstract

Using the ECB Consumer Expectations Survey, this paper investigates revisions of medium-term inflation expectations. We provide robust evidence that consumers adjust medium-term inflation views in response to changes in short-term inflation expectations and, to a lesser degree, to changes in inflation perceptions. We find that the strong adverse Covid-19 shock contributed to an increase in consumer inflation expectations. We show that both higher financial literacy and higher trust in the central bank reduce responsiveness of medium-term inflation expectations, which supports their stability. Our results increase understanding of expectations formation, which is essential for medium-term oriented monetary policy.

JEL: D12, D84, E31, E58

Keywords: Inflation expectations, financial literacy, trust in the central bank, consumer survey, micro-data

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1 Introduction

After more than a decade of persistently low inflation rates, the ECB is currently facing the problem of rapidly accelerating inflation reflecting mainly the pandemic related supply and demand imbalances. The Russia-Ukraine war has further restricted supply, particularly for commodities. The future prospects of euro area inflation largely depend on the way inflation expectations of consumers adjust to elevated inflation. If economic agents view that the surge in inflation is transitory, the pass through of inflation shocks to wage bargaining and price setting is likely to be limited, which contributes to lower inflation persistence. From the monetary policy perspective, it is crucial to analyze how consumers' longer-term inflation expectations respond to changing economic conditions and what factors support their low responsiveness.

Using micro-level responses from the new monthly ECB Consumer Expectations Survey (CES), the aim of this study is to answer to the following questions: How strongly do medium-term inflation expectations of consumers co-move with changes in their shorter-term inflation views? What is the impact of the Covid-19 pandemic—a strong adverse shock to the economy, associated with high economic uncertainty—on consumer inflation expectations? How responsiveness of consumer inflation expectations is related to consumers' trust in the ECB, their financial literacy and accuracy of their inflation perceptions? In addition to the whole sample from April 2020 to December 2021, we examine behaviour of consumer inflation expectations separately in two sub-periods: *non-inflationary period* (April 2020 – December 2020) and *inflationary period* (January 2021 – December 2021).

We find that medium-term inflation expectations of euro area consumers clearly co-move with changes in short-term inflation expectations and, to a lesser extent, with changes in inflation perceptions. In the inflationary period we do not observe stronger adjustment of medium-term inflation expectations to changes in in-

flation perceptions compared to the *non-inflationary* period, suggesting that recent changes in inflation are not assessed by consumers as more persistent than previously. Moreover, we show that consumers' views of future inflation increased in response to the pandemic shock during the period of the most severe restrictions on economic activity. Finally, our results indicate that although medium-term inflation expectations are not fully invulnerable to current economic developments, their responsiveness might be dampened by strengthening trust in the ECB and increasing financial literacy of ordinary people.

Analysis of responsiveness of medium-term consumer inflation expectations might be of interest for at least two reasons. First, it is related to inflation persistence, as low responsiveness restricts a pass through of temporary inflationary shocks to wages and prices. Second, lack of responsiveness of inflation expectations to temporary factors constitutes one condition of anchored inflation expectations. It is typically assumed that anchored expectations should be close to implicit or explicit inflation target of a central bank and stable over time (Beechey et al., 2011; Ciccarelli and Osbat, 2017; Kumar et al., 2015; Łyziak and Paloviita, 2017). In particular, they should not react to transitory fluctuations and macroeconomic news. Anchoring may also refer to high certainty or low dispersion of views related to future inflation.

The caveat is that the notion of anchoring refers to a long-term horizon, while the horizon of consumer inflation views in the CES survey is no longer than three years which typically is classified as a medium-term horizon. However, one might argue that medium-term horizon is long enough for monetary policy making given time lags in the monetary policy transmission mechanism, or that medium-term inflation expectations are a useful proxy for longer-term ones. For example, Coibion et al. (2020) state that inflation expectations of consumers in various horizons are 'strikingly similar' and D'Acunto, Malmendier, and Weber (2022) mention lack of term-structure in consumer inflation expectations as one of the stylized facts. Wong (2015) finds similar response of one-year ahead and 5-to-10 years ahead consumer

inflation expectations to oil price shock, and Bems et al. (2021), when investigating the link between inflation expectations anchoring and inflation persistence, show that the same results hold for three-year-ahead and five-year-ahead inflation expectations.

Our paper contributes to the existing literature in several ways. First, it provides new evidence of inflation expectations of euro area consumers based on a fully comparable, new data set for six euro area countries. The CES is a new monthly online survey, the aim of which is to provide timely information on euro area households and consumers for monetary policy analysis. The CES was launched in the middle of the Covid-19 pandemic, and it covers several topics such as consumption, inflation, household income, and financial conditions, as well as labour and housing markets. In particular, it provides information on both qualitative and quantitative inflation views of consumers for the current month, one-year ahead (short-term) and three-years ahead (medium-term).[1] The European Commission Consumer Survey (ECCS) also provides qualitative and quantitative estimates of inflation perceptions and inflation expectations but only for one-year-ahead forecast horizon.[2]

Second, our paper contributes to the literature on responsiveness of inflation expectations, which has so far mainly focused on inflation views of professionals and financial market participants, not consumers (e.g. Apokoritis et al., 2019; Beechey et al., 2011; Buono and Formai, 2018; Corsello et al., 2021; Dovern and Kenny, 2020; van der Cruijsen and Demertzis, 2007; Levin et al., 2004; Łyziak and Paloviita, 2017; Moessner and Takáts, 2020; Yetman, 2020). According to Ha et al.

[1] Bańkowska et al. (2021) report a comprehensive evaluation of the survey. See also Christelis et al. (2020) and Coibion et al. (2021).

[2] In the ECCS, quantitative inflation views are treated as experimental and published only in limited scope. For more information, see: https://ec.europa.eu/info/business-economy-euro/indicators-statistics/economic-databases/business-and-consumer-surveys_en. The basic properties of inflation expectations in the ECCS have been analysed e.g. by Arioli et al. (2017), European Commission (2014), Stanisławska (2019), and Stanisławska et al. (2021). Other recently examined aspects include, for example, formation of inflation perceptions and expectations, the impact of inflation expectations on consumers' economic decisions, and the role of uncertainty in expectations formation (Abildgren and Kuchler, 2021; Andrade et al., 2020; Duca-Radu et al., 2021; Easaw et al., 2013; Reiche and Meyler, 2022). D'Acunto, Hoang, Paloviita, and Weber (2022) use ECCS data to study how inflation expectations, cognitive abilities and consumption plans of consumers are related.

(2022), the sensitivity of long-term inflation expectations to shocks in emerging and developing economies (EMDEs) is higher than in advanced economies, but in both country groups the sensitivity is lower in 2005-2018 than in 1990-2004. Barlevy et al. (2021) find that the sensitivity of long-term inflation expectations of professionals and consumers fell gradually in the 1990s and remained relatively flat until the financial crisis. After that, however, the sensitivities have reverted to their levels of the mid-1990s. When it comes to consumers, Łyziak and Paloviita (2017) find that one-year-ahead inflation expectations of euro area consumers respond to current inflation and that this responsiveness increased after the global financial crisis. Using the New York Fed's Survey of Consumer Expectations (SCE) and Michigan Survey of Consumers since 2014, Armantier et al. (2022) show that before 2020, US consumers' one-year-ahead inflation expectations were very responsive to inflation surprises, and this responsiveness slightly increased during the pandemic period. Instead, three-year-ahead inflation expectations have recently become clearly less responsive to inflation surprises and to shorter-term inflation expectations relative to the pre-pandemic period. We provide evidence of relatively stable responsiveness of medium-term inflation expectations of euro area consumers to changes in inflation perceptions in the *non-inflationary* and *inflationary period*. However, we find that sensitivity to changes in short-term inflation expectations has become slightly larger in the latter period.

Third, we contribute to the literature, which analyses the importance of financial literacy for inflation expectations. For many consumers, inflation and inflation expectations are difficult to grasp. Financial literacy means knowledge of economic and financial concepts. Lusardi and Mitchell (2014) define that financial literacy is related to knowledge of basic numeracy, interest compounding, inflation and risk diversification.[3] Based on evidence from a laboratory experiment, Burke and Manz

[3]According to Jump$tart Financial Foundations for Educators, financial literacy refers to "the ability to use knowledge and skills to manage financial resources effectively for lifetime of financial well-being" (https://www.jumpstart.org/).

(2014) find that a significant share of demographic heterogeneity in consumer inflation expectations can be explained by heterogeneity of economic literacy. Van Rooij et al. (2011) report that survey respondents with low financial literacy are much less likely to invest in stocks. Rumler and Valderrama (2020) show that average consumer has a relatively low level of 'inflation literacy'. They also provide evidence that high level of 'inflation literacy' is related to more accurate inflation expectations and higher levels of inflation uncertainty. According to Lusardi and Mitchell (2008), Bruine de Bruin et al. (2010) and Bruine De Bruin et al. (2011), less financially literate consumers tend to overestimate inflation more than other consumers. We provide evidence that higher financial literacy and lower responsiveness of inflation expectations are related.

Fourth, our results deepen understanding of the role of trust in the central bank in expectations formation.[4] This topic has been lately debated in the context of the Covid-19 pandemic.[5] Recent empirical studies show that higher trust in the central bank contributes to lower inflation expectations and lower uncertainty, as well as to an increase in accuracy of expectations (Christelis, Georgarakos, Jappelli, and van Rooij, 2020; Mellina and Schmidt, 2018; Rumler and Valderrama, 2020). According to our analysis, higher trust in the ECB is also linked with lower responsiveness of consumer inflation expectations to transitory fluctuations.

The remainder of the paper is structured as follows. Section 2 introduces the data set and Section 3 reports the empirical analysis. Robustness analysis is presented in Section 4 and conclusions are drawn in Section 5.

[4]Trust in the central bank is often described as confidence of the public that institution will fulfil its mandate. It is related to interpersonal trust but also to evaluation of institution's performance by the public (Mishler and Rose, 2001). Bursian and Faia (2018) note that the notion of trust in monetary authorities is more general than central bank reputation.

[5]See for example a speech by Schnabel, Member of the Executive Board of the ECB: https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp201216_1~9caf7588cd.en.html.

2 Data description

2.1 Survey questions

We analyse fully comparable, anonymized individual survey responses in the ECB CES survey which was launched in its pilot phase in January 2020. The survey participants are from the six largest euro area economies (Belgium, France, Germany, Italy, the Netherlands, and Spain) which account for the major share of the euro area in terms of HICP weights (86%). The unique features of the CES, such as high (monthly) frequency, rotating panel structure, qualitative and quantitative questions on inflation views at various forecast horizons, help establishing new empirical facts about expectations formation in the euro area.

Our sample covers period from April 2020, when the survey reached the target sample size of approximately 10,000 households, to December 2021 (21 waves). The total number of euro area consumers who took part in the pilot waves under investigation is 20,660. On average, each respondent participated in six survey waves. In total, the analysed data consists of about 230,000 completed questionnaires. Descriptive statistics for survey participants are reported in Table 1.

In the CES questionnaire, consumers firstly reveal their views on inflation in the country they live—current inflation (inflation perceptions), inflation expectations one-year ahead (short-term) and inflation expectations three-years ahead (medium-term)—in qualitative terms, meaning that they choose between increase, decrease, and no change in prices in general. Medium-term horizon refers to 12-month period ending in three years. Contrary to longer time periods (like the average inflation rate over several years), this kind of specific time period in the future is easier to understand for consumers. More specifically, the available response categories are as follows:

(1) Prices went up (will increase) a lot; (2) Prices went down (will decrease)

a lot; (3) Prices went up (will increase) a little; (4) Prices went down (will decrease) a little; (5) Prices stayed (will be) exactly the same (that is 0% change).

Then, consumers are asked to respond to the following quantitative questions:

How much higher/lower 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.

How much higher/lower 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.

By about what percentage do you expect prices in general in the country you currently live in to increase/decrease over the 12-month period between [survey month, year+2] and [survey month, year+3]? Please give your best guess of the change in percentage terms.

The survey includes also a probabilistic question on short-term inflation expectations in which respondents assign probabilities to predefined ranges of inflation. Bańkowska et al. (2021) show that inflation expectations measured with quantitative and probabilistic questions are generally speaking consistent with each other. We exploit the probabilistic question to measure consumers' uncertainty about future inflation, when comparing differences in response to the pandemic shock across demographic sub-groups.

The survey was conducted in extraordinary circumstances, during the Covid-19 pandemic and lockdown measures in reaction. The pandemic shock resulted in strong collapse in the euro area economic activity in March and April 2020, followed by a slow recovery related to relaxing lockdown rules in the following months (ECB,

2020). The ECB reacted to the shock by extending asset purchasing programs and taking other measures supporting access to credit. Due to distortions in the economy, as well as high health and economic uncertainty, the pandemic significantly affected economic decisions of consumers and potentially their inflation views.

Unlike face-to-face surveys, the CES survey was not distorted during the pandemic, since it was conducted online. Therefore, it provides unique information about consumer's opinions during the pandemic. We employ responses to one of the Covid-19 related question, in which survey participants are asked to assess how seriously they are concerned about the epidemic's influence on economic situation of the country they live in. When responding to this question, the scale ranges from 0 (no concern) to 10 (extreme concern).

The survey provides also a great deal of background information about individual respondents and their opinions on the economy, which we use as control variables in estimations and to deepen analysis of behavior of expectations. In particular, apart from gathering demographic characteristics, the survey questions measure respondent's financial literacy, by checking understanding of savings accounts, real interest rates, risk diversification and interest compounding for loans.

The CES data, due to its panel character, enables us to observe directly changes in expectations of individual consumers. Focusing on changes instead of levels of expectations has several advantages. First, we can leave aside the issue of the level of expectations which in consumer surveys typically suffers from an overestimation bias. The overestimation bias may be especially problematic at the time of pandemic. Secondly, the impacts of all time-invariant characteristics of consumers (such as age, education level, financial literacy) on changes of expectations are likely to be reduced in comparison to the levels of expectations, as they cancel out when using the first differences.[6]

[6]For studies documenting heterogeneity of inflation expectations with respect to socio-economic characteristics, see Bruine de Bruin et al. (2010); Easaw et al. (2013); Jonung (1981); Stanisławska et al. (2021).

2.2 Summary of the data set

Table 1 indicates that on average euro area consumers expected that inflation in one year will be 3.6% and in three years 3.8%, while their average estimate of current inflation is 4.1%. The median medium-term inflation expectations of consumers, however, is 2%, which is in line with the inflation aim of the ECB (below, but close to 2% until July 2021, and 2% thereafter). Men, young consumers and consumers with high education level have systematically lower inflation views than women, older consumers and consumers with low education level. Low inflation views are related to high financial literacy, high trust in the ECB, medium Covid-19 concerns and low inflation uncertainty. Low inflation perceptions and expectations are also typical for employed consumers and consumers with high income level or small household size.

Distributions of individual survey responses (Figure 2a) reveal that the largest share of consumers expect prices to be stable in the short- and medium-term, and relatively large share of consumers have inflation expectations of 2%. However, some consumers expect very high inflation rates, which is reflected in long right tails of the distributions. Another feature, typical for consumer inflation expectations, is heaping of responses at round numbers (like multiplies of 5 and 10), which might be indicative of consumer's uncertainty with regard to the future inflation.[7] All in all, the CES data confirm earlier empirical findings that consumers hold very dispersed inflation views, have tendency to overestimate current and future inflation and to provide rounded values (see for example Arioli et al., 2017, Duca-Radu et al., 2021, Reiche and Meyler, 2022).

Consumers were highly worried about the economic consequences of the Covid-

[7]Rounding behavior is common in responses to numerical questions in surveys (see Binder, 2017, for an overwiev). This may reflect the fact that quantitative responses may have qualitative features (Bryan and Palmqvist, 2005). Binder (2017) and Reiche and Meyler (2022) argue that rounded quantitative inflation expectations are related to high uncertainty (i.e. survey responses of uncertain consumers are typically multiples of 5 and 10). Others show that reporting of round numbers is linked to personal characteristics and question-level characteristics. For example, Gideon et al. (2017) find that rounding is more common for respondents with low ability and low motivation, as well for more difficult questions.

19 pandemic. Between April 2020 and December 2021, almost 20% of consumers declared that they are 'extremely worried' about the impact of the pandemic on their country's economic situation (Figure 3a). In the whole sample, the mean (median) value of Covid-19 concerns was 7.3 (8.0). The mean pandemic concerns were relatively stable and above 7.5 until April 2021, but later somewhat lower values were surveyed (Figure 3b).

Panel structure of the CES survey allows us to assess frequency and size of changes in individual inflation views, both in qualitative and quantitative terms. The frequency of adjusting inflation expectations is related to attentiveness of consumers to new information, but only under implicit assumption that adjustments are driven by new information rather than noise (Andrade and Le Bihan, 2013). As shown in Table 2, on average about 70% of consumers adjust their quantitative inflation views each month. This number is much lower if we consider changes in qualitative inflation views: about 35%. Dräger and Lamla (2012) find similar patterns in one-year ahead and 5-10-years-ahead inflation expectations in the US data, but comparison to CES is not straightforward due to different frequencies of re-interviewing respondents in these surveys.[8]

The consumers participating in the CES survey slightly more often changed their inflation expectations than perceptions. They revised slightly more often their inflation perceptions upwards than downwards, reflecting increasing inflation in the 2nd half of the sample. When it comes to the size of changes in individual inflation views from month to month, it does not differ much for shorter- and medium-term inflation expectations. According to Table 2, the mean absolute changes equal to 2.8 pp and 3.0 pp, respectively. These revisions are clearly larger than changes in the actual inflation rate (Figure 2b).

[8]Dräger and Lamla (2012) use data from the Michigan Survey of Consumers, a monthly survey in which a fraction of respondents is re-interviewed only after six months. In the CES respondents are re-interviewed every month.

3 Evidence on adjustments in quantitative inflation expectations

In this section, we use quantitative inflation views of euro area consumers to examine various dimensions of sensitivity of medium-term inflation expectations.[9] First, we study how consumer short- and medium-term inflation expectations adjust to changes in inflation perceptions and increasing Covid-19 concerns. We pay special attention to possible differences in response to the pandemic across demographic sub-groups and consider possible asymmetries in sensitivity of inflation expectations. Then, we check whether medium-term inflation expectations co-move with changes in short-term inflation expectations, taking into account for possible asymmetries and cross-country heterogeneity. Finally, we assess whether and how responsiveness of consumer inflation expectations is related to consumers' financial literacy, their trust in the ECB, and accuracy of consumers' inflation perceptions. In Appendix A, we provide evidence that our analysis—which is based on a rotating panel—is not distorted by the tenure effect.[10]

3.1 Adjustment of inflation expectations to changes in inflation perceptions and increasing Covid-19 concerns

We analyse sensitivity of consumer inflation expectations using methodology commonly used in the literature (Apokoritis et al., 2019; Buono and Formai, 2018; Corsello et al., 2021; Levin et al., 2004; Łyziak and Paloviita, 2017; van der Cruijsen and Demertzis, 2007). More specifically, we regress changes in medium-term inflation expectations of an individual consumer ($\Delta\pi_{it}^{3Y}$) on changes in his/her inflation perceptions ($\Delta\pi_{it}^{P}$), the pandemic shock (Cov_{it}), and a set of control variables (X_{it})

[9] In order to limit the effect of extreme observations, 2% of the highest and 2% of the lowest survey responses from our data set are winsorized.

[10] Repeated surveys are subject to the tenure effect, if respondent's declarations are affected by the number of survey waves a respondent has participated in.

expressed as follows:

$$\triangle \pi_{it}^{3Y} = \alpha_i + \beta \triangle \pi_{it}^{P} + \gamma Cov_{it} + \mu X_{it} + \epsilon_{it} \tag{1}$$

Corresponding specification is applied to changes in short-term inflation expectations ($\Delta \pi_{it}^{1Y}$) in order to have useful references in the sensitivity analysis:

$$\triangle \pi_{it}^{1Y} = \alpha_i + \beta \triangle \pi_{it}^{P} + \gamma Cov_{it} + \mu X_{it} + \epsilon_{it} \tag{2}$$

Both specifications focus on adjustments of inflation expectations to changes in subjective views on current inflation rather than actual inflation. It is well documented that consumers pay more attention to prices they experience in everyday life than to official inflation figures when forming inflation expectations (e.g., D'Acunto et al., 2019; Bruine de Bruin et al., 2010, 2011). Some studies document that consumers pay more attention to price increases than decreases, ignoring small changes in prices, and they are affected by media reporting (Brachinger, 2008; Hałka and Łyziak, 2015; Lamla and Lein, 2015; Stanisławska, 2019). Thus, inflation perceptions seem better suited to analyse adjustments of inflation expectations.

Equations (1) and (2) include a dummy variable related to the Covid-19 outbreak (Cov_{it}) to account for the influence of the pandemic on consumers' inflation expectations. It reflects changes in subjective assessment of the impact of the pandemic on the economy: it is equal to one if respondent in the current month is more concerned about the consequences of the pandemic on country's economic situation than in the previous month. The pandemic-related variable in the specifications above allows us assess reaction of inflation expectations to an additional factor, apart from inflation views.

The set of control variables (X_{it}) account for consumer-specific, country-specific, and time-specific factors, which potentially affect changes in inflation views in various

forecast horizons. The consumer-specific factors refer to observed personal characteristics (gender, age, education level, employment status, income, household size, and score in the financial literacy test). The impacts of any omitted time invariant attributes of consumers, like personal optimism or pessimism, on adjustment of inflation expectations are captured by individual effects. Common time effects account for euro area wide macroeconomic conditions (e.g. monetary policy, common inflation trends, common component of economic activity). By including country effects we control for cross-country heterogeneity.

Table 3 summarizes our main results on responsiveness of short- and medium-term inflation expectations. It shows that medium-term inflation expectations co-move with inflation perceptions, meaning that consumers believe that inflation is relatively persistent. Taking under consideration the whole sample, 1 pp increase in inflation perceptions translates to 0.21 pp increase in three-year-ahead inflation expectations. In line with intuition, this adjustment is weaker than in the case of short-term inflation expectations, for which the pass-trough equals 0.38 pp.

In 2020 euro area inflation was close to 0%, but in 2021 it rapidly accelerated mainly due to sharp rise in energy prices. In the end of the sample, i.e. in December 2021, the euro area HICP inflation rate was record high (5.0%). Since such large change in price developments could have impact on behaviour of inflation expectations, we compare responsiveness of consumer inflation expectations in two sub-periods, *non-inflationary period* (April 2020 – December 2020) and *inflationary period* (January 2021 – December 2021). The estimates of pass-through in both subsamples are very close to each other (Table 3), indicating no increase in responsiveness of consumer expectations in the period of rapidly accelerating inflation.

Analysis of responsiveness of the medium-term inflation expectations might bring some insights about anchoring of inflation expectations[11], but our estimation results

[11]We focus solely on responsiveness property since it is very challenging to measure the level of consumer inflation expectations (e.g., Arioli et al., 2017; Bruine de Bruin et al., 2012; Reiche and Meyler, 2022).

are inconclusive. Some responsiveness of medium-term consumer inflation expectations reported in Table 3 does not necessarily rule out firmly anchored expectations, because in the case of medium-term forecast horizon, contrary to the long-term horizon, some degree of responsiveness might be natural and the requirement of zero-responsiveness might be too strict. Interestingly, Baumann et al. (2021) show that since the global financial crisis the expectations of professional forecasters formulated in a comparable medium-term horizon do adjust to actual inflation—which probably reflects stronger inflation persistence after 2008–while expectations four to five years ahead are not responsive to the current inflation.

Table 3 indicates that the Covid-19 shock resulted in an increase in consumer inflation expectations in the euro area. We identify this effect only in the 1st sub-sample, covering an early phase of the pandemic characterized by strong restrictions imposed by governments on economic activity to limit a spread of the pandemic, as well as by disruptions in the global supply chains. In the second subsample, we do not find connection between increased Covid-19 concerns and inflation expectations which potentially reflect easing of restrictions and building up immunity to Covid-19 by vaccination.

In 2020 consumers expected that the pandemic shock would have a persistent effect on inflation as both short- and medium-term inflation expectations were affected by the increasing Covid-19 fears. In line with intuition, responsiveness of short-term inflation expectations to increasing Covid-19 concerns was higher than that of medium-term inflation expectations. For US consumers, Dietrich et al. (2022) estimate that the pandemic increased short-term inflation expectations by about 5 pp. Our results suggest that in the euro area this effect is weaker – we roughly estimate that the outbreak of the pandemic led to increase of short-term inflation expectations of a typical consumer no larger than about 2.4 pp and the increase in medium-term inflation expectations was even smaller, i.e. 1.4 pp.[12]

[12]The Covid-19 dummy measures qualitatively whether a consumer's Covid-19 concerns are

Our results complements the previous literature on Covid-19 consequences for consumer inflation expectations, which is inconclusive. Binder (2020) and Dietrich et al. (2022) document that the pandemic contributed to higher short-term inflation expectations. Contrary to these papers, Coibion et al. (2020) find that US consumers living under lockdowns expected lower one-year ahead inflation, while Armantier et al. (2021) find no clear upward or downward trend in aggregated inflation expectations after the outbreak of the pandemic. The latter paper stresses however that the pandemic contributed to higher disagreement and increased uncertainty, which indicates difficulties of ordinary people in assessing consequences of the pandemic for the economy.

The results that consumers adjusted upward their inflation expectations in response to the pandemic is in line with Coibion et al. (2019) and Candia et al. (2020) who provide evidence that consumers interpret inflation as a supply-side driven phenomenon and, as a result, link economic slowdown with higher inflation. As noted by several authors (e.g., Meyer et al., 2022), response of consumer inflation expectations to Covid-19 differs from response of professional forecasters and firms, which interpret this shock as a demand driven and associate it with a decrease in future inflation.

Our results are robust to introducing country-specific time effects to allow for more heterogeneity across countries and variables related to consumer sentiment (i.e. subjective assessment of current state of the economy and household's economic situation) to account for their importance in shaping inflation expectations (Ehrmann et al., 2017).

higher in the current month than in the previous month without specific information on how much the level of concerns increases (by one or several categories). Our approximation of the impacts of increasing pandemic concerns on inflation expectations in non-inflationary period is based on the assumption that consumers' zero-level concerns before the pandemic increased on average to level 8 in non-inflationary period, which is the level of median concerns at that time.

3.1.1 Whose inflation expectations did increase due to Covid-19 pandemic?

The Covid-19 pandemic had uneven impacts on economies, and certain sectors like tourism, travel and services suffered more than the other sectors. Also some groups of consumers experienced stronger consequences of the pandemic shock than the others. As reported by Christelis, Georgarakos, Jappelli, and Kenny (2020), younger, female, and low-income consumers expressed more concerns about their financial situation due to the Covid-19, and these higher fears affected consumption behaviour. In this section, we investigate whether various groups of consumers differently adjusted their inflation expectations due to the pandemic shock. In line with the evidence presented in the previous section, we focus only on the first subsample, which covers the first two waves of the Covid-19 pandemic. We extend specifications (1) and (2) by interacting the Covid dummy with different demographic variables.

In these estimations, we additionally control for changes in consumer inflation uncertainty, as we aim to mitigate a possibly disturbing effect of rounded survey responses at the time of increased uncertainty. As mentioned in Section 2.2, in periods of higher uncertainty consumers have tendency to provide rounded responses to quantitative survey questions, which in turn disturbs comparability of data over time. Thus, relatively high inflation expectations during the first months of the pandemic might reflect rather elevated inflation uncertainty than assessments of future inflation (Reiche and Meyler, 2022).

We measure individual consumer inflation uncertainty based on survey responses to the probabilistic question on short-term inflation expectations using a methodology of Engelberg et al. (2009), applied also to New York Fed's SCE (Armantier et al., 2017). More specifically, we fit a uniform, triangular or beta distribution (depending on a number of bins used by a respondent) to the probabilities provided by individual survey participants and use IQRs of the fitted distributions as an uncertainty

measure. We exclude those cases, in which probabilities provided by a respondent do not sum to 100 or all probability is assigned to an open-end interval (in such a case the IQR depends fully on an assumption about a maximum or a minimum of the domain).

First, we find that the Covid-19 contributed to increased inflation expectations in short- and medium-term horizon even if we account for a change in consumer uncertainty (Table 4 and Table 5, column (1)). Second, Table 4 shows that increasing pandemic fears have different impacts on inflation expectations of various demographic subgroups. More specifically, (i) women expected a higher increase in inflation one-year ahead due to increased Covid-19 fears than men, and (ii) the oldest consumers did not expect that the pandemic contributes to the higher inflation one-year ahead contrary to the younger consumers. In the case of medium-term inflation expectations, we find heterogeneity only with respect to the education level and the household size (Table 5). Interestingly, better educated consumers expect the impact of the Covid-19 on inflation to be more persistent than consumers with primary education. It seems that consumers with different household income level adjusted their inflation expectations in response to the Covid-19 shock in the same way. However, consumers living in larger households (meaning smaller income per person in a family) expected the impact of Covid-19 on inflation to last longer.

3.1.2 Asymmetries to positive and negative changes in inflation perceptions

Next, we consider whether responsiveness of consumer inflation expectations to changes in inflation perceptions is asymmetric. More specifically, we examine whether the adjustment of short- and medium-term inflation expectations is different to increasing and decreasing inflation perceptions. Some studies document asymmetric adjustments of euro area long-term inflation expectations of professional forecasters. For example, Corsello et al. (2021) show that long-term inflation expectations do

not react to positive surprises in HICP releases, but they are sensitive to negative surprises (since mid-2013). Similar evidence is presented in Ehrmann (2015) for a group of countries with inflation targeting central banks, as well as the euro area, the US, and Switzerland. Moessner and Takáts (2020) find that only positive deviations of inflation from the inflation target affect long-term inflation expectations of professional forecasters.

We investigate presence of asymmetries by decomposing changes in inflation perceptions into positive ($\triangle\pi^{P+}$) and negative terms ($\triangle\pi^{1Y+}$). After modifications, we are able to separate these two effects and test for differences:

$$\triangle\pi_{it}^{3Y} = \alpha_i + \beta_1\triangle\pi_{it}^{P+} + \beta_2\triangle\pi_{it}^{P-} + \gamma Cov_{it} + \mu X_{it} + \epsilon_{it} \tag{3}$$

$$\triangle\pi_{it}^{1Y} = \alpha_i + \beta_1\triangle\pi_{it}^{P+} + \beta_2\triangle\pi_{it}^{P-} + \gamma Cov_{it} + \mu X_{it} + \epsilon_{it} \tag{4}$$

Based on the full sample, we do not find any evidence on asymmetric responses of consumer inflation expectations to increases and decreases in perceived inflation (Table 6, Table 7). Similar result is found for the two sub-periods characterized by very different inflation dynamics. So even when euro area inflation started to accelerate rapidly, after a prolonged period of low inflation, consumers did not become more sensitive to perceived inflation increases than decreases.

One explanation of this finding might be that consumers, differently than professional forecasters, attach greater importance to their subjective inflation assessments than the actual inflation. Therefore, next we split consumers into two groups based on the level of their inflation perceptions. We define that a consumer belongs to *Low (High) inflation perception* group, if his/her view of current inflation is below (above) the sample median. According to Table 6 and Table 7, the level of perceived inflation matters for responsiveness of inflation expectations. Consumers with low inflation perceptions adjust their short-term inflation expectations more strongly to a negative change in inflation perceptions than to a positive change. When it comes

to the medium-term inflation expectations, they react only to decreases in inflation perceptions. Instead, consumers with high inflation perceptions, react symmetrically to changes in inflation perceptions.

3.2 Adjustment of medium-term inflation expectations to changes in short-term inflation expectations

Consumers' subjective views of short-term inflation outlook filter information shocks that are likely to affect medium-term inflation expectations (Buono and Formai, 2018). These views include all types of shocks, for example shocks in food and energy prices, as well as changes in administrative prices and wages. Short-term inflation expectations capture also the impact of subjective assessment of current price developments. Therefore, we estimate the following specification in order to assess whether the medium-term inflation expectations co-move with changes in the short-term inflation expectations:[13]

$$\triangle \pi_{it}^{3Y} = \alpha_i + \beta \pi_{it}^{1Y} + \gamma Cov_{it} + \mu X_{it} + \epsilon_{it} \tag{5}$$

It is worth noting that in the CES, horizons of short-term and medium-term inflation expectations do not overlap as the former relates to next 12 months, while the latter refers to inflation over 12-month period ending in three years. Therefore, there is no direct (mechanical) dependency between these expectations.

One-year ahead inflation expectations filter many current and short-term factors that might affect medium-term inflation outlook. Since perceived inflation is one of the most important driver of consumer inflation expectations, it is useful to assess the effect of short-term factors on medium-term inflation expectations beyond the effect of the perceived inflation. To this end, we remove the influence of inflation

[13]Similar approach is used by Apokoritis et al. (2019), Buono and Formai (2018), Łyziak and Paloviita (2017), and Yetman (2020).

perceptions and actual price changes on short-term inflation expectations by orthogonalising these expectations with respect to inflation perceptions, country-specific inflation (π_t) and socio-demographic characteristics (X_{it}):

$$\triangle \pi_{it}^{1Y} = \alpha_i + \beta \triangle \pi_{it}^{P} + \mu X_{it} + \delta \triangle \pi_t + \epsilon_{it} \tag{6}$$

The residuals from the regression above (denoted by $\tilde{\pi}_{it}^{1Y}$) represent changes of short-term inflation expectations, which are not related to the perceived or actual inflation. We interpret them as a forward-looking component of short-term inflation expectations, related for example to an influence of forecasts of professional forecasters, macroeconomic news (except those regarding current inflation), and shocks not affecting current prices.[14] Next, in equation (5) we replace short-term inflation expectations with these residuals:

$$\triangle \pi_{it}^{3Y} = \alpha_i + \beta \tilde{\pi}_{it}^{1Y} + \gamma Cov_{it} + \mu X_{it} + \epsilon_{it} \tag{7}$$

The results in Table 8 indicate that medium-term inflation expectations react significantly to changes in short-term inflation expectations in the original data set without orthogonalization, and the same result is obtained, if short-term inflation expectations are cleaned from the influence of inflation perceptions. Both in the whole sample and the two sub-samples, the estimated reaction is only slightly lower with orthogonalization than without orthogonalization. This suggests that forward-looking factors included in short-term inflation expectations—beyond those which are related to inflation perceptions—play a greater role in shaping medium-term inflation expectations than inflation perceptions. The estimated parameters for the increasing Covid-19 concerns are not statistically significant (with one exception), which is in line with the view that short-term inflation expectations capture con-

[14] Forecasts of professionals constitute another important driver of consumer inflation expectations as suggested by the epidemiological model of expectations formation; see Carroll (2003; 2006).

sumers' views of how the pandemic affects future inflation.

Comparing estimates in the two sub-periods, *non-inflationary* and *inflationary*, our results indicate somewhat stronger responsiveness in the latter period. This might suggest that consumers perceive current shocks to inflation as more persistent than previously.

3.2.1 Asymmetries to positive and negative changes in short-term expectations

Similarly as in the case of responsiveness to changes in inflation perceptions, we find no asymmetry in responsiveness of medium-term inflation expectations to positive and negative changes in short-term inflation expectations, if we consider all consumers (Table 9). Considering separately consumers with low and high inflation perceptions reveals however, that the former react more strongly to decreases than to increases in inflation perceptions.

Summing up our asymmetry analysis, we present consistent evidence on weaker adjustments of medium-term inflation expectations to increases in inflation perceptions and short-term inflation expectations among consumers with low inflation perceptions. This group of consumers believes that increases in current inflation (subjectively assessed) are temporary and have less persistent effect on future inflation. In the period of above the target inflation, as currently experienced in the euro area, this might help medium-term inflation expectations to stay close to the inflation aim. Another implication is that this asymmetry might contribute to a growing disagreement in consumer inflation expectations during periods of accelerating inflation.

3.2.2 Cross-country heterogeneity

We repeat the baseline analysis of responsiveness of medium-term inflation expectations to changes in short-term inflation expectations on datasets for individual euro area economies. In all six countries, we confirm that consumers perceive changes in current inflation (subjectively assessed) as relatively persistent, i.e. having effect on medium-term inflation expectations. The estimated responsiveness parameters (in both specifications, with and without orthogonalizing changes in inflation perceptions) are somewhat lower for Belgium, Germany and the Netherlands than for France, Italy and Spain (Figure 4). These differences might reflect for example different persistence of inflation shocks across the countries (e.g. Gadea and Mayoral, 2006) or divergent levels of trust in the ECB (van der Cruijsen and Samarina, 2021).

3.3 Role of trust in the ECB, financial literacy, and accuracy of inflation perceptions

In this section we study how the level of trust in the ECB, consumers' financial literacy, and accuracy of their inflation perceptions are related to responsiveness of medium-term inflation expectations. To the best our knowledge, these issues have not been previously addressed in the literature so far. Our intuition is that high trust in the ECB should be related to more stable (less responsive) medium-term inflation expectations, reflecting consumers' confidence that the central bank maintains price stability. Consumers with high economic knowledge, i.e., financial literacy, might better understand the inflation process and their assessment of inflation persistence might be different from consumers with low economic knowledge. Similarly, we anticipate that consumers with more accurate inflation perceptions might pay more attention to economic developments[15] or be more certain about in-

[15]For example, Lindén (2005) documents that more accurate perceptions are related to incentives to gather information on prices due to planned large purchases, like a car, a house or making a renovation.

flation than consumers with less precise perceptions, and therefore differ in a degree of responsiveness.

We measure trust based on the CES question, in which survey participants are asked to declare their level of trust in the ECB and some other institutions[16] using the scale from 0 (not trust at all) to 10 (complete trust). Figure 5a displays that in general, the level of trust in the ECB is on a relatively high level, since dominant values lie between five and seven, and the mean level of trust among the euro area consumers remained quite stable in the whole sample in spite of the pandemic (Figure 5b).

Consumer's financial literacy test score is constructed using survey responses to questions related to savings accounts, real interest rates, risk diversification and interest compounding for loans.[17] Figure 6 shows that about 60% of consumers in our CES data have test score values 2 or 3, and only 5% of consumers belong to the lowest test score group, meaning that they did not provide any correct answers to the test questions. The mean (median) test score value is 2.4 (3.0).

The accuracy of inflation perceptions is measured with the mean error (ME) and root mean squared error (RMSE). Figure 7 shows that a median consumer only slightly overestimates current inflation (ME equal to 1.2 pp; RMSE equal to 3.3 pp), but a relatively large share of consumers report numbers much higher than the actual HICP inflation rate. Thus, consumers with low accuracy of inflation perceptions are mainly those who overestimate current inflation.

Based on distributions of each of the three characteristics, we categorize consumers into three separate sub-groups using the 33rd and 66th percentiles. More specifically, we first construct low, medium and high sub-groups of the considered metrics and then compare responsiveness of medium-term inflation expectations in the group of consumers with low and high value of the metrics.

[16]Other institutions are the European Parliament, the European Commission, and the United Nations.

[17]See Bańkowska et al. (2021) for the list of financial literacy questions in the CES.

Table 10 reveals that consumers with high level of trust in the ECB revise their medium-term inflation expectations less to changes in inflation perceptions and to changes in short-term inflation expectations than consumers with low level of trust in the ECB. In the latter case, the difference in responsiveness is somewhat higher. Only consumers with low level of trust in the ECB expected the Covid-19 shock to have long-lasting impacts on inflation, while consumers declaring high trust in the ECB did not revise their medium-term inflation expectations upwards as a response to increasing Covid-19 concerns.

High financial literacy has similar effect on responsiveness of medium-term inflation expectations, as also in this case we find that consumers with high financial literacy adjust their medium-term inflation expectations systematically to a lesser degree than consumers with low financial literacy (Table 11).

The accuracy of inflation perceptions seems to be less important for responsiveness of medium-term inflation expectations, as the estimated parameters associated with changes in inflation perceptions and increasing pandemic concerns are qualitatively quite similar for the two sub-groups (Table 12). Only in the case of changes in the short-term inflation expectations, the low accuracy group of consumers is slightly more sensitive. This result indicates that in spite of very divergent views, consumers with high bias in inflation perceptions do not differ much in the assessment of persistence of short-term shocks from those with low bias. This finding is consistent with Reiche and Meyler (2022) who analyse short-term inflation expectations of euro area consumers in the ECCS. They provide evidence that consumers have quite similar views of inflation dynamics while some of them have problems to accurately estimate the level of inflation.

Financial literacy, trust in the ECB and accuracy of inflation perceptions might be interrelated. For example, consumers with better financial knowledge and with high trust in the ECB tend to report lower inflation perceptions (Table 1). Financial knowledge also supports higher trust in the central bank (van der Cruijsen and

Samarina, 2021). As a robustness check we examine all three characteristics in a single equation by interacting sensitivity parameter with dummy variables. The results reported in Table B.1 and B.2 confirm our earlier conclusions that both high trust in the ECB and high level of financial literacy contribute to lower sensitivity of medium-term inflation expectations. Interestingly, the contributions of these two factors are of similar importance. The 3rd demographic feature – the accuracy of inflation perceptions – seem not to be an important factor determining sensitivity of medium term inflation expectations.

Our results on financial literacy are related to the recent evidence of the relationship between cognitive abilities, the formation of inflation expectations, and the consumption plans of consumers presented by D'Acunto, Hoang, Paloviita, and Weber (2022). They show that high-IQ consumers have more accurate inflation expectations than low-IQ consumers, and only high-IQ consumers increase their propensity to consume when expecting higher inflation, in a way consistent with the consumer Euler equation. However, both high-IQ and low-IQ consumers with a college degree in economics or business behave in line with the consumer Euler equation. Thus, economic training, which improves consumers' financial literacy, helps consumers to better understand consequences of inflation and economic relationships.

4 Robustness check using qualitative inflation views

Apart from quantitative inflation views, the CES gathers also qualitative opinions on inflation in various horizons. Despite the fact that qualitative inflation views provide less precise information on consumers' beliefs than quantitative views, as they describe only directional change in prices (see Section 2.1), they have some advantages. First, qualitative formulation of survey question is potentially easier for consumers, which might lead to more reliable responses (Jonung, 1986; Pesaran and Weale, 2006). Second, qualitative inflation views are not affected by rounding behaviour

which might disturb inference, especially in period of changing uncertainty. Thirdly, as recently emphasized by Andrade et al. (2020), changes in broadly defined qualitative inflation expectations might better explain consumers' economic decisions than changes in quantitative inflation expectations. For these reasons, we complement analysis of adjustments of quantitative inflation expectations with analogous analysis based on qualitative opinions.

For simplicity, we consider only increases in inflation views. A binary variable describing change in qualitative inflation view of consumer i referring to horizon h, denoted as $d\pi_{it}^{h}$, takes 1 if consumer's qualitative opinion is shifted towards higher prices, and zero otherwise. A shift toward higher prices might describe, for example, a situation in which a consumer changes his/her opinion from '*Prices went up (will increase) a little'* to '*Prices went up (will increase) a lot*' or from '*Prices went down (will decrease) a lot*' to '*Prices stayed (will be) exactly the same (that is 0% change)*'.

We model probability of an increase in inflation expectations ($\mathrm{P}(d\pi_{it}^{3Y} = 1)$ or $\mathrm{P}(d\pi_{it}^{1Y}=1)$) using a random effects binary logit model. The set of regressors is analogous to equations (1) and (5) in Sections 3.1 and 3.2. It includes changes in qualitative inflation perceptions ($d\pi_{it}^{P}$) or changes in qualitative short-term inflation expectations ($d\pi_{it}^{1Y}$), the Covid-19 concerns, and the set of control variables (demographic characteristics, time-effects, country-effects). Next, we introduce interactions of the main independent variables with the categorical variables defining low, medium and high level of trust in the ECB, financial literacy and accuracy of inflation perceptions.

Table 13 displays parameter estimates and corresponding average marginal effects of increase in qualitative inflation perceptions, short-term inflation expectations and Covid-19 concerns on probability of increase in medium-term inflation expectations. They confirm our quantitative conclusions that medium-term inflation expectations are responsive to increases in inflation perceptions. We find that probability of an increase in medium-term inflation expectations is about 12 pp higher for a consumer

who increased his/her inflation perceptions than for a consumer who did not changed views on current inflation or who shifted views on current prices toward lower values. The responsiveness of medium-term inflation expectations is weaker than responsiveness of short-term inflation expectations, as for the latter the marginal effect amounts to about 24 pp. Based on qualitative data, we also corroborate that medium-term inflation views co-move with changes in short-term inflation views. The estimations results indicate that probability of adjusting medium-term inflation expectations upwards is higher when short-term inflation expectations go up than when inflation perceptions increase. When it comes to the pandemic related fears, the results from the logit models indicate that increasing Covid-19 concerns are linked with higher probability of an upward revision of short-term and medium-term inflation views, but the effect is quantitatively small.

Our conclusions on the role of trust in the ECB, financial literacy, and accuracy of inflation perceptions based on quantitative inflation views also hold when we consider qualitative inflation views. Tests for significance of interaction terms between change in inflation views and these characteristics indicate that responsiveness of medium-term inflation expectations differs with the level of trust in ECB and the level of financial literacy, but not with the the accuracy of inflation perceptions (Table 14). Marginal effects show that consumers declaring higher trust in the central bank and having better financial literacy are less likely to increase medium-term inflation expectations due to increase in inflation perceptions or short-term expectations than other consumers. The size of marginal effects suggests greater role of the financial literacy in facilitating stability of consumer inflation expectations. However, trust in the ECB played a special role during the Covid-19 pandemic, as it limited an increase in consumers medium-term inflation expectations.

5 Conclusions

The ECB CES online survey is the first source which provides fully comparable and timely information about qualitative and quantitative medium-term inflation expectations of euro area consumers. Based on micro-level panel data from six countries, we provide robust evidence that medium-term inflation expectations of consumers co-move with changes in short-term inflation expectations, and to lesser degree, with changes in inflation perceptions. This finding suggests that consumers consider inflation as relatively persistent. Comparing two very different inflation periods, one with inflation around zero and one with rapidly accelerating inflation to record high levels, does not indicate that responsiveness of consumer inflation expectations to changes in inflation perceptions has increased lately. However, sensitivity of medium-term inflation expectations to changes in short-term inflation expectations has become slightly larger. This issue should be continuously monitored in current high inflation environment.

We also find that higher trust in the ECB and higher financial literacy are related to weaker responsiveness of medium-term inflation expectations to changes in subjectively assessed current inflation, which contributes to smaller pass-through of temporary inflation shocks to wages and prices. This finding gives clear support for central banks' education campaigns targeted for different consumer groups, the aim of which is to boost people's financial literacy and trust in monetary policy making.

We show that in 2020 consumers perceived the pandemic shock as quite persistent. More specifically, increasing Covid-19 concerns were associated with higher short-term and medium-term inflation expectations, but only during the first two Covid-19 waves when the pandemic restrictions were extremely tight. We also find that more educated consumers and those with many family members were more afraid of inflationary consequences of the pandemic in the medium-term than other consumers. The results that consumers adjusted upward their inflation expecta-

tions in response to the pandemic is in line with Coibion et al. (2019) and Candia et al. (2020) who provide evidence that consumers interpret inflation as a supply-side driven phenomenon and, as a result, link economic slowdown with higher inflation.

Analysis of the way consumers adjust their inflation expectations based on the new euro area survey is very useful for medium-term oriented monetary policy, as it provides new information on how shocks hitting the economy are passed to medium-term consumer inflation expectations through their inflation perceptions and short-term inflation expectations. Future prospects of euro area inflation will largely depend on the way consumers' inflation expectations will respond to elevated inflation. In order to make monetary policy more effective, the ECB has revised its monetary policy strategy by adopting symmetric inflation target of 2% and by improving its communication to non-expert audiences.

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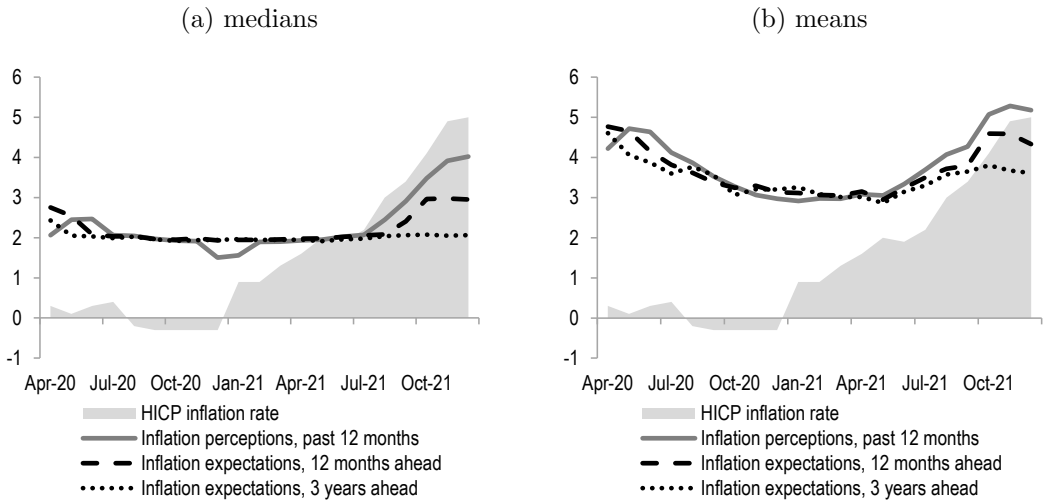
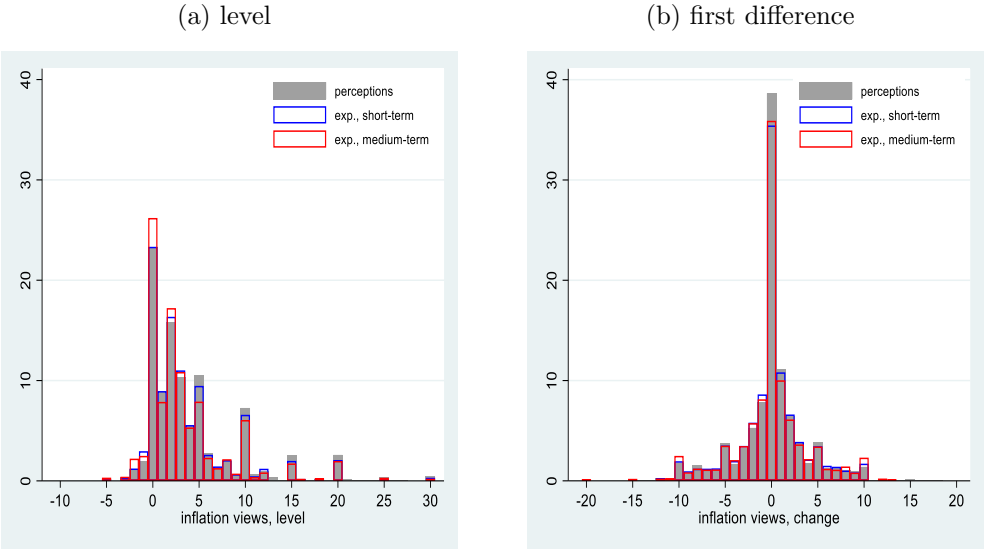
Figures and Tables

Figure 1: Level of aggregate inflation views



Source: own calculations based on CES data, Eurostat.

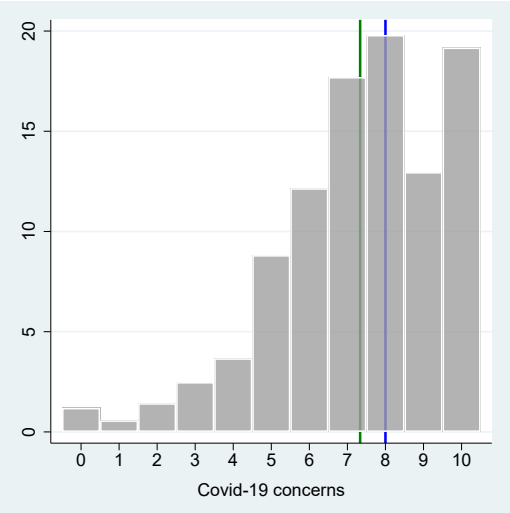
Figure 2: Individual inflation views



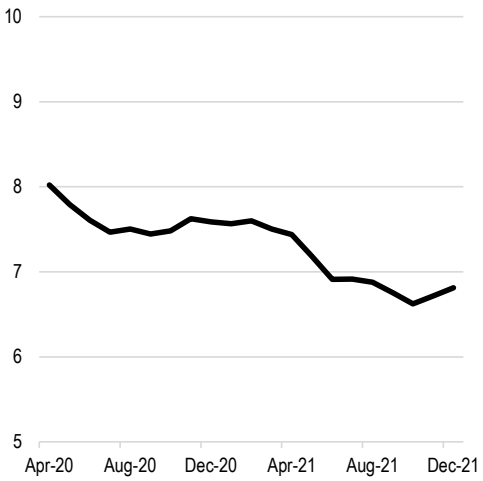
Source: own calculations based on CES data.

Figure 3: Concerns about impact of Covid-19 on country's economic situation

(a) distribution of responses



(b) average level of concerns

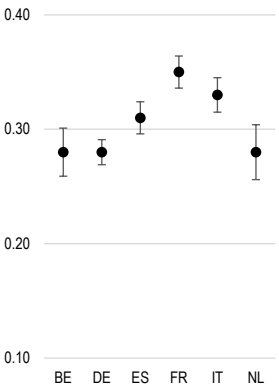


Notes: Green line marks mean; blue line marks median.

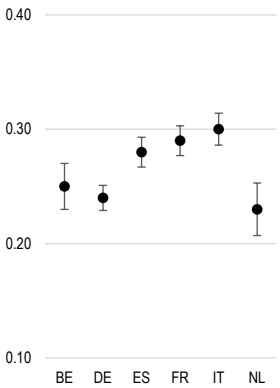
Source: own calculations based on CES data.

Figure 4: Estimates of sensitivity in single euro area economies

(a) to changes in short-term inflation expectations



(b) to orthogonalized changes in short-term inflation expectations

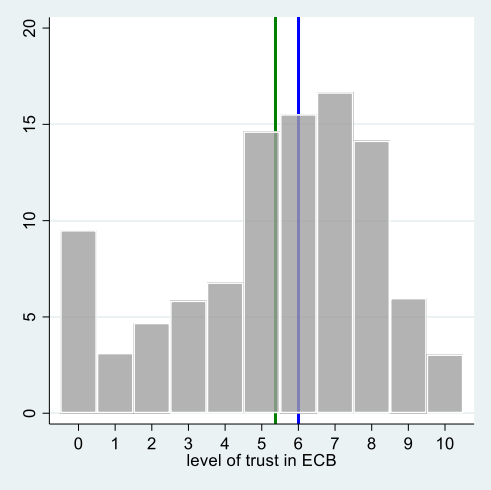


Notes: Parameter estimates with 95% confidence interval.

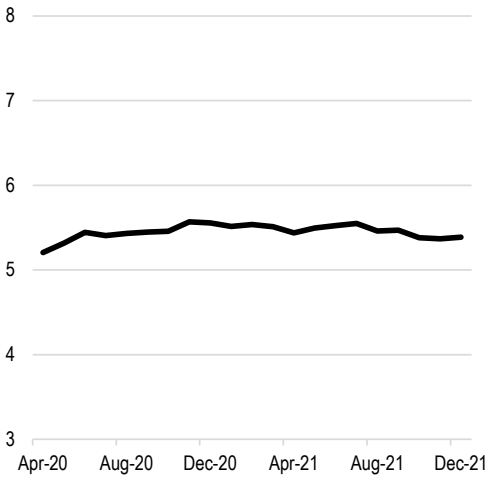
Source: own calculations based on CES data.

Figure 5: Declared trust in the ECB

(a) distribution of responses

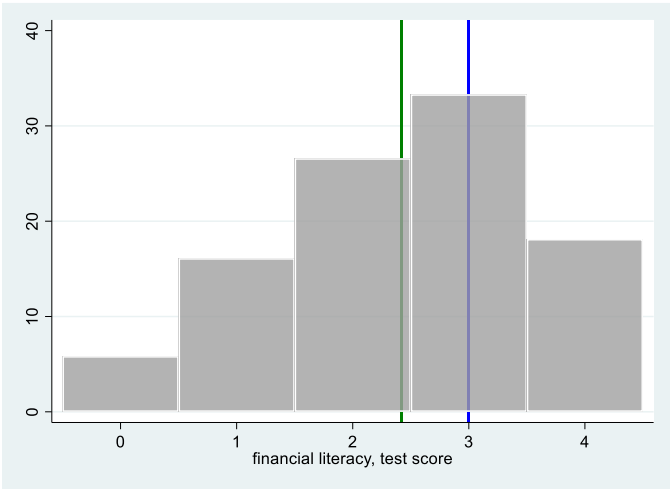


(b) average level of trust



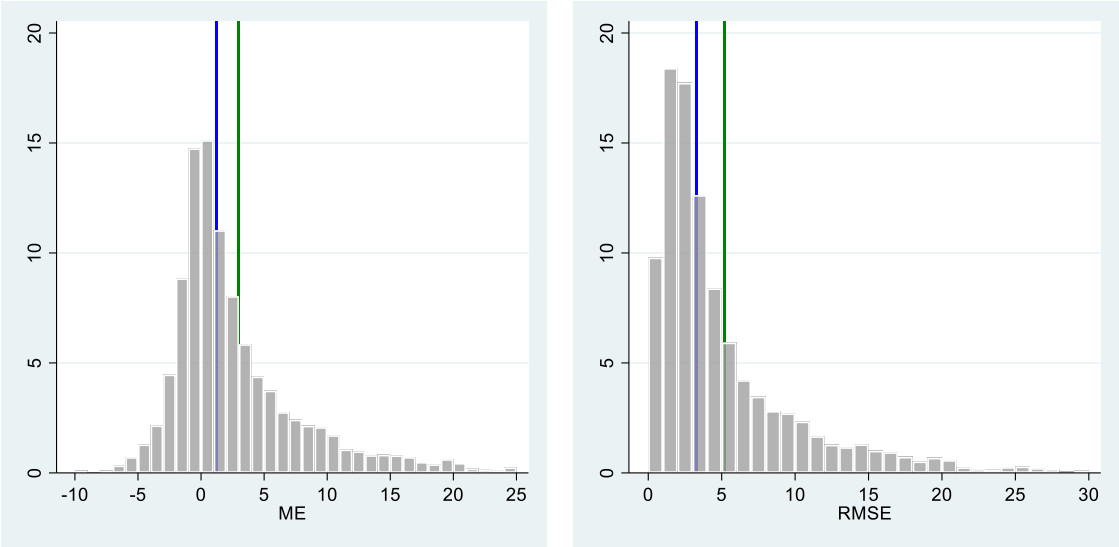
Notes: Green line marks mean; blue line marks median.
Source: own calculations based on CES data.

Figure 6: Distribution of financial literacy test score



Notes: Green line marks mean; blue line marks median.
Source: own calculations based on CES data.

Figure 7: Distribution of individual respondent's ME and RMSE of inflation perceptions



Notes: Green line marks mean; blue line marks median.

Source: own calculations based on CES data.

Table 1: Sample description

	N obs	Share in sample	Inflation percep.	Inflation expec., short-term	Inflation expec., medium-term
Total	229 433	100%	4.1	3.8	3.6
Gender					
male	112 828	49.2%	3.4	3.2	3.1
female	116 605	50.8%	4.3	4.1	3.8
Education					
primary	31 596	13.8%	4.2	3.9	3.9
secondary	72 643	31.7%	4.2	4.0	3.8
tertiary	125 194	54.6%	3.5	3.4	3.2
Employment status, 1=employed					
0	81 648	35.6%	4.1	3.9	3.7
1	147 785	64.4%	3.7	3.5	3.3
Income, quintiles					
1	46 634	20.3%	4.8	4.4	4.2
2	45 865	20%	4.0	3.9	3.7
3	46 595	20.3%	3.9	3.6	3.3
4	44 966	19.6%	3.4	3.3	3.2
5	45 373	19.8%	3.1	3.1	3.0
Financial knowledge - test score					
0	13 412	5.8%	4.7	4.3	4.1
1	36 980	16.1%	4.2	4.0	3.8
2	61 065	26.6%	4.2	3.9	3.7
3	76 396	33.3%	3.6	3.5	3.3
4	41 580	18.1%	3.3	3.2	2.9
Trust in ECB					
low trust (0 to 4)	51 695	23.2%	5.4	5.3	5.1
medium trust (5-7)	82 315	37.0%	3.7	3.5	3.2
high trust (8-10)	88 680	39.8%	3.1	3.0	2.8
Covid-19 concerns, country's economic situation					
low (0 to 4)	13 012	5.7%	3.8	3.5	3.4
medium (5-7)	56 092	24.7%	3.0	2.8	2.6
high (8-10)	157 579	69.5%	4.1	4.0	3.8
Uncertainty level					
low uncertainty	69 630	35.1%	1.7	1.4	1.8
medium uncertainty	61 405	30.9%	3.3	3.1	2.9
high uncertainty	67 537	34%	6.4	6.1	5.7

Notes: Inflation perceptions and expectations are winsorized at 2% and 98% percentile. Uncertainty is measured with IQR of fitted uniform, triangular or beta distribution (cases when respondent assigned full probability to one of open intervals are excluded).

Source: own calculations based on CES data.

Table 2: Characteristics of changes in inflation views of individual consumers

	Inflation perceptions	Inflation expec., short-term	Inflation expec., medium-term
Quantitative inflation views			
Mean absolute change (pp)	2.6	2.8	3.0
Share of decreases in views (%)	33.4	36.4	36.5
Share of no change in views (%)	30.7	27.2	27.9
Share of increases in views (%)	35.9	36.4	35.6
Qualitative inflation views			
Share of decreases in views (%)	15.6	17.7	19.0
Share of no change in views (%)	67.8	64.8	62.7
Share of increases in views (%)	16.6	17.6	18.3

Source: own calculations based on CES data.

Table 3: Responsiveness of short- and medium-term inflation expectations to changes in inflation perceptions

	Full time span		Non-inflationary period		Inflationary period	
	$\triangle\pi_{it}^{1Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{1Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{1Y}$	$\triangle\pi_{it}^{3Y}$
$\triangle\pi_{it}^{P}$	0.38***	0.21***	0.39***	0.20***	0.38***	0.22***
	(0.010)	(0.010)	(0.009)	(0.010)	(0.012)	(0.011)
Cov_{it}	0.11***	0.05	0.30***	0.18**	0.01	-0.01
	(0.027)	(0.041)	(0.056)	(0.070)	(0.022)	(0.040)
Individual effects	yes	yes	yes	yes	yes	yes
Country effects	yes	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes	yes
Demographics	yes	yes	yes	yes	yes	yes
Overall R^2	0.134	0.033	0.121	0.027	0.143	0.039
N of observations	183,768	183,768	60,064	60,064	123,704	123,704
N of respondents	19,816	19,816	12,131	12,131	17,186	17,186

Notes: RE estimator with robust (clustered at country level) standard errors (in parentheses). *** p<0.01, ** p<0.05, * p<0.1. Non-inflationary period is from April 2020 to December 2020. Inflationary period is from January 2021 to December 2021.

Source: own calculations based on CES data.

Table 4: Covid-19 concerns and short-term inflation expectations across demographic groups

	$\triangle\pi_{it}^{1Y}$	$\triangle\pi_{it}^{1Y}$	$\triangle\pi_{it}^{1Y}$	$\triangle\pi_{it}^{1Y}$	$\triangle\pi_{it}^{1Y}$	$\triangle\pi_{it}^{1Y}$
$\triangle\pi_{it}^{P}$	0.33***	0.33***	0.33***	0.33***	0.33***	0.33***
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
Cov_{it}	0.20***	0.13***	0.33*	0.22**	0.14	0.14
	(0.052)	(0.036)	(0.171)	(0.089)	(0.207)	(0.106)
Female × Cov_{it}	-	0.13**	-	-	-	-
		(0.054)				
Age 2 × Cov_{it}	-	-	-0.11	-	-	-
			(0.111)			
Age 3 × Cov_{it}	-	-	-0.15	-	-	-
			(0.208)			
Age 4 × Cov_{it}	-	-	-0.43*	-	-	-
			(0.233)			
Education 2 × Cov_{it}	-	-	-	-0.06	-	-
				(0.091)		
Education 3 × Cov_{it}	-	-	-	-0.01	-	-
				(0.109)		
Income 2 × Cov_{it}	-	-	-	-	0.16	-
					(0.279)	
Income 3 × Cov_{it}	-	-	-	-	0.00	-
					(0.250)	
Income 4 × Cov_{it}	-	-	-	-	0.05	-
					(0.223)	
Income 5 × Cov_{it}	-	-	-	-	0.05	-
					(0.151)	
Hh size 2 × Cov_{it}	-	-	-	-	-	0.07
						(0.124)
Hh size 3 × Cov_{it}	-	-	-	-	-	0.03
						(0.207)
Hh size 4 × Cov_{it}	-	-	-	-	-	0.09
						(0.118)
Individual effects	yes	yes	yes	yes	yes	yes
Country effects	yes	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes	yes
Demographics	yes	yes	yes	yes	yes	yes
Uncertainty	yes	yes	yes	yes	yes	yes
N of observations	46,142	46,142	46,142	46,142	46,142	46,142
N of respondents	10,582	10,582	10,582	10,582	10,582	10,582
Overall R^2	0.119	0.119	0.119	0.119	0.119	0.119

Notes: RE estimator with robust (cluster at country level) standard errors (in parentheses). *** p<0.01, ** p<0.05, * p<0.1. Sample from April 2020 to December 2020. Age categories: 18-34 years (reference category), 35-54 years (age 2), 55-64 years (age 3) and 65+ (age 4). Education categories: primary or lower secondary (reference category), upper secondary and non-tertiary (education 2), tertiary education (education 3). Income refers to household disposable income; Income categories correspond to quintiles (1st quintile is a reference category). Household size denotes number of household members (category 4 includes households with 4 or more members).

Source: own calculations based on CES data.

Table 5: Covid-19 concerns and medium-term inflation expectations across demographic groups

	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$
$\triangle\pi_{it}^{P}$	0.17***	0.17***	0.17***	0.17***	0.17***	0.17***
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Cov_{it}	0.17***	0.11	0.26**	-0.14	0.08	-0.04
	(0.028)	(0.083)	(0.118)	(0.132)	(0.117)	(0.093)
Female × Cov_{it}	-	0.14	-	-	-	-
		(0.180)				
Age 2 × Cov_{it}	-	-	-0.08	-	-	-
			(0.129)			
Age 3 × Cov_{it}	-	-	-0.21	-	-	-
			(0.166)			
Age 4 × Cov_{it}	-	-	0.03	-	-	-
			(0.228)			
Education 2 × Cov_{it}	-	-	-	0.27**	-	-
				(0.130)		
Education 3 ×Cov_{it}	-	-	-	0.41**	-	-
				(0.196)		
Income 2 × Cov_{it}	-	-	-	-	0.11	-
					(0.187)	
Income 3 × Cov_{it}	-	-	-	-	0.21	-
					(0.175)	
Income 4 × Cov_{it}	-	-	-	-	0.04	-
					(0.196)	
Income 5 × Cov_{it}	-	-	-	-	0.10	-
					(0.159)	
Hh size 2 × Cov_{it}	-	-	-	-	-	0.33***
						(0.039)
Hh size 3 × Cov_{it}	-	-	-	-	-	0.06
						(0.171)
Hh size 4 × Cov_{it}	-	-	-	-	-	0.35***
						(0.106)
Individual effects	yes	yes	yes	yes	yes	yes
Country effects	yes	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes	yes
Demographics	yes	yes	yes	yes	yes	yes
Uncertainty	yes	yes	yes	yes	yes	yes
N of observations	46,142	46,142	46,142	46,142	46,142	46,142
N of respondents	10,582	10,582	10,582	10,582	10,582	10,582
Overall R^2	0.022	0.022	0.022	0.022	0.022	0.022

Notes: RE estimator with robust (cluster at country level) standard errors (in parentheses). *** p<0.01, ** p<0.05, * p<0.1. Sample from April 2020 to December 2020. Age categories: 18-34 years (reference category), 35-54 years (age 2), 55-64 years (age 3) and 65+ (age 4). Education categories: primary or lower secondary (reference category), upper secondary and non-tertiary (education 2), tertiary education (education 3). Income refers to household disposable income; Income categories correspond to quintiles (1st quintile is a reference category). Household size denotes number of household members (category 4 includes households with 4 or more members).

Source: own calculations based on CES data.

Table 6: Reaction of short-term inflation expectations to increase and decrease in inflation perceptions

	Full time span	Non-infl. period	Infl. period	Low infl. percep.	High inf. percep.
	$\triangle\pi_{it}^{1Y}$	$\triangle\pi_{it}^{1Y}$	$\triangle\pi_{it}^{1Y}$	$\triangle\pi_{it}^{1Y}$	$\triangle\pi_{it}^{1Y}$
$\triangle\pi_{it}^{P+}$	0.38***	0.37***	0.38***	0.15***	0.40***
	(0.008)	(0.010)	(0.011)	(0.038)	(0.006)
$\triangle\pi_{it}^{P-}$	0.39***	0.40***	0.38***	0.37***	0.41***
	(0.017)	(0.018)	(0.020)	(0.018)	(0.020)
Cov_{it}	0.11***	0.30***	0.01	0.03	0.17***
	(0.027)	(0.056)	(0.021)	(0.021)	(0.054)
Individual effects	yes	yes	yes	yes	yes
Country effects	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes
Demographics	yes	yes	yes	yes	yes
Overall R^2	0.134	0.121	0.143	0.109	0.139
N of observations	183,768	60,064	123,704	91,873	91,895
N of respondents	19,816	12,131	17,186	14,397	16,339
$H_0: \beta_+ = \beta_-$	0.249	1.599	0.042	25.970	0.409
p-val	0.618	0.206	0.837	0.000	0.522

Notes: RE estimator with robust (clustered at country level) standard errors (in parentheses). *** p<0.01, ** p<0.05, * p<0.1. Non-inflationary period is from April 2020 to December 2020. Inflationary period is from January 2021 to December 2021.

Source: own calculations based on CES data.

Table 7: Reaction of medium-term inflation expectations to increase and decrease in inflation perceptions

	Full time span	Non-infl. period	Infl. period	Low infl. percep.	High inf. percep.
	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$
$\triangle\pi_{it}^{P+}$	0.21***	0.19***	0.22***	-0.03	0.23***
	(0.010)	(0.005)	(0.014)	(0.036)	(0.011)
$\triangle\pi_{it}^{P-}$	0.22***	0.21***	0.22***	0.19***	0.24***
	(0.013)	(0.016)	(0.013)	(0.016)	(0.015)
Cov_{it}	0.05	0.18**	-0.01	0.00	0.09*
	(0.041)	(0.070)	(0.041)	(0.064)	(0.057)
Individual effects	yes	yes	yes	yes	yes
Country effects	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes
Demographics	yes	yes	yes	yes	yes
Overall R^2	0.033	0.027	0.039	0.024	0.037
N of observations	183,768	60,064	123,704	91,873	91,895
N of respondents	19,816	12,131	17,186	14,397	16,339
$H_0: \beta_+ = \beta_-$	0.327	3.112	0.003	71.460	0.551
p-val	0.567	0.078	0.959	0.000	0.458

Notes: RE estimator with robust (clustered at country level) standard errors (in parentheses). *** p<0.01, ** p<0.05, * p<0.1. Non-inflationary period is from April 2020 to December 2020. Inflationary period is from January 2021 to December 2021.

Source: own calculations based on CES data.

Table 8: Responsiveness of medium-term inflation expectations to changes in short-term inflation expectations

	Changes in short-term inflation expectations			Orthogonalized changes in short-term inflation expectations		
	Full time span	Non-infl. period	Infl. period	Full time span	Non-infl. period	Infl. period
	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$
$\triangle\pi_{it}^{1Y}$	0.32***	0.29***	0.33***	-	-	-
	(0.009)	(0.007)	(0.015)			
$\triangle\tilde{\pi}_{it}^{1Y}$	-	-	-	0.28***	0.26***	0.29***
				(0.011)	(0.009)	(0.016)
Cov_{it}	0.02	0.09	-0.01	0.02	0.10*	-0.01
	(0.043)	(0.059)	(0.046)	(0.048)	(0.062)	(0.050)
Individual effects	yes	yes	yes	yes	yes	yes
Country effects	yes	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes	yes
Demographics	yes	yes	yes	yes	yes	yes
Overall R^2	0.0808	0.0665	0.0924	0.0551	0.0470	0.0615
N of observations	183,768	60,064	123,704	183,768	60,064	123,704
N of respondents	19,816	12,131	17,186	19,816	12,131	17,186

Notes: RE estimator with robust (clustered at country level) standard errors (in parentheses). *** p<0.01, ** p<0.05, * p<0.1. Non-inflationary period is from April 2020 to December 2020. Inflationary period is from January 2021 to December 2021.

Source: own calculations based on CES data.

Table 9: Reaction of medium-term inflation expectations to increase and decrease in short-term inflation expectations

	Full time span	Non-infl. period	Infl. period	Low infl. percep.	High inf. percep.
	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$
$\triangle\pi_{it}^{1Y+}$	0.31***	0.28***	0.33***	0.18***	0.34***
	(0.017)	(0.028)	(0.015)	(0.025)	(0.018)
$\triangle\pi_{it}^{1Y-}$	0.32***	0.30***	0.34***	0.32***	0.32***
	(0.008)	(0.014)	(0.015)	(0.009)	(0.008)
Cov_{it}	0.02	0.09	-0.01	-0.01	0.06
	(0.043)	(0.060)	(0.046)	(0.065)	(0.060)
Individual effects	yes	yes	yes	yes	yes
Country effects	yes	yes	yes	yes	yes
Time effects	yes	yes	yes	yes	yes
Demographics	yes	yes	yes	yes	yes
Overall R^2	0.0808	0.0665	0.0925	0.0665	0.0868
N of observations	183,768	60,064	123,704	91,873	91,895
N of respondents	19,816	12,131	17,186	14,397	16,339
$H_0: \beta_+ = \beta_-$	0.186	0.210	0.467	52.720	0.802
p-val	0.666	0.647	0.494	0.000	0.371

Notes: RE estimator with robust (clustered at country level) standard errors (in parentheses). *** p<0.01, ** p<0.05, * p<0.1. Non-inflationary period is from April 2020 to December 2020. Inflationary period is from January 2021 to December 2021.

Source: own calculations based on CES data.

Table 10: Sensitivity of inflation views and trust in the ECB

	Low trust in ECB		High trust in ECB	
	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$
$\triangle\pi_{it}^{P}$	0.25***	-	0.19***	-
	(0.012)		(0.015)	
$\triangle\pi_{it}^{1Y}$	-	0.37***	-	0.29***
		(0.018)		(0.016)
Cov_{it}	0.17***	0.13*	-0.03	-0.05
	(0.061)	(0.070)	(0.081)	(0.084)
Individual effects	yes	yes	yes	yes
Country effects	yes	yes	yes	yes
Time effects	yes	yes	yes	yes
Demographics	yes	yes	yes	yes
Overall R^2	0.0452	0.106	0.0284	0.0712
N of observations	41,824	41,824	72,735	72,735
N of respondents	8,111	8,111	12,043	12,043

Notes: RE estimator with robust (cluster at country level) standard errors (in parentheses). *** p<0.01, ** p<0.05, * p<0.1. Respondent is classified to a low (high) trust group if his level of trust in ECB is below 5 (above 7).

Source: own calculations based on CES data.

Table 11: Sensitivity of inflation views and financial literacy

	Low financial literacy		High financial literacy	
	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$
$\triangle\pi_{it}^{P}$	0.25***	-	0.17***	-
	(0.007)		(0.016)	
$\triangle\pi_{it}^{1Y}$	-	0.36***	-	0.26***
		(0.024)		(0.010)
Cov_{it}	0.05	-0.00	0.02	0.00
	(0.045)	(0.067)	(0.057)	(0.045)
Individual effects	yes	yes	yes	yes
Country effects	yes	yes	yes	yes
Time effects	yes	yes	yes	yes
Demographics	yes	yes	yes	yes
Overall R^2	0.0456	0.104	0.0220	0.0585
N of observations	38,282	38,282	34,395	34,395
N of respondents	4,477	4,477	3,486	3,486

Notes: RE estimator with robust (cluster at country level) standard errors (in parentheses). *** p<0.01, ** p<0.05, * p<0.1. Respondent is classified to a low (high) financial literacy group if his/her score in the financial literacy test is below 2 (above 3).

Source: own calculations based on CES data.

Table 12: Sensitivity of inflation views and accuracy of inflation perceptions

	Low accuracy		High accuracy	
	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$	$\triangle\pi_{it}^{3Y}$
$\triangle\pi_{it}^{P}$	0.22***	-	0.19***	-
	(0.013)		(0.026)	
$\triangle\pi_{it}^{1Y}$	-	0.33***	-	0.26***
		(0.010)		(0.026)
Cov_{it}	0.10	0.05	0.01	0.00
	(0.094)	(0.107)	(0.046)	(0.045)
Individual effects	yes	yes	yes	yes
Country effects	yes	yes	yes	yes
Time effects	yes	yes	yes	yes
Demographics	yes	yes	yes	yes
Overall R^2	0.0377	0.0909	0.0128	0.0486
N of observations	57,295	57,295	51,821	51,821
N of respondents	6,607	6,607	5,887	5,887

Notes: RE estimator with robust (cluster at country level) standard errors (in parentheses). *** p<0.01, ** p<0.05, * p<0.1. Respondent is classified to a low (high) accuracy group if the RMSE of his/her inflation perceptions is below 2.25 pp (above 4.9 pp).

Source: own calculations based on CES data.

Table 13: Responsiveness of qualitative inflation views

	$d\pi_{it}^{1Y}$	$d\pi_{it}^{3Y}$	$d\pi_{it}^{3Y}$
Parameter estimates:			
$d\pi_{it}^{P}$	1.37***	0.70***	-
	(0.018)	(0.017)	
$d\pi_{it}^{1Y}$	-	-	1.20***
			(0.059)
Cov_{it}	0.07***	0.06***	
	(0.014)	(0.014)	
N of observations	183,768	183,768	183,768
N of respondents	19,816	19,816	19,816
Marginal effects:			
$d\pi_{it}^{P}$	0.241***	0.116***	-
$d\pi_{it}^{1Y}$	-	-	0.212***
Cov_{it}	0.009***	0.009***	0.003***

Notes: RE logit estimator with robust standard errors (in parenthesis). *** p<0.01, ** p<0.05, * p<0.1.
Source: own calculations based on CES data.

Table 14: Responsiveness of qualitative medium-term inflation expectations of different groups of consumers – parameter estimates

	Characteristics of consumers (I_i)		
	trust in ECB	financial literacy	RMSE of inflation perceptions
$d\pi_{it}^P$	0.78***	0.86***	0.66***
	(0.035)	(0.035)	(0.035)
$d\pi_{it}^P \times$medium level of I_i	-0.12***	-0.19***	0.033
	(0.043)	(0.041)	(0.043)
$d\pi_{it}^P \times$high level of I_i	-0.08*	-0.26***	0.078*
	(0.043)	(0.055)	(0.045)
Cov_{it}	0.08***	0.07***	0.11***
	(0.030)	(0.029)	(0.028)
$Cov_{it} \times$ medium level of I_i	0.01	-0.02	-0.07**
	(0.037)	(0.034)	(0.035)
$Cov_{it} \times$ high level of I_i	-0.05	0.01	-0.04
	(0.037)	(0.045)	(0.037)
medium level of I_i	0.021	-0.03	0.27***
	(0.024)	(0.023)	(0.025)
high level of I_i	-0.04	-0.24***	0.40***
	(0.024)	(0.032)	(0.027)
Test of heterogeneity in responsiveness to $d\pi_{it}^P$			
test statistics	8.02**	29.63***	3.15
p-value	0.018	0.000	0.207
Test of heterogeneity in response to Cov_{it}			
test statistics	4.56	0.52	4.03
p-value	0.102	0.773	0.133
N of observations	180,489	183 768	183 768
N of respondents	19,614	19,816	19,816

Notes: RE logit estimator with robust standard errors (in parenthesis). Depending of the column, the variable I denotes the level of trust in ECB, the level of consumer's financial literacy, or the level of RMSE of inflation perceptions. Test of heterogeneity in responsiveness to inflation perceptions (Covid-19 concerns) refers to test of statistical significance of interaction term $d\pi_{it}^P \times I_i$ ($Cov_{it} \times I$) *** p<0.01, ** p<0.05, * p<0.1.

Source: own calculations based on CES data.

Table 15: Marginal effects of increase in inflation perceptions and Covid-19 concerns on qualitative medium-term inflation expectations of different groups of consumers

	trust in ECB	financial literacy	accuracy of perceptions
Marginal effect of increase in inflation perceptions ($d\pi_{it}^P$):			
low level of I	0.133***	0.153***	0.094***
medium level of I	0.110***	0.111***	0.115***
high level of I	0.114***	0.087***	0.133***
Marginal effect of increase in Covid-19 concerns:			
low level of I	0.012***	0.011**	0.014***
medium level of I	0.014***	0.008***	0.006*
high level of I	0.004	0.010**	0.011***

Notes: Average marginal effects based on RE logit estimator with robust standard errors. Depending of the column, the variable I denotes the level of trust in ECB, the level of consumer's financial literacy, or the level of RMSE of inflation perceptions. *** p<0.01, ** p<0.05, * p<0.1.

Source: own calculations based on CES data.

Appendix A. Analysis of the tenure effect

In this Appendix we assess whether our responsiveness analysis is distorted by the tenure effect. This effect is also known as panel conditioning effect, time-in-sample effect or learning-from-survey effect (see, Binder, 2019; Kim and Binder, 2020). Generally speaking, the tenure effect may take place in rotating panel datasets when participation in the previous survey rounds affects responses in consecutive survey rounds. For example, respondents may actively search for information related to survey questions or in order minimize efforts they provide specific responses.

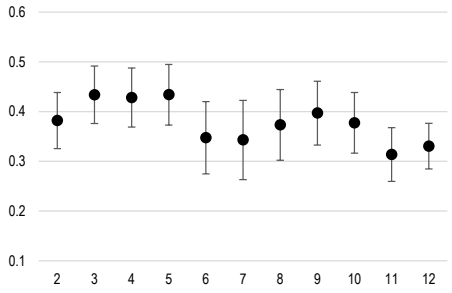
In order to identify the potential tenure effect we estimate regressions, in which change in short- or medium-term inflation expectations is explained by (i) changes in shorter-term inflation views, (ii) its interactions with a number of surveys taken by an individual respondent up to the current one, (iii) time dummy. This allows us to assess whether the sensitivity of expectations and the CES survey experiences are systematically related.

We restrict analysis to the year 2021, since in 2020 the survey was new for all survey participants. and we focus on tenures from 2 to 12 months, since it is reasonable to assume that new survey participants are more subject to the tenure effect.

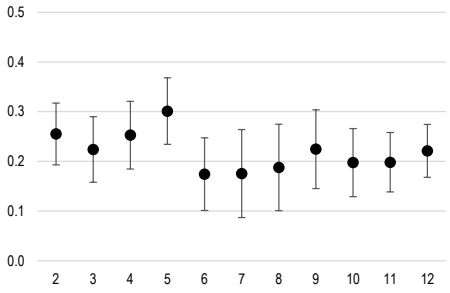
Our estimations suggest that our analysis is not distorted by the tenure effect, as the estimated parameters do not steadily increase or decrease with the number of survey waves a consumer has participated in (Figure A.1). Also the estimated parameters for consumers who have just joined the CES survey and for consumers who have more CES experience are not statistically different.

Figure A.1: Responsiveness of inflation expectations depending on respondents' survey experience

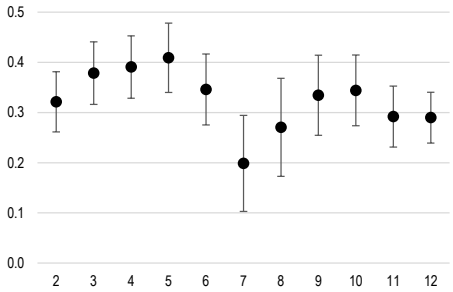
(a) responsiveness of short-term inflation expectations to changes in inflation perceptions



(b) responsiveness of medium-term inflation expectations to changes in inflation perceptions



(c) responsiveness of medium-term inflation expectations to changes in short-term inflation expectations



Notes: Figures show estimate (with 95% confidence intervals) of average effect of change in inflation view on short- or medium-term inflation expectations, conditional on the number of surveys already taken by respondents. Based on FE model with robust standard errors.

Source: own calculations based on CES data.

Appendix B. Additional regressions

Table B.1: Responsiveness of short-term inflation views of different groups of consumers

	$\triangle\pi_{it}^{1Y}$
$\triangle\pi_{it}^{P}$	0.28***
	(0.028)
$\triangle\pi_{it}^{P}$ × medium trust	-0.05**
	(0.024)
$\triangle\pi_{it}^{P}$ × high trust	-0.06***
	(0.015)
$\triangle\pi_{it}^{P}$ × medium financial literacy	-0.04***
	(0.012)
$\triangle\pi_{it}^{P}$ × high financial literacy	-0.08***
	(0.018)
$\triangle\pi_{it}^{P}$ × medium accuracy	0.00
	(0.030)
$\triangle\pi_{it}^{P}$ × low accuracy	0.01
	(0.022)
Cov_{it}	0.12**
	(0.052)
Cov_{it} × medium trust	-0.08
	(0.074)
Cov_{it} × high trust	-0.21*
	(0.125)
Cov_{it} × medium financial literacy	0.03
	(0.038)
Cov_{it} × high financial literacy	-0.01
	(0.074)
Cov_{it} × medium accuracy	0.03
	(0.028)
Cov_{it} × low accuracy	0.08
	(0.094)
Individual effects	yes
Country effects	yes
Time effects	yes
Demographics	yes
N of observations	180,489
N of respondents	19,614
Overall R^2	0.035

Notes: RE estimator with robust (cluster at country level) standard errors (in parentheses). *** p<0.01, ** p<0.05, * p<0.1.

Source: own calculations based on CES data.

Table B.2: Responsiveness of medium-term inflation views of different groups of consumers

	$\triangle\pi_{it}^{3Y}$
$\triangle\pi_{it}^{1Y}$	0.37***
	(0.034)
$\triangle\pi_{it}^{1Y}$ × medium trust	-0.07***
	(0.024)
$\triangle\pi_{it}^{1Y}$ × high trust	-0.06***
	(0.024)
$\triangle\pi_{it}^{1Y}$ × medium financial literacy	-0.05**
	(0.024)
$\triangle\pi_{it}^{1Y}$ × high financial literacy	-0.09***
	(0.019)
$\triangle\pi_{it}^{1Y}$ × medium accuracy	-0.00
	(0.022)
$\triangle\pi_{it}^{1Y}$ × low accuracy	0.04**
	(0.018)
Individual effects	yes
Country effects	yes
Time effects	yes
Demographics	yes
N of observations	180,489
N of respondents	19,614
Overall R^2	0.083

Notes: RE estimator with robust (cluster at country level) standard errors (in parentheses). *** p<0.01, ** p<0.05, * p<0.1.

Source: own calculations based on CES data.

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