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Abstract

This paper proposes a new measure proxying the degree of anchoring of inflation expectations on an individual forecaster level and studies the co-movement of this measure with expectations regarding monetary policy and different cost-push factors. In doing so, we rely on data taken from the ECB Survey of Professional Forecasters for both parts of the analysis. First, we construct a measure for the degree of anchoring of inflation expectations for each forecaster based on his/her inflation expectations taking into account both point and density forecasts. Second, we regress this anchoring measure on the professional forecasters' expectations regarding the policy rate of the ECB and three different cost-push factors potentially affecting the inflation rate: the crude oil price, the USD/EUR exchange rate, and unit labor costs. The main findings indicate that expectations regarding a tightening of monetary policy are generally able to enhance the degree of anchoring while an expected increase in unit labor costs seems to lower the degree of anchoring. We also find the our anchoring measure was sensitive to short-term inflation expectations in the most recent high inflation period indicating a de-anchoring.

Keywords: Anchoring, Inflation expectations, Monetary policy, Crude oil, Unit labor costs
JEL: E31, E52, Q43

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1 Introduction

The anchoring of inflation expectations is crucial for the effectiveness of monetary policy (King, 1995). When inflation expectations are well-anchored, it is easier for central banks to achieve their inflation targets. If market participants expect the central bank to be willing and able to control inflation around the announced target level, they are less likely to react strongly to short-term fluctuations in prices (Gürkaynak *et al.*, 2005). Otherwise, a de-anchoring of inflation expectations might result in second-round price increases, which might occur when workers expect prices to rise rapidly. Then, they may demand higher wage increases to maintain their real purchasing power. Employers, in turn, may raise prices to cover the increased labor costs. This cycle of rising wages and prices can become self-reinforcing, leading to sustained inflation. This can make it more difficult for central banks to control inflation and may require more aggressive monetary policy actions to bring inflation back under control. Consequently, central banks monitor the anchoring of inflation expectations closely and take preemptive measures to prevent a potential de-anchoring. This issue has appeared even more on the agenda of many central banks as inflation has started accelerating in 2021 due to disrupted supply-chains resulting from the COVID-19 pandemic and even more so in 2022 due to increasing energy prices as a response to the Russian invasion of Ukraine.

Therefore, the aim of the present paper is to propose a proxy for the degree of anchoring of inflation expectations and to study the expectation formation mechanism of professionals in this context by analyzing co-moving factors with the degree of anchoring. Measures for the degree of anchoring of inflation expectations have already been considered on an aggregate level for the economy as a whole (Grishchenko *et al.*, 2019; Bems *et al.*, 2021; Binder *et al.*, 2023) but not at an individual forecaster level.[1] However-

[1] To the best of our knowledge, the only exception is the study by Binder *et al.* (2023), which considers deviations of individual inflation expectations in the root squared mean and examines the

ever, recent literature emphasizes the importance of heterogeneity among forecasters and suggests that forecasts of individuals offer important implications for policymakers beyond mean forecasts (Coibion *et al.*, 2019; Falck *et al.*, 2021; Binder *et al.*, 2023; Meeks and Monti, 2023). Therefore, the main contribution of the present paper is to extend this idea and to propose a measure on an individual level, which also enables us to dig deeper into the expectation formation mechanism behind. In doing so, we rely on both point and density forecasts for future inflation taken from the European Central Bank Survey of Professional Forecasters (ECB-SPF) and we construct an anchoring measure for each individual forecaster.

The Euro Area presents a particularly intriguing case study due to the availability of data spanning the entire history of the monetary union and the recent modification of the inflation target in July 2021. An integral part of the new monetary policy strategy of the ECB is the inflation target of 2% over the medium term, which should provide an anchor for inflation expectations (ECB, 2021). The main difference compared to the previous strategy is the symmetry of the inflation target, which means that both negative and positive deviations are regarded as equally undesirable. This implies that the inflation target can now be interpreted as a point target instead of an upper limit as within the previous strategy.[2]

Having constructed a measure proxying the degree of anchoring of inflation expectations, we assess whether de-anchoring patterns can be observed over the different decades in the history of the monetary union. Therefore, we contribute to the literature on the anchoring of inflation expectations (Strohsal and Winkelmann, 2015; Łyziak and Paloviita, 2017; Natoli and Sigalotti, 2018; Buono and Formai, 2018; Hachula and

share of forecasters exceeding specific bounds. This study solely focuses on one characteristic of a de-anchoring of individuals. In the present paper we extend this and consider six different characteristics.

[2]Prior to the announcement of the new monetary policy strategy, price stability has been defined by the ECB as an inflation rate of below, but close to, 2% over the medium term (ECB, 2011).

Nautz, 2018; Dovern and Kenny, 2020; Corsello *et al.*, 2021). Past research predominantly hinges on diverse regression methods to assess how inflation expectations respond to new information or shocks, yielding evidence of de-anchoring across various economies and time periods.

As the degree of anchoring crucially depends on the credibility of the central bank, we investigate the extent to which expectations related to the ECB's main policy instrument – its policy rate – are linked to the degree of anchoring. Furthermore, inflation depends on cost-push factors such as energy prices and labor costs. Therefore, we also examine whether the expectations on such factors might be responsible for a(n) (de-)anchoring of inflation expectations. As indicator of energy prices we rely on the price for Brent crude oil. Yet another factor of potential importance is the USD/EUR exchange rate, which may exert an influence on inflation as a depreciation of the euro results in increased import prices and heightened export demand. Both might lead to an inflation rise within the Euro Area. Hence, we study whether the degree of anchoring co-moves with forecasters' expectations regarding the stance of monetary policy and different cost-push factors. In doing so, we also use data from the ECB-SPF. Professional forecasters are not only surveyed by the ECB on their beliefs regarding future inflation, GDP growth, and unemployment but are also requested to provide their expectations regarding assumptions underlying these economic factors. In this context, they provide forecasts for the ECB's policy rate (i.e., the main refinancing operations rate), the Brent crude oil price, the USD/EUR exchange rate, and unit labor costs, which are used to make their inflation forecasts.

The main findings are as follows. First, we provide evidence in favor de-anchoring patterns for the Euro Area in the most recent high-inflation period. Second, we demonstrate how these de-anchoring patterns can be linked to expectations regarding crude oil price, exchange rate, and unit labor cost changes. Third, we find that expectations regarding the monetary policy of the ECB contribute to the anchoring of inflation expectations, emphasizing that the ECB's monetary policy strategy seems generally to be perceived as credibility among professional forecasters. This applies not only to longer-term interest rate expectations but also becomes apparent in the case of short-term interest rate expectations.

The remainder of the paper is as follows. The next section reviews the most relevant literature. Section 3 provides a detailed description of the survey data and our empirical strategy while Section 4 reports and discusses our main findings. Section 5 concludes.

2 Review of the Literature

This section discusses the literature on anchoring of inflation expectations, which on the one hand studies whether (long-run) inflation expectations can be explained by any type of (macroeconomic) news relying on different regression approaches and on the other hand proposes proxies for the degree of anchoring of inflation expectations.

Related to the former strand of the literature, Jochmann *et al.* (2010) analyze the connection between long-term and short-term inflation expectations using daily data on inflation compensation computed from the term structure of real and nominal interest rates for the US from January 2003 to June 2008 and provide evidence against firmly anchored inflation expectations. Based on daily bond yield data Gürkaynak *et al.* (2010) examine whether inflation targeting is crucial for the anchoring of inflation expectations. In doing so, they compare two inflation targeters (i.e., the UK and Sweden) to the US as a non-inflation-targeter and conclude that a credible inflation target helps to anchor inflation expectations. Beechey *et al.* (2011) also extract inflation expectations from inflation-indexed assets and compare the anchoring of long-run inflation expectations in the US and the Euro Area for the sample period from June 2003 to December 2006.

They argue that long-run inflation expectations are more firmly anchored in the Euro Area than in the US.

Galati *et al.* (2011) rely on structural break tests showing that the sensitivity of long-run inflation expectations to news about inflation and other macroeconomic variables has increased during the global financial crisis (GFC) for the US, the Euro Area, and the UK. They use two proxies for inflation expectations – survey-based measures and measures extracted from financial market instruments – and conclude that long-run inflation expectations may have become less firmly anchored during the crisis. Strohsal and Winkelmann (2015) also rely on daily inflation expectations derived from inflation-indexed government bonds for the period from January 2004 to February 2011 and regress these on macroeconomic news variables. However, they extend the approach to assess the degree of anchoring of inflation expectations by the use of an exponential smooth transition autoregressive (ESTAR) model, which allows for nonlinearity due to the deviation of past inflation expectations from the inflation target. Their findings indicate that the degree of anchoring varies substantially across the US, the Euro Area, the UK, and Sweden.

Scharnagl and Stapf (2015) use option-implied probability density functions of future inflation for the period from October 2009 to December 2013 and focus on the anchoring of inflation expectations in the Euro Area during the European sovereign debt crisis. They basically provide evidence supporting anchored inflation expectations, however, they also argue in favor of a growing uncertainty, which might reveal market participants' concerns about future extreme inflation or deflation. Łyziak and Paloviita (2017) study the anchoring of inflation expectations of both professional forecasters and consumers in the Euro Area relying on survey data for the quarterly sample period from 1999Q1 to 2015Q3 and also consider the presence of a structural break due to the GFC after 2008Q2. They find that longer-term inflation expectations have become more sensitive to shorter-term expectations and to actual inflation in the post-crisis period. Based on these findings they argue in favor of a de-anchoring of inflation expectation in the Euro Area since the GFC. Natoli and Sigalotti (2018) also examine the anchoring of inflation expectations in the Euro Area during the post-crisis period using inflation expectations extracted from inflation derivatives for a daily data set spanning from October 2009 and February 2015. They conclude that their results indicate a risk of downside de-anchoring of long-term inflation expectations.

Buono and Formai (2018) compare the anchoring of inflation expectations across different advanced economies relying on data taken from the survey of professional forecasters conducted by Consensus Economics for the period from October 1989 to October 2017. Their findings indicate that after the GFC inflation expectations have been firmly anchored in the US and, to a lesser extent, also in the UK. For the Euro Area a de-anchoring has been observed shortly after the crisis and again from 2014. For Japan they find clear evidence in favor of a de-anchoring for the entire sample period.

Using US data on inflation-linked treasury securities Hachula and Nautz (2018) test whether inflation expectations are effected by macroeconomic news identified by their correlation with surprises from macroeconomic news announcements for a daily sample period from July 2009 to August 2016. They do not find any evidence of de-anchoring for the long run horizon but for the short run. The findings are mainly in line with the ones provided by Nautz *et al.* (2019) relying on data for US consumer inflation expectations taken from the Michigan Survey of Consumers for the monthly sample from April 1990 to December 2015.

Dovern and Kenny (2020) exploit the availability of distributional forecasts for inflation in the ECB-SPF to assess anchoring for the period of unconventional monetary policy until 2017 by testing for structural changes in the distribution of long-run inflation expectations. They find no evidence of a de-anchoring by a shift in the entire distribution of long-run forecasts in the Euro Area, although mean expectations declined. Corsello *et al.* (2021) rely on data from the ECB-SPF until 2019 and argue that long-term inflation expectations have become de-anchored in the Euro Area while their distribution is skewed towards lower values.

The second strand of the literature refers to the establishment of anchoring measures. Based on data from surveys of professional forecasters for a sample period from January 1999 to June 2016 for the US and the Euro Area Grishchenko *et al.* (2019) construct a measure of the anchoring of inflation expectations relying on an estimated dynamic factor model of inflation featuring time-varying uncertainty. Their findings indicate that following the GFC, inflation anchoring improved in the US, while a mild de-anchoring has been observed in the Euro Area. Bems *et al.* (2021) derive an anchoring measure based on survey data taken from Consensus Economics for 45 economies for a sample period from 1989 to 2017 and analyze the response of consumer prices to terms-of-trade shocks depending on the degree of anchoring. Beckmann and Czudaj (2023) rely on the same approach but extend the sample period to 2022 as well as the number of economies to 86 and shed some light on the correlation between the subindexes considered and their connection to impossible trinity indexes.

Armantier *et al.* (2022) suggest using so-called "strategic surveys" to assess whether inflation expectations are firmly anchored. They examine whether households revise their long-run inflation expectations after presenting them different economic scenarios as treatments and find that long-run inflation expectations were well anchored in the US in July 2019 as well as in August 2021. Binder *et al.* (2023) propose a "bounds anchoring" indicator, which is based on the idea that long-run inflation expectations should not deviate significantly from the target of 2%. In doing so, they consider individual long-run inflation expectations taken from the Federal Reserve SPF and assess whether the root mean-squared deviations exceed bounds of 0.2 or 0.5. Based on their concept they basically find that the share of professional forecasters not exceeding the bounds has increased in the US in the years following the target announcement of the Federal Open Market Committee (FOMC) in 2012, but they also argue that this trend has recently started to reverse.

The present study extends both strands of the literature by proposing a proxy for the degree of anchoring of inflation expectations on an individual forecasters level and by studying the expectation formation mechanism of professionals in this context while analyzing co-moving factors with the degree of anchoring. The main contribution lies in extending the idea put forward by Bems *et al.* (2021) to an individual level, which also enables us to shed more light on the expectation formation mechanism and potential reasons of (de-)anchoring. In doing so, we rely on data taken from the ECB-SPF, which is described in the next section.

3 Data and Empirical Methodology

3.1 Inflation Expectations

The data on inflation expectations has been taken from the ECB Survey of Professional Forecasters (ECB-SPF), which is available for the quarterly sample period from 1999Q1 to 2024Q2. The survey provides inflation forecasts as point and density forecasts for different forecast horizons h. In this study we rely on the so-called rolling horizon forecasts for the month one-year-ahead ($h = 1$) and two-years-ahead ($h = 2$) of the latest available observation as well as the longer term forecast ($h = 5$), which refers to four (five) calendar years ahead in the Q1 and Q2 (Q3 and Q4) waves of the survey. These forecasts have been provided by professional institutions from the Euro Area (i.e., major banks and research institutes) in the first month of each quarter as point forecasts and also as histograms. In case of the latter participants are requested to assign subjective probabilities to given intervals, into which the inflation rate rate might fall (see Figure A.1 for the questionnaire). The corresponding probability distributions enable us to assess individual forecasts for the entire distribution going beyond point forecasts.

To derive a measure for the degree of anchoring, we especially consider the five-years-ahead forecast data ($h = 5$) as the anchoring of inflation expectations refers to the medium-term perspective. The ECB refers to this medium-term orientation in its monetary policy strategy[3] and tries to convince market participants that inflation will be near the target value of 2% in the medium run. Therefore, medium-term expectations should be close to the target, stable, and associated with low uncertainty and disagreement. Hence, our anchoring measure takes all these dimensions into account. In addition, a common measure of anchoring that has been used in the existing literature is the degree to which medium-term inflation expectations respond to short-term inflation expectations (e.g., Łyziak and Paloviita, 2017; Buono and Formai, 2018). Thus, in the second step of our analysis, we also regress our anchoring measure constructed for the medium-term horizon ($h = 5$) on inflation forecasts for shorter horizons ($h = 1, 2$).

The individual point forecasts for the rate of inflation (as the percent per annum change in the harmonized index of consumer prices) are shown by the black points in Figure 1 for two forecast horizons ($h = 1, 5$). Cross-sectional mean forecasts across forecasters are visualized by red lines. The plots provide evidence in favor of heterogeneity, especially around the global financial crisis (2007-2009), the COVID-19 pandemic (2020-2021), and the high-inflation period thereafter. In addition, we clearly see larger fluctuations for short-term forecasts ($h = 1$) than for medium-term forecasts ($h = 5$). Unsurprisingly, it seems that short-term inflation forecasts are much more sensitive

[3] See ECB (2021) for the new monetary policy strategy but the medium-term orientation has also been used in the older framework since the beginning of the monetary union.

to shocks and news than medium-term forecasts, which basically fluctuated closely around the inflation target of 2%. This also becomes clear when directly comparing the cross-sectional means across forecast horizons as displayed in Panel (a) of Figure 2 and already provides a first indication for the degree of anchoring.

*** Insert Figure 1 about here ***

Panel (b) of Figure 2 illustrates the disagreement among forecasters by the cross-sectional standard deviations (SDs) across forecasters and shows that this is also larger for short-term forecasts ($h = 1, 2$) than for medium-term forecasts ($h = 5$) in general and especially large in the most recent high-inflation period. Panel (c) of Figure 2 takes the information available in the forecasters' probability distribution into account. Based on these we have computed individual standard deviations as proxies for the forecasters' individual uncertainty surrounding their inflation expectations. Panel (c) of Figure 2 plots cross-sectional means of these individual standard deviations for each horizon. We see that the uncertainty related to inflation has increased substantially over time and that it increases with the horizon as also shown by Binder *et al.* (2022).

*** Insert Figure 2 about here ***

These individual standard deviations have been computed from distributional forecasts by the 'mass-at-midpoint' approach following Abel *et al.* (2016) and Glas and Hartmann (2022):

$$\mu_{i,t,h} = 1/100 \sum_{s=1}^{S} p_{i,s,t,h} m_s, \tag{1}$$

$$\sigma^2_{i,t,h} = 1/100 \sum_{s=1}^{S} p_{i,s,t,h}(m_s - \mu_{i,t,h})^2, \quad \sigma_{i,t,h} = \sqrt{\sigma^2_{i,t,h}}, \tag{2}$$

where $\mu_{i,t,h}$ represents the mean forecast computed from the histogram forecasts, $\sigma^2_{i,t,h}$ denotes the individual variance, and $\sigma_{i,t,h}$, is the corresponding standard deviation. m_s stands for the midpoint of each bin while S is the number of bins. $p_{i,s,t,h}$ gives the subjective probabilities assigned to the bins, which sum up to 100, and i, t, h, and s are indexes for individual forecaster, point in time, forecast horizon, and bin, respectively.[4]

In addition, we have also calculated individual forecasters' skewness ($\text{skew}_{i,t,h}$) and kurtosis ($\kappa_{i,t,h}$) as measures of asymmetry and heavy-tailness of the inflation forecasts:

$$\text{skew}_{i,t,h} = 1/100 \sum_{s=1}^{S} p_{i,s,t,h}[(m_s - \mu_{i,t,h})/\sigma_{i,t,h}]^3, \tag{3}$$

$$\kappa_{i,t,h} = 1/100 \sum_{s=1}^{S} p_{i,s,t,h}[(m_s - \mu_{i,t,h})/\sigma_{i,t,h}]^4. \tag{4}$$

3.2 Anchoring Measure

The different parameters characterizing the forecast distribution have been computed as outlined in the previous subsection to construct a proxy for the forecasters' degree of anchoring of inflation expectations. In doing so, we basically extend the work by Bems *et al.* (2021), who derive an anchoring measure on an aggregated level for different economies using aggregated survey forecast data from Consensus Economics.

In their work, Bems *et al.* (2021) introduce an anchoring measure that utilizes three distinct features to characterize the level of anchoring. These features are computed by analyzing cross-sectional means and standard deviations across forecasters for various countries. We employ these same three subindexes, but we calculate them at

[4] In the ECB-SPF dataset, there were 0.1 percentage point gaps between the interior bins. These gaps were removed by expanding both the lower and upper boundaries of each bin by 0.05, a practice established in prior literature (Abel *et al.*, 2016; Glas and Hartmann, 2022). To calculate the midpoints, denoted as m_s, the bins in the left and right tails of the distribution were assumed to be twice as wide as the interior bins.

the individual forecaster level to assess the anchoring degree for each forecaster. Furthermore, we expand the list of subindexes to six by incorporating parameters that describe the forecast distribution, which helps to account for more dimensions of a potential de-anchoring providing a broader picture. The complete procedure is detailed in the following.

The first three subindexes follow the ideas by Bems *et al.* (2021). First, we derive the absolute deviation of individual inflation expectations from the ECB's inflation target:

$$\text{Index}_{1,i,t,h} = \sqrt{(E_{i,t}(\pi_{t+h}) - 2\%)^2}, \tag{5}$$

where $E_{i,t}(\pi_{t+h})$ represents inflation expectations of forecaster i made in period t for horizon h with $h = 5$ years. This subindex is based on the principle that firmly anchored inflation expectations should remain in alignment with the inflation target and is in line with the approach by Binder *et al.* (2023). In addition, this subindex also addresses the symmetry of the inflation target of the ECB, which considers positive and negative deviations from its target as equally undesirable (ECB, 2021).

Second, we compute the absolute variation of inflation expectations from the forecaster-specific time series mean:

$$\text{Index}_{2,i,t,h} = \sqrt{(E_{i,t}(\pi_{t+h}) - \overline{\pi}_{i,h})^2}, \tag{6}$$

where $\overline{\pi}_{i,h}$ gives the time series mean of inflation expectations for each forecaster i. The concept underpinning this subindex is that firmly anchored inflation expectations should be stable and should seldom require revisions by experts over time. The difference compared to the first subindex is that variation of individual expectations is computed to the forecaster-specific time series mean instead of the actual inflation target of the central bank. This also accounts for the possibility that the old inflation target ('below, but close to, 2%', ECB, 2011) has been interpreted differently by individual forecasters.

Third, we use the absolute difference of individual inflation expectations to the cross-sectional mean across forecasters as a measure of dispersion of inflation expectations:

$$\text{Index}_{3,i,t,h} = \sqrt{(E_{i,t}(\pi_{t+h}) - \overline{\pi}_{t,h})^2}, \tag{7}$$

where $\overline{\pi}_{t,h}$ gives the cross-sectional mean forecast across forecasters at each point in time. This measure is grounded in the notion that if professional forecasters have well-anchored expectations, they would exhibit a low disagreement regarding future inflation.[5]

As the fourth, fifth, and sixth subindex, we additionally include the uncertainty, the absolute skewness, and the kurtosis derived from density forecasts as outlined in the previous subsection:

$$\text{Index}_{4,i,t,h} = \sigma_{i,t,h}, \quad \text{Index}_{5,i,t,h} = |\text{skew}_{i,t,h}|, \quad \text{and} \quad \text{Index}_{6,i,t,h} = \kappa_{i,t,h}. \tag{8}$$

The last three subindexes offer additional dimensions of (de-)anchoring and basically extend the approach proposed by Dovern and Kenny (2020), who also compute the mean, variance, skewness, and kurtosis from the distributional forecasts available in the ECB-SPF and test for structural changes in the entire distribution and the individual probabilities for each bin in the survey. An increase in forecasters uncertainty regarding future inflation is a clear sign for a lower degree of anchoring.[6] A greater skewness and kurtosis is an indication that professionals perceive a higher likelihood for more extreme

[5] One could also argue that if all participants are sure that the inflation target will be missed, disagreement among them should also be low. However, in a situation, in which many participants have de-anchored inflation expectations, they will adjust their inflation forecasts probably to different values as in such a case a clear anchor is missing and this would probably result in a higher dispersion across forecasters compared to periods with firmly anchored inflation expectations. Panel (b) of Figure 2, which shows a stronger disagreement among forecasters in turbulent periods, supports this view.

[6] One could argue that the optimal degree of anchoring should not be indicated by an uncertainty of zero but it should be positive and in line with the historically observed forecast error variances. However, it should be kept in mind that we are considering a horizon of five-years-ahead, at which uncertainty regarding inflation expectations should be very low and should not react to shocks or news when inflation expectations are well anchored. Therefore, even if the level of uncertainty is slightly positive, it should be stable to indicate anchored inflation expectations.

inflation rates either by a skewed density forecast or by assigning a higher density to the tails, which can also be considered as evidence against firmly anchored inflation expectations and which basically follows the idea of inflation disasters put forward by Hilscher *et al.* (2022) and Ryngaert (2022) focusing on tail probabilities. Due to the fact that an entire distribution cannot be fully described by its mean and its standard deviation, it seems reasonable to also consider the skewness and kurtosis of the inflation forecast density. Despite a potentially stable mean and standard deviation, both a higher skewness and a higher kurtosis could indicate that a higher density is assigned to extreme values. The skewness is used in absolute terms as an increase into both directions is considered as a sign for a de-anchoring.

Lastly, the consolidation of these six anchoring subindexes into a single measure is carried out, as they collectively offer complementary insights into the degree of anchoring. Initially, individual measures are normalized across forecasters and time periods to achieve a zero mean and a unity variance:

$$\text{Standard Index}_{n,i,t,h} = -\frac{\left(\text{Index}_{n,i,t,h} - \overline{\text{Index}}_{n,h}\right)}{\sigma(\text{Index})_{n,h}}, \quad n = 1, \ldots, 6, \tag{9}$$

where $\overline{\text{Index}}_{n,h}$ and $\sigma(\text{Index})_{n,h}$ represent the sample average and standard deviation of the corresponding subindex across forecasters i and periods t.

Furthermore, we invert the sign of each subindex in Eq. (9), so that in this context, an increase (or decrease) in the respective measure signifies a greater (or lesser) degree of anchoring. This adjustment facilitates a clear interpretation of our anchoring measure. Finally, we calculate the simple average of the six standardized subindexes to obtain our ultimate anchoring measure:

$$\text{Anchor}_{i,t,h} = \frac{1}{6}\sum_{n=1}^{6} \text{Standard Index}_{n,i,t,h}, \quad h = 5. \tag{10}$$

The individual anchoring measure constructed for each forecaster is shown in Panel (a) of Figure 3 for the medium-term horizon ($h = 5$) by the black points while the average across forecasters is illustrated by the red line. The latter is also provided in Panel (b) of Figure 3 together with the 95% confidence band. First of all, when focusing on the pattern in the degree of anchoring on an aggregated level across forecasters, we see that the level of anchoring was negative for the first two years after the establishment of the monetary union. It seems that the ECB required a few years to gain enough credibility among professional forecasters. Beyond this point, the degree of anchoring remained relatively stable for a substantial period of time until a decline in anchoring has been observed more recently, beginning in 2019 and lasting until 2024. If any, this period including the COVID-19 pandemic and the Russian invasion of Ukraine shows the clearest sign of a de-anchoring. However, when also considering the 95% confidence interval provided in Panel (b) of Figure 3, it becomes evident that these fluctuations around zero are not statistically significant at a 5% significance level.[7]

*** Insert Figure 3 about here ***

Second, in Panel (a) of Figure 3 we also see some heterogeneity across forecasters, which underlines the importance to allow for the degree of anchoring on an individual level. Especially, the turbulent periods around the global financial crisis (2007-2009), the European sovereign debt crisis (2010-2013), the COVID-19 pandemic (2020-2021), and the Russian invasion of Ukraine (2022-2024) have resulted in a stronger

[7]The most relevant measure for assessing the degree of anchoring is, of course, the one provided for $h = 5$ as the inflation target announced by the ECB refers to the medium-run horizon. However, to get a full picture we have also computed the anchoring index for the short run ($h = 1, 2$) for an earlier version of the paper and have compared their cross-sectional means across horizons. Unsurprisingly, at shorter horizons we observe periods, which can be characterized by a de-anchoring of inflation expectations. For the periods around the global financial crisis, the period of ultra-low interest rates, and the most recent high-inflation period the degree of anchoring has taken negative values for $h = 1, 2$. The corresponding findings are available upon request.

disagreement regarding the level of anchoring of inflation expectations among professional forecasters. These findings for individual forecasters confirm and extend evidence of a (de)-anchoring provided in different periods in existing studies for the Euro Area (Galati *et al.*, 2011; Strohsal and Winkelmann, 2015; Scharnagl and Stapf, 2015; Łyziak and Paloviita, 2017; Natoli and Sigalotti, 2018; Buono and Formai, 2018; Grishchenko *et al.*, 2019). For instance, Buono and Formai (2018) find a de-anchoring shortly after the global financial crisis and starting from 2014 for the Euro Area.

Overall, we provide evidence in favor of a de-anchoring of inflation expectations in specific periods such as the most recent high-inflation period for some individual forecasters, although the evidence is insignificant when considering the aggregate level. Therefore, in the following we want to study whether the degree of (de-)anchoring can be explained by a co-movement with expectations regarding several variables, which are introduced in the next subsection.

3.3 Assumptions Expectations

Since 2002Q1 the ECB-SPF also includes expectations regarding assumptions underlying the inflation expectations. In this context, professionals also provide forecasts for the ECB's policy rate (i.e., the main refinancing operations rate), the Brent crude oil price, the USD/EUR exchange rate, and the unit labor costs change per employee, which they use to make their inflation forecasts. See the bottom part of Figure A.1 for details how these forecasts are surveyed.

These forecasts are provided in a different horizon structure and are solely requested as point forecasts. The expectations regarding the policy rate, the Brent crude oil price, and the USD/EUR exchange rate are available for four consecutive quarters (denoted as $k = 1, 2, 3, 4$) as well as for the next calendar year (annual average, represented by

$h = 1$) and the calendar year after the next one (annual average, $h = 2$).[8] Forecasts for the year-on-year unit labor cost change are only available since 2004Q3 for the current calendar year (annual average, denoted as $h = 0$), the next calendar year (annual average, $h = 1$), the calendar year after next (annual average, $h = 2$), and a longer term forecast ($h = 4/5$).[9]

The policy rate and the year-on-year unit labor cost change per employee are given in percent per annum. However, the Brent crude oil price is given in US dollar (USD) per barrel and the USD/EUR exchange rate is denominated in USD per one euro (i.e., an increase of the exchange rate represents an appreciation of the euro against the USD). Therefore, based on the survey data we have computed expected percentage changes for both:

$$E_{i,t}(\Delta op_{t+k}) = 100\frac{E_{i,t}(OP_{t+k}) - OP_t}{OP_t}, \quad E_{i,t}(\Delta xr_{t+k}) = 100\frac{E_{i,t}(XR_{t+k}) - XR_t}{XR_t}, \quad (11)$$

where $E_{i,t}(OP_{t+k})$ and $E_{i,t}(XR_{t+k})$ stand for forecasts of the crude oil price and the USD/EUR exchange rate, respectively, made in period t by forecaster i and k refers to a horizon of k-quarters-ahead. OP_t and XR_t are the corresponding spot prices on the day the forecasts had to be submitted in the survey (the exact dates are published by the ECB). Daily spot prices for Brent crude oil prices and the daily spot USD/EUR exchange rate have been retrieved from Federal Reserve Economic Data (FRED).[10]

The individual forecasts for all four assumptions are provided in the Appendix (see Figures A.2 to A.5) while the cross-sectional means are displayed in Figure 4. Overall, we see that the forecasts roughly show the some pattern across the different horizons. However, we also observe differences in expectations across horizons. For the policy rate we see that professionals have expected higher interest rates over the longer horizon

[8]The latter two horizons ($h = 1, 2$) have been included to the survey since wave 2010Q2.

[9]The latter is provided for the four-years-ahead (five-years-ahead) horizon in the Q1 and Q2 (Q3 and Q4) waves.

[10]The corresponding codes for the two series are: DCOILBRENTEU and DEXUSEU.

($h = 2$) compared to shorter horizons for nearly the entire sample period. Solely, in the latest sample period professionals started expecting policy rate cuts over the longer horizon ($h = 2$) compared to their expectations in the very short run. Expectations for the exchange rate change are unsurprisingly much more volatile and show differences across the forecast horizons in several periods. For unit labor cost forecasts we observe that longer term forecasts are much more stable and do not seem to react strongly to news.

*** Insert Figure 4 about here ***

3.4 Empirical Methodology

Finally, we aim to examine expectation formation among professional forecasters in the context of the anchoring of inflation expectations. Therefore, based on our panel data set, which has been described in the previous subsections, we estimate the following model:

$$\begin{aligned} \text{Anchor}_{i,t,h=5} &= \beta_1 E_{i,t}(i_{t+k}) + \beta_2 E_{i,t}(\Delta op_{t+k}) + \beta_3 E_{i,t}(\Delta xr_{t+k}) + \beta_4 E_{i,t}(\Delta ulc_{t+k}) \\ &+ \beta_5 E_{i,t}(ur_{t+k}) + \beta_6 E_{i,t}(\pi_{t+k}) + \xi_i + \varepsilon_{i,t} \end{aligned} \tag{12}$$

where $\text{Anchor}_{i,t,h=5}$ measures the degree of anchoring of inflation expectations at period t for forecaster i over a horizon of five-years-ahead, $E_{i,t}(.)$ stands for expectations made in period t by forecaster i and k refers to a horizon of k-quarters-ahead. i_{t+k} denotes the policy rate of the ECB, i.e., the main refinancing operations rate, Δop_{t+k} represents the percentage change in the Brent crude oil price between t and $t + k$, Δxr_{t+k} gives the percentage change in the USD/EUR exchange rate between t and $t + k$, Δulc_{t+k}

is the year-on-year rate of change in labor costs per employee, ur_{t+k} stands for the unemployment rate, and π_{t+k} denotes the inflation rate. ξ_i and $\varepsilon_{i,t}$ refer to time-invariant forecaster-specific fixed effects (FE) and idiosyncratic errors, respectively. The regression is conducted for $\text{Anchor}_{i,t,h}$ at the horizon $h = 5$ regressed on forecasts for the four factors made for four consecutive quarters ($k = 1, 2, 3, 4$) as well as the forecast for the next calendar year ($h = 1$) and the calendar year after next ($h = 2$). For Δulc_{t+k} forecasts for four consecutive quarters ($k = 1, 2, 3, 4$) are not available but only the forecast for the current calendar year. Therefore, the latter is included in each specification for $k = 1, 2, 3, 4$. For ur_{t+k} and π_{t+k} we also do not have forecasts for quarterly horizons. Therefore, for the specifications for $k = 1, 2, 3, 4$ and $h = 1$ we always include the one-year-ahead forecasts ($h = 1$) and only for the specification for $h = 2$ we use the two-years-ahead forecasts ($h = 2$). To also allow for variation over time due to the different crisis events experienced by the monetary union, we also estimate the regression model given by Eq. (12) for a rolling window with a window size of 20 quarters, which equals five years.

Although a simultaneous causality between the anchoring and the different assumptions expectations cannot be ruled out in the specification given by Eq. (12), we basically regress the anchoring measure constructed from professionals inflation expectations on the four factors, which they state in the survey as assumptions used to built their inflation forecasts.[11] Therefore, we believe that it is plausible to select these as possible explanatory variables for our anchoring measure. However, we also want to state that we are not making any causality claims but focus on co-movements between the variables.

[11] More precisely, on the first sheet of the questionnaire that the ECB sends to the participants of the survey, inflation point and probability forecasts are asked and directly below these the participants are also asked to provide their forecasts for the four underlying assumptions stating: "Please report selected other information underlying your forecasts (average over the period)". See Figure A.1 in the Appendix.

In addition to the set of assumptions described above, we also consider two control variables. First, we also regress our anchoring measure, which is constructed for the medium-term horizon ($h = 5$), on inflation expectations over short-term horizons ($h = 1, 2$). The latter have been already shown for $h = 1$ in Figure 1 and compared to the horizon of $h = 5$. Short-term inflation expectations are much more volatile and more strongly react to actual inflation than medium-term inflation expectations. Therefore, short-term inflation expectations are included into our panel regression model outlined above for two reasons. They account for individual forecasters perceptions to the actual inflation rate and also act as an implicit check for the presence of de-anchoring in our regression model. The latter is in line with a common measure of anchoring used in the previous literature: the degree to which medium-term inflation expectations respond to short-term inflation expectations (e.g., Łyziak and Paloviita, 2017; Buono and Formai, 2018). Second, we also consider unemployment rate expectations over the same horizons ($h = 1, 2$), which are also surveyed within the ECB-SPF and are displayed in Figure A.6 in the Appendix. The inclusion of unemployment rate expectations also controls for individual forecasters perceptions to a measure of economic activity.

4 Empirical Findings

In this section we report and discuss our main findings, which are subdivided into three subsections referring to the estimations carried out for the entire available sample period, robustness checks, and the time-varying rolling window estimation.

4.1 Full Sample Results

Full sample estimation results for the regression model given by Eq. (12) are reported in Table 1. The estimated coefficients, first of all, indicate that expectations regarding the stance of monetary policy seem to be positively associated with the degree of anchoring.

This finding is robust across the different horizons, at which policy rate expectations are measured, and are highly significant (at least at the 1% level) when considering policy rate expectations within one year ($k = 1, 2, 3, 4$). Policy rate expectations over higher horizons ($h = 1, 2$) show the same pattern but are insignificant, which might be due to the lower number of observations as the horizons $h = 1, 2$ have been included to the survey since wave 2010Q2 as already mentioned in Section 3.3.[12] The overall finding is plausible as the expectation of a tightening of monetary policy can be seen as the belief in the credibility of the ECB, which tries to achieve its main objective of price stability. It also shows that even expectations regarding a change in monetary policy over the very short-run horizon (i.e., for the next quarters) seem to contribute to the anchoring of inflation expectations for a horizon of five-years-ahead.

*** Insert Table 1 about here ***

Turning to the coefficient estimates for expectations regarding different cost-push factors in Table 1 also provides evidence in favor of de-anchoring tendencies in the Euro Area. An expected increase in unit labor costs as one important production factor seems to lower the degree of anchoring. This finding is clearly significant (in most cases at the 1% level) and robust across all horizons of expectations. It is also plausible as expectations of rising unit labor costs might imply de-anchoring tendencies due to expectations of cost increases, which could force firms to increase prices. This becomes evident, although we also control for inflation expectations per se. The negative coefficient for short-term inflation expectations, which is also significant at conventional

[12] We will shed some light on the effect of the different sample sizes in the rolling window estimation conducted in Section 4.3.

levels, points into the same direction and also provides evidence for de-anchored inflation expectations as it shows that the medium-run anchoring measure seems to be inversely related to short-term inflation expectations.

Expectations regarding Brent crude oil price changes, appreciations of the euro against the USD (i.e., an increase of the USD/EUR exchange rate), or the unemployment rate seem to play at best a minor role for the anchoring of inflation expectations as the corresponding coefficient estimates are all insignificantly different from zero for all specifications. Especially, for crude oil price and exchange rate expectations this seems reasonable as both are usually quite volatile while these short-term fluctuations are of minor importance for monetary policy in general and for inflation expectations over the longer horizon in specific. In addition, expected large increases in energy prices such as for crude oil are already included in short-term inflation expectations and are therefore, controlled for within our regression specification.

Overall, we provide evidence for a de-anchoring of inflation expectations due to expectations of higher production costs attributed to compensations for employees and due to the sensitivity of the anchoring measure to variations in short-term inflation expectations. Expectations regarding crude oil price and exchange rate changes seem not to play any role for a potential de-anchoring. In contrast, expectations of a tightening of monetary policy at different horizons seem to improve the degree of anchoring. In general, the findings in terms of coefficient estimates and explanatory power are quite robust across the different forecast horizons of the regressors. In the next two sub-sections we also want to consider each sub-measure of anchoring and also time-variation within our anchoring regression model.

4.2 Robustness across Sub-Measures of Anchoring

In Section 3.2 we have described how the anchoring measure is derived based on six different sub-indexes. To make sure, on the one hand side, that all these sub-measures characterize different dimensions of (de-)anchoring but on the other hand side that our results are not solely driven by one metric, we have considered the same regression model as given by Eq. (12) but have replaced the overall measure by each individual component separately. First of all, Figure A.7 in the Appendix shows the time series pattern of the cross-sectional averages for each individual sub-measure and indicates that these are correlated but also show some idiosyncratic patterns. Second, in the Appendix we also report the regression results for each sub-measure (see Tables A.1 to A.6). Overall, they support the findings discussed above for the aggregated measure. It seems for most of the sub-measures that interest rate expectations contribute to the anchoring of inflation expectations while expected increases in unit labor costs coincide with de-anchoring patterns. However, some interesting distinctive patterns are also observed. A potential de-anchoring due to an increase in the uncertainty regarding inflation forecasts (i.e., sub-measure 4; see Table A.4) does not seem to coincide with expected unit labor cost increases but with expected crude oil price increases, especially for longer horizons (i.e., $h = 1, 2$). In addition, the explanatory power for this measure is substantially higher than for the others (i.e., $\overline{R}^2$ is around 0.7).

4.3 Sub-Sample Analysis

In this subsection we check whether the findings presented in Section 4.1 are robust over the entire sample period, which was characterized by dramatic crises and several changes in monetary policy in the Euro Area. The rolling window estimation results for our regression model provided by Eq. (12) for a window size of 20 quarters are visualized in Figures 5 to 10.[13] These show time series diagrams plotting the coefficient estimates over time together with the 95% confidence interval based on heteroskedasticity and autocorrelation robust (HAC) standard errors according to Driscoll and Kraay (1998). Each plot visualizes one of the six different coefficient estimates of Eq. (12) across two different specifications: we have considered assumptions expectations over the horizons of one-quarter-ahead ($k = 1$) and one-year-ahead ($h = 1$). The time series for the latter begin later as the corresponding expectations are only available since wave 2010Q2.[14]

The time-varying coefficient for expectations regarding the policy rate is illustrated in Figure 5 and shows that an expected increase of the policy rate significantly coincides with an increase in the degree of inflation anchoring for the most recent period since 2019. This implies that professionals belief that the expected tightening of monetary policy in this period contributes to the anchoring of inflation expectations in the medium run. However, around 2017 we also observe significantly negative coefficients. This would imply that expected raises of the policy rate co-move with a reduction in the degree of anchoring. This finding can also be rationalized. When interest rate increases are expected to hold for a longer period of time, this might raise concerns of a recession among the forecasters, which might result in a deflation fear also decreasing the degree of anchoring. However, this seems to be an exceptional finding. For most of the time since the global financial crisis (GFC), where interest rates have been expected to be very low by professionals, the corresponding relation to the anchoring measure is insignificant.

*** Insert Figure 5 about here ***

[13]It should be noted that a window size of 20 quarters does not imply that the estimation is carried out based on 20 observations. We are estimating the same panel regression model as given in Eq. (12). Therefore, the effective sample size varies between 200 and 450 observations across the different periods and thus, leaves enough observations for consistent estimation.

[14]The rolling window estimation results for assumptions expectations over other horizons ($k = 2, 3, 4$ and $h = 2$) show very similar patterns and are available upon request.

Figure 6 illustrates the time-varying coefficient for crude oil price expectations. These mostly confirm the full sample period results as they are insignificant for most parts of the sample period. However, a significantly negative coefficient is also observed for the period around 2020 implying a de-anchoring of inflation expectations due to expected fluctuations in the crude oil price. The latter period was characterized by a sharp demand-driven fall in crude oil prices during the COVID-19 pandemic, which has resulted in expectations of huge oil price increase as can be seen in Panel (b) of Figure 4. This expected rise in crude oil prices coincides with a drop in the anchoring of inflation expectations and shows that expected large increases in cost-push factors might contribute to a de-anchoring of inflation expectations.

*** Insert Figure 6 about here ***

The time-varying coefficient for exchange rate expectations provided in Figure 7 shows that the contribution of exchange rate expectations to the (de-)anchoring of inflation expectations was insignificant for most of the sample period as already shown in Table 1. The role of exchange rate expectations for the anchoring of inflation expectations is theoretically not clear-cut as both an appreciation and a depreciation of the domestic currency can result in a de-anchoring. An expected appreciation of the euro against the USD (i.e., an increase of the USD/EUR exchange rate) should coincide with expectations of falling import prices and export demand, which both should result in an expected decrease of the general price level in the economy. Vice versa, an expected depreciation of the euro should correspond to an expected increase of the general price level. However, a de-anchoring of inflation expectations can occur into both directions. Whether an expected exchange rate change results in a de-anchoring or even supports the anchoring might depend on the size of the expected change and the current level of the exchange rate. In the same vein, the coefficient estimates also do not provide a clear picture. In most cases the exchange rate expectation coefficient is insignificant, especially when considering exchange rate expectations over a horizon of one-year-ahead (see Panel (b)). However, for the shorter horizon we observe periods with a significant coefficients going into different directions.

*** Insert Figure 7 about here ***

The time-varying coefficient for labor cost expectations is visualized in Figure 8 and provides evidence in favor of a de-anchoring of inflation expectations in line with the full sample results for the periods around the GFC and since the COVID-19 pandemic. Figure 9 provides the time-varying coefficient for unemployment rate expectations and also shows that an expected rise in unemployment during the GFC and during the COVID-19 pandemic seems to have contributed to a de-anchoring of inflation expectations when considering unemployment expectations at the very short-run horizon (see Panel (a)). Finally, the time-varying coefficient for short-term inflation expectations is displayed in Figure 10 and shows an interesting pattern. It seems that until 2017 the anchoring measure was not sensitive to short-term inflation expectations, which confirms the presence of firmly anchored inflation expectations until this period. Thereafter, the co-movement between the anchoring measure and short-term inflation expectations is significantly positive between 2017 and 2021. It seems that the relatively low inflation expectations during this period of time have even contributed to the anchoring. But the since 2022 the coefficient switches the sign and becomes significantly negative. This clearly indicates that the degree of anchoring has been lowered by rising inflation expectations during this period due to large increases in energy prices as a result of the Russian invasion of Ukraine.

*** Insert Figures 8 to 10 about here ***

Overall, the findings for the full sample period discussed in Section 4.1 are confirmed by most of the rolling window estimates and can be summarized as follows. First, we provide evidence in favor a de-anchoring of inflation expectations for individual forecasters in the most recent high-inflation period for the Euro Area. Second, we show that these de-anchoring patterns can be attributed to expectations regarding unit labor cost changes and short-term inflation. We also find that expectations of large increases of other cost-push factors can also contribute to de-anchoring tendencies, such as observed during the pandemic for the crude oil price. Third, our findings also indicate that the monetary policy of the ECB generally contributes to the anchoring of inflation expectations and that the ECB's monetary policy strategy is regarded as credible by professional forecasters to steer inflation expectations around 2% in the medium term. This especially holds for the most recent high-inflation period. However, this effect is not restricted to interest rate expectations over longer horizons but is already manifested by expectations in the very short run (i.e., for the upcoming quarters).

5 Concluding Remarks

The present study contributes to the existing literature by proposing an anchoring measure considered on an individual level computed based on different characteristics of point and density forecasts derived from the ECB-SPF. This measure helps us to assess whether inflation expectations are firmly anchored at different points in time and enables us to analyze co-movements of the anchoring with professional forecasters' expectations regarding the stance of monetary policy and different cost-push factors, which include the crude oil price, the USD/EUR exchange rate, and labor costs.

The main findings are as follows. First, we provide evidence for de-anchoring patterns for the Euro Area in the most recent high-inflation period. Second, we show that these patterns coincide with expectations regarding unit labor cost changes and short-term inflation expectations. Third, we provide evidence that expectations regarding the monetary policy of the ECB generally contribute to the anchoring of inflation expectations and show that the policy of the ECB is regarded as credible by professional forecasters. This does not solely hold when referring to longer term interest rate expectations but becomes already evident for interest rate expectations over the very short run.

The anchoring measure proposed in this study provides another useful tool for central banks to monitor the degree of anchoring in real-time and to better analyze factors being responsible for a potentially observed de-anchoring. This may help central banks to decide about the future path of monetary policy, which is especially important and challenging in the current period. A promising path for future research would be to extend the proposed anchoring measure by distinguishing in the direction of de-anchoring.

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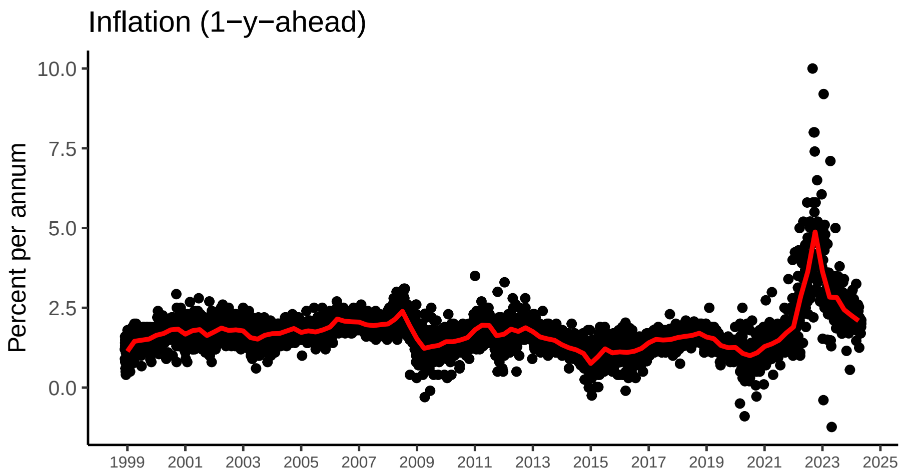
Figure 1: **Individual inflation expectations**

The plots illustrate quarterly Euro Area inflation forecasts for each forecaster (in percent per annum) by the black dots. These are shown for two horizons h (one-year-ahead and five-years-ahead) for the entire period from 1999Q1 to 2024Q2 taken from the ECB Survey of Professional Forecasters. Cross-sectional averages across forecasters are visualized by a red line.

Panel (a): $h = 1$



Panel (b): $h = 5$

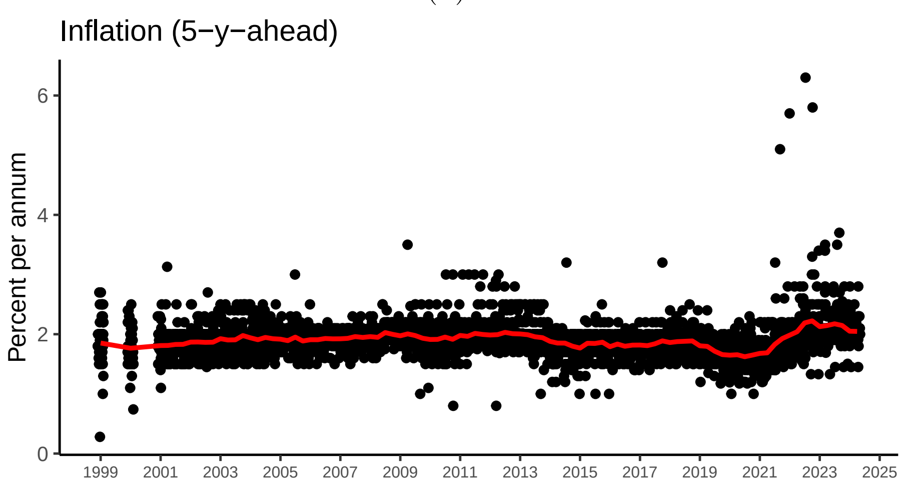
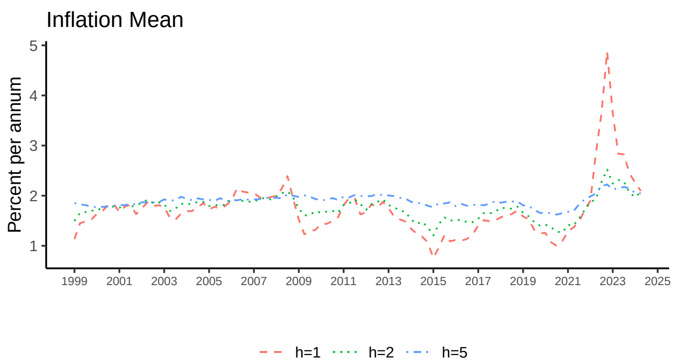


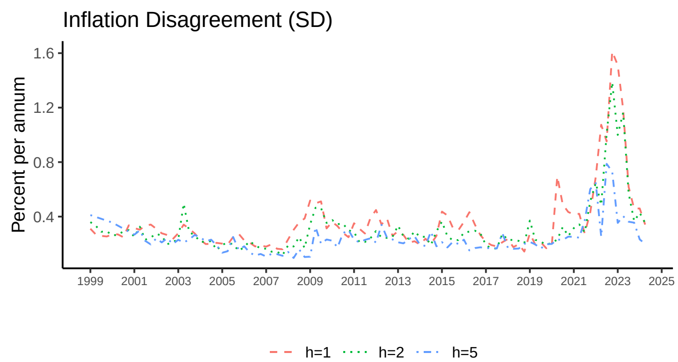
Figure 2: **Aggregated inflation expectations**

The plots illustrate aggregated inflation expectations for different horizons h (one-year-ahead, two-years-ahead, and five-years-ahead) for the entire period from 1999Q1 to 2024Q2 taken from the ECB Survey of Professional Forecasters. Panel (a) shows cross-sectional means of point forecasts across forecasters. Panel (b) gives cross-sectional standard deviations (SDs) of point forecasts across forecasters, which measure the disagreement across forecasters. Panel (c) provides cross-sectional means of individual standard deviations (SDs) computed from the individual density forecasts, which exhibits the ex-ante uncertainty across forecasters.

Panel (a): Cross-sectional means



Panel (b): Cross-sectional SDs



Panel (c): Cross-sectional means of SDs

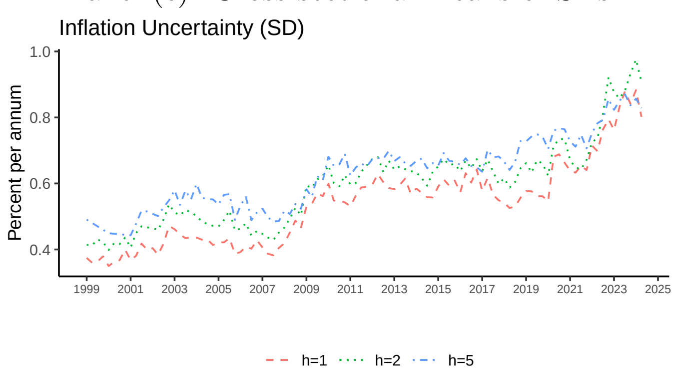
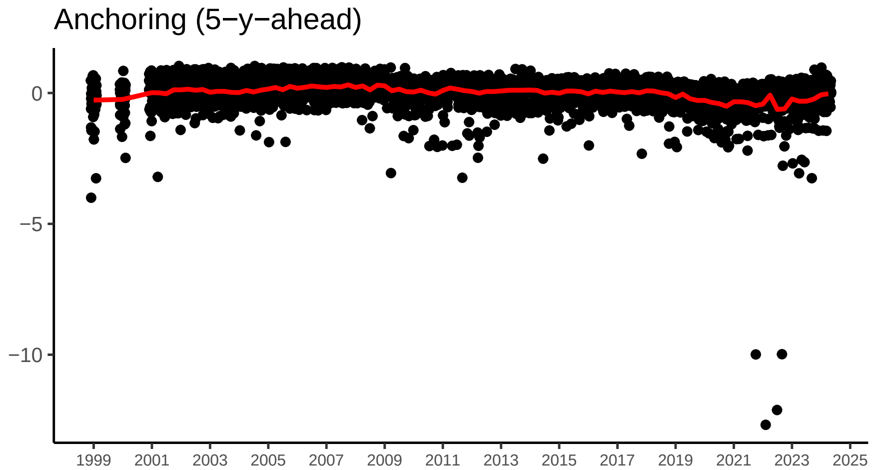


Figure 3: **Anchoring measure**

Panel (a) visualizes the anchoring measure on an individual level for each forecaster by the black dots for the period from 1999Q1 to 2024Q2. The red line illustrates the corresponding cross-sectional means across forecasters. Panel (b) only shows this cross-sectional mean together with the 95% confidence band.

Panel (a): Individual and mean forecasts



Panel (b): Mean forecast with 95% confidence band

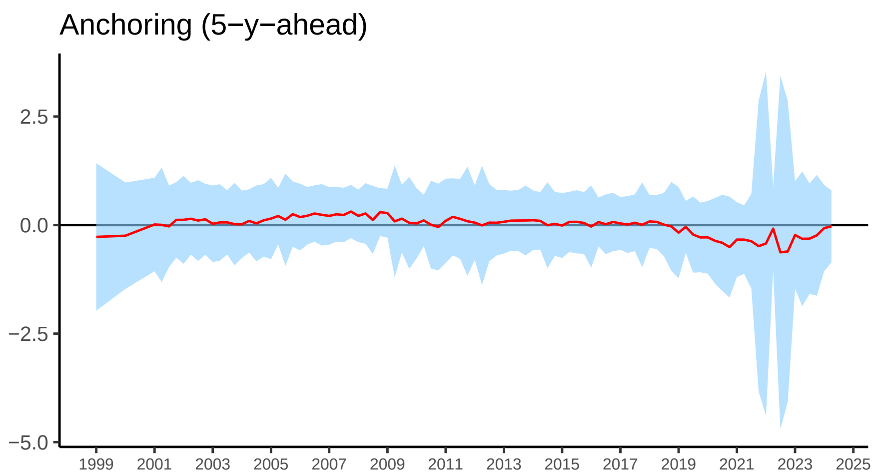


Figure 4: **Aggregate expectations**

The plots compare the cross-sectional means of point forecasts for four different variables across forecasters for each horizon for the period from 2002Q1 to 2024Q2 taken from the ECB Survey of Professional Forecasters. The plots include forecasts for the main refinancing operations rate of the ECB (Panel (a)), the Brent crude oil price change (Panel (b)), the USD/EUR exchange rate change (Panel (c)), and the unit labor costs change per employee (Panel (d)).

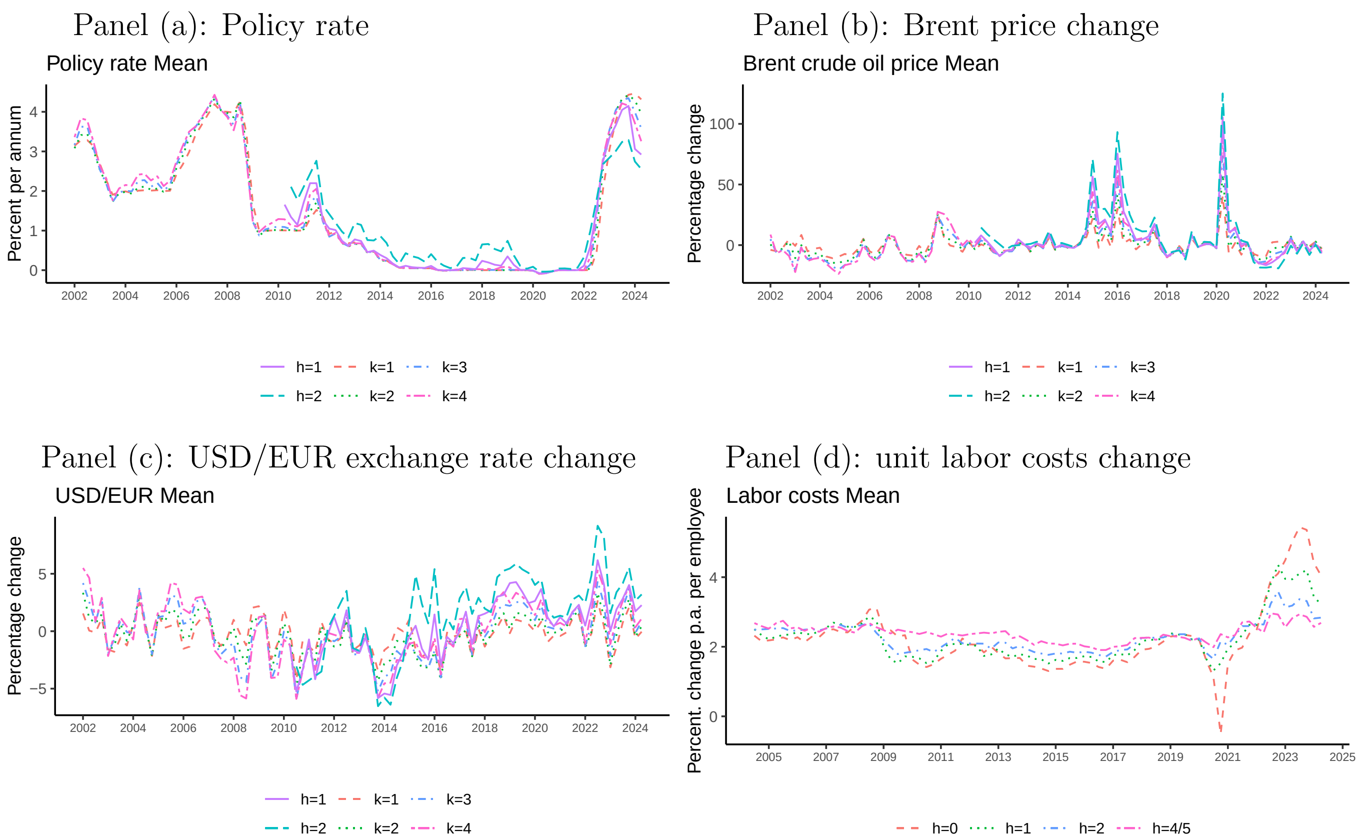
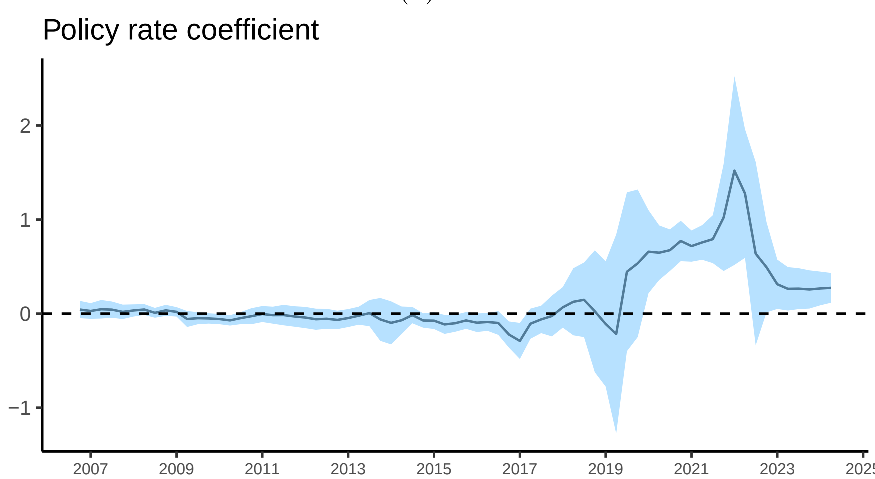


Figure 5: **Time-varying policy rate coefficient**

The plots visualize rolling window coefficient estimates of the policy rate for the regression of the anchoring measure on the expectations regarding the policy rate, the Brent crude oil price change, the USD/EUR rate change, the unit labor costs change, the unemployment rate, and the inflation rate. The window size is 20 quarters. $k = 1$ ($h = 1$) refers to a regression of the anchoring measure regressed on the regressor variables over horizon $k = 1$ ($h = 1$), where h stands for years and k for quarters. The black line shows the coefficient estimate and the light blue shaded area provides the 95% confidence interval based on heteroskedasticity and autocorrelation robust (HAC) standard errors according to Driscoll and Kraay (1998).

Panel (a): $k = 1$



Panel (b): $h = 1$

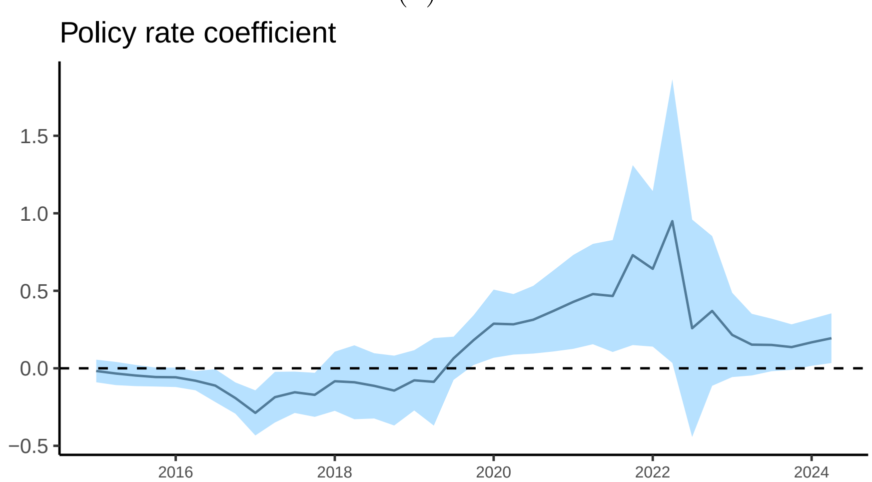
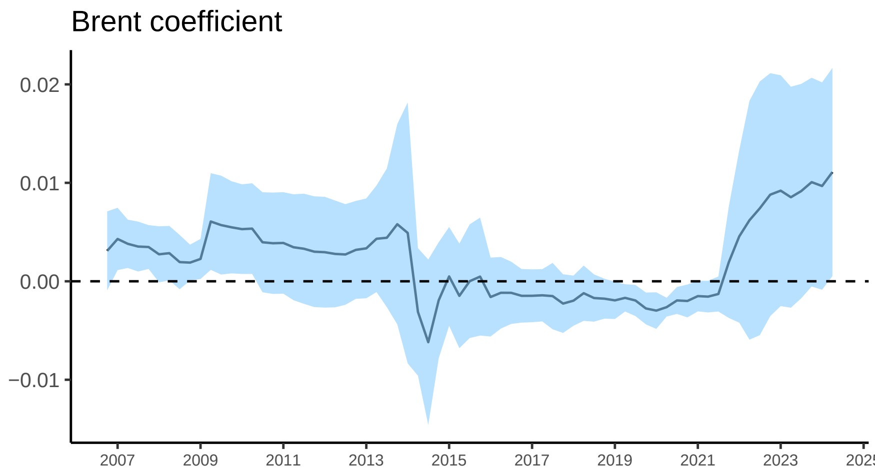


Figure 6: **Time-varying Brent coefficient**

The plots visualize rolling window coefficient estimates of the Brent change for the regression of the anchoring measure on the expectations regarding the policy rate, the Brent crude oil price change, the USD/EUR rate change, the unit labor costs change, the unemployment rate, and the inflation rate. The window size is 20 quarters. $k = 1$ ($h = 1$) refers to a regression of the anchoring measure regressed on the regressor variables over horizon $k = 1$ ($h = 1$), where h stands for years and k for quarters. The black line shows the coefficient estimate and the light blue shaded area provides the 95% confidence interval based on heteroskedasticity and autocorrelation robust (HAC) standard errors according to Driscoll and Kraay (1998).

Panel (a): $k = 1$



Panel (b): $h = 1$

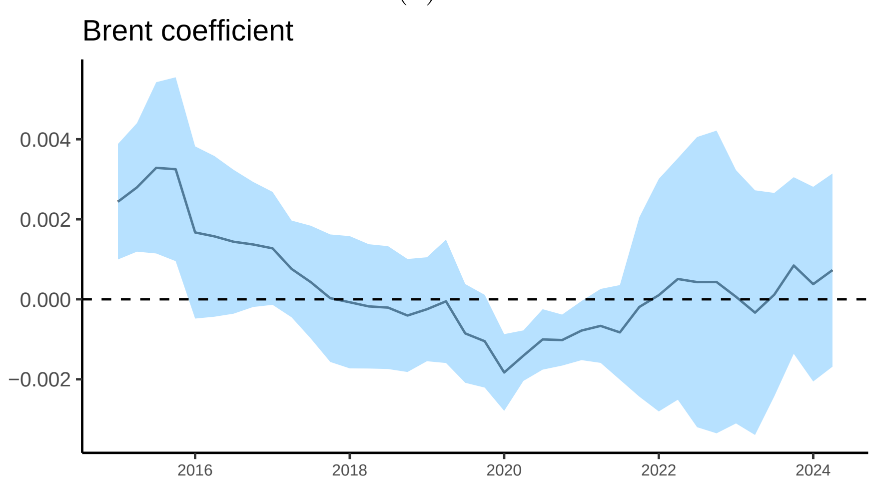
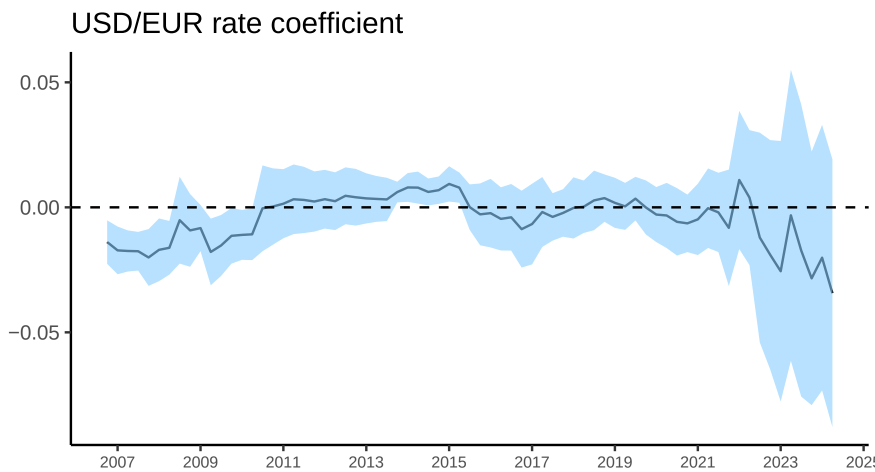


Figure 7: **Time-varying USD/EUR coefficient**

The plots visualize rolling window coefficient estimates of the USD/EUR change for the regression of the anchoring measure on the expectations regarding the policy rate, the Brent crude oil price change, the USD/EUR rate change, the unit labor costs change, the unemployment rate, and the inflation rate. The window size is 20 quarters. $k = 1$ ($h = 1$) refers to a regression of the anchoring measure regressed on the regressor variables over horizon $k = 1$ ($h = 1$), where h stands for years and k for quarters. The black line shows the coefficient estimate and the light blue shaded area provides the 95% confidence interval based on heteroskedasticity and autocorrelation robust (HAC) standard errors according to Driscoll and Kraay (1998).

Panel (a): $k = 1$



Panel (b): $h = 1$

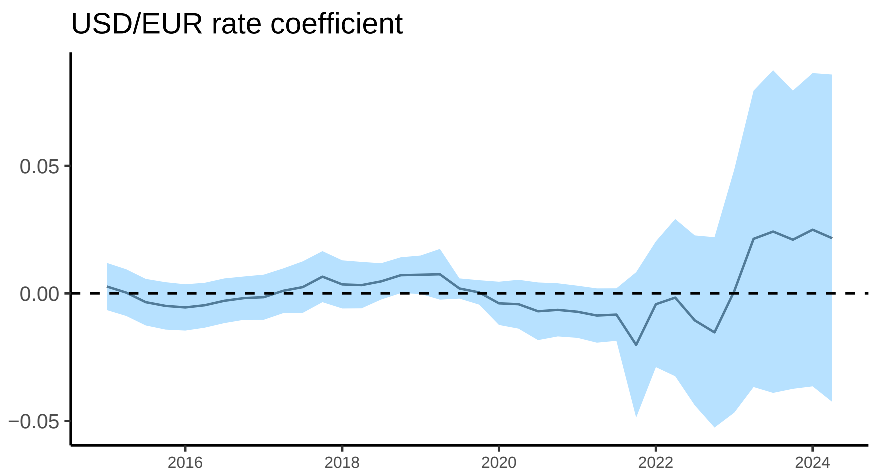
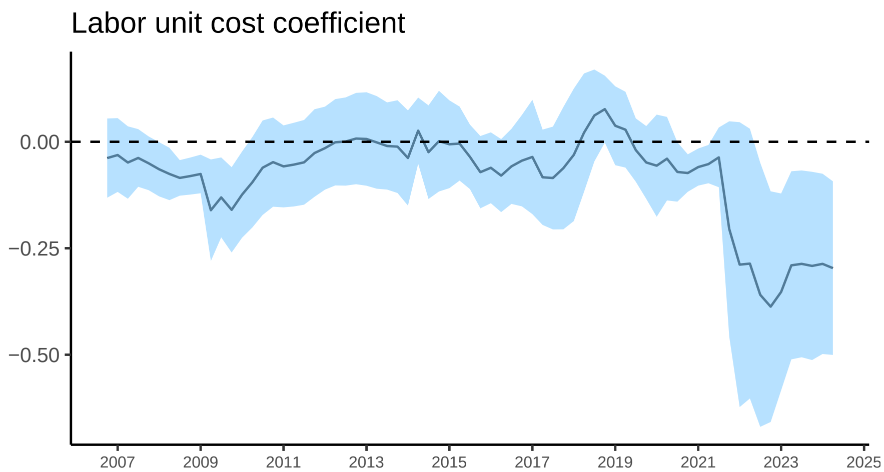


Figure 8: **Time-varying labor cost coefficient**

The plots visualize rolling window coefficient estimates of the labor cost change for the regression of the anchoring measure on the expectations regarding the policy rate, the Brent crude oil price change, the USD/EUR rate change, the unit labor costs change, the unemployment rate, and the inflation rate. The window size is 20 quarters. $k = 1$ ($h = 1$) refers to a regression of the anchoring measure regressed on the regressor variables over horizon $k = 1$ ($h = 1$), where h stands for years and k for quarters. The black line shows the coefficient estimate and the light blue shaded area provides the 95% confidence interval based on heteroskedasticity and autocorrelation robust (HAC) standard errors according to Driscoll and Kraay (1998).

Panel (a): $k = 1$



Panel (b): $h = 1$

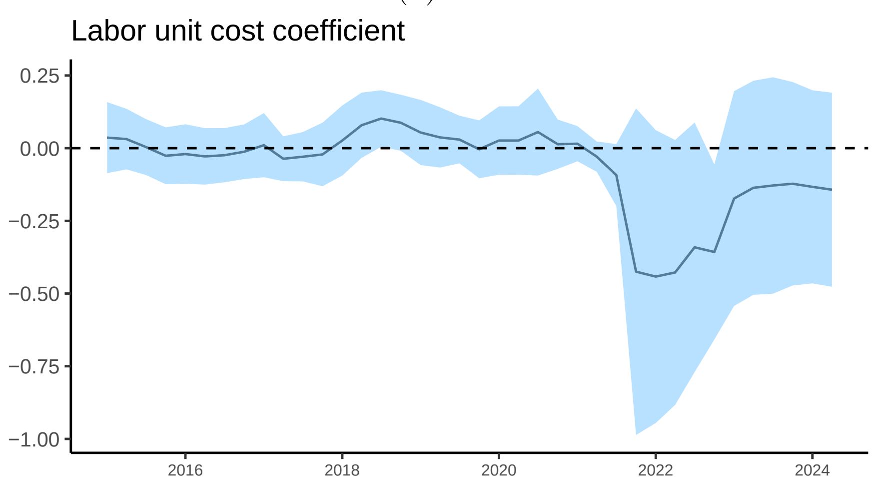
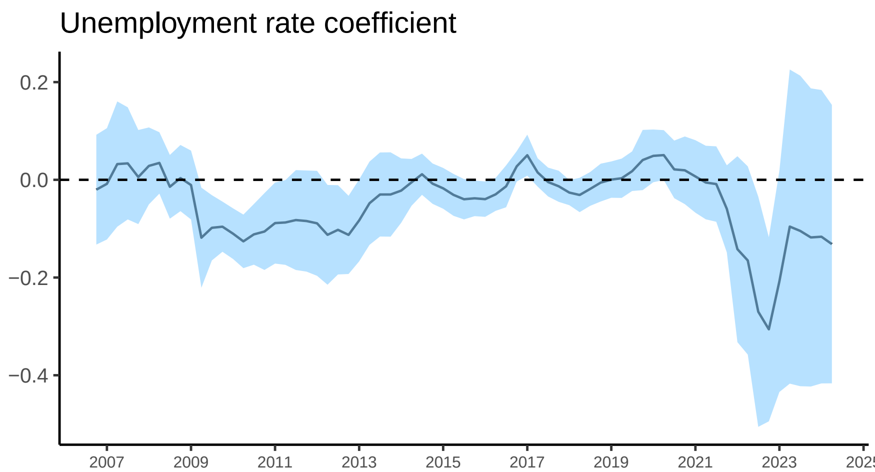


Figure 9: **Time-varying unemployment rate coefficient**

The plots visualize rolling window coefficient estimates of the unemployment rate for the regression of the anchoring measure on the expectations regarding the policy rate, the Brent crude oil price change, the USD/EUR rate change, the unit labor costs change, the unemployment rate, and the inflation rate. The window size is 20 quarters. $k = 1$ ($h = 1$) refers to a regression of the anchoring measure regressed on the regressor variables over horizon $k = 1$ ($h = 1$), where h stands for years and k for quarters. The black line shows the coefficient estimate and the light blue shaded area provides the 95% confidence interval based on heteroskedasticity and autocorrelation robust (HAC) standard errors according to Driscoll and Kraay (1998).

Panel (a): $k = 1$



Panel (b): $h = 1$

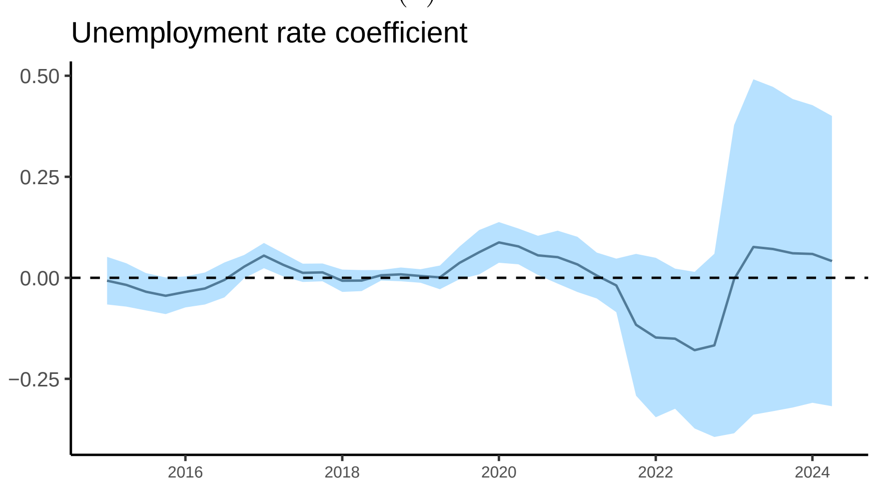
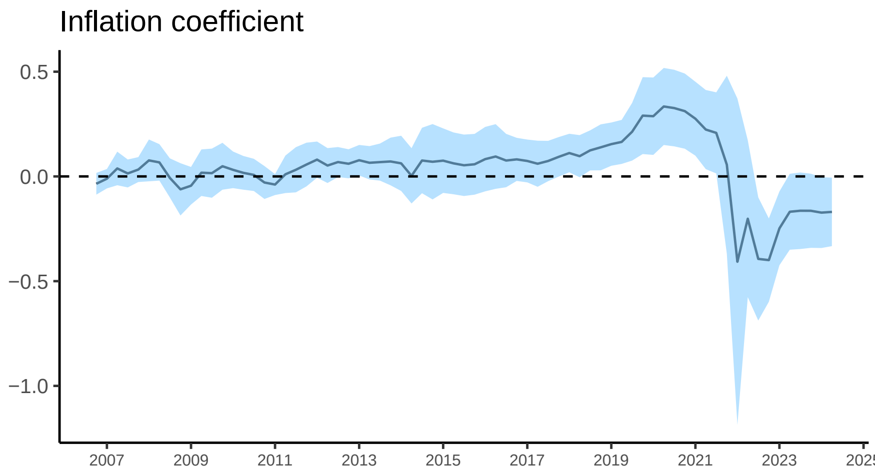


Figure 10: **Time-varying inflation rate coefficient**

The plots visualize rolling window coefficient estimates of the inflation rate for the regression of the anchoring measure on the expectations regarding the policy rate, the Brent crude oil price change, the USD/EUR rate change, the unit labor costs change, the unemployment rate, and the inflation rate. The window size is 20 quarters. $k = 1$ ($h = 1$) refers to a regression of the anchoring measure regressed on the regressor variables over horizon $k = 1$ ($h = 1$), where h stands for years and k for quarters. The black line shows the coefficient estimate and the light blue shaded area provides the 95% confidence interval based on heteroskedasticity and autocorrelation robust (HAC) standard errors according to Driscoll and Kraay (1998).

Panel (a): $k = 1$



Panel (b): $h = 1$

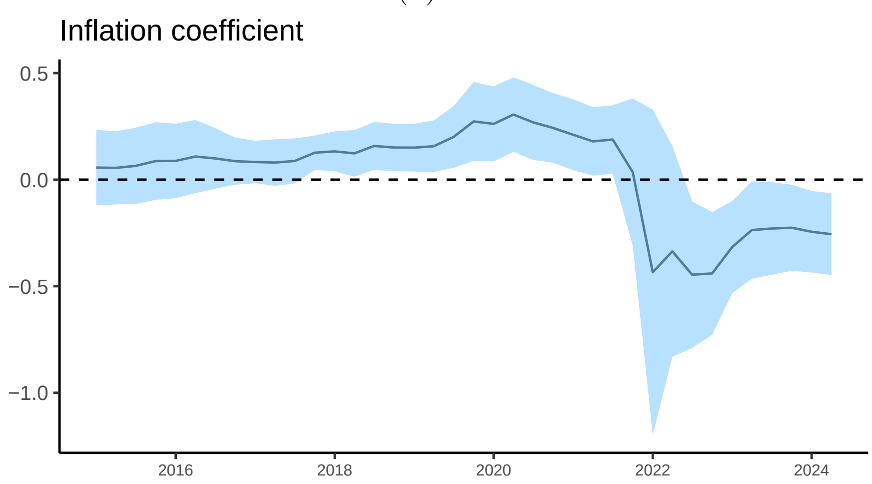


Table 1: **Anchoring regression results**

	$k=1$	$k=2$	$k=3$	$k=4$	$h=1$	$h=2$
$E_{i,t}(i_{t+k})$	0.1310	0.1289	0.1290	0.1215	0.0799	0.1134
SE	(0.0364)	(0.0374)	(0.0393)	(0.0399)	(0.0562)	(0.0930)
p-value	[0.0003]	[0.0006]	[0.0011]	[0.0024]	[0.1560]	[0.2230]
$E_{i,t}(\Delta op_{t+k})$	0.0031	0.0030	0.0024	0.0013	0.0001	-0.0010
SE	(0.0024)	(0.0020)	(0.0016)	(0.0013)	(0.0010)	(0.0008)
p-value	[0.1909]	[0.1300]	[0.1221]	[0.2970]	[0.9316]	[0.1921]
$E_{i,t}(\Delta xr_{t+k})$	-0.0047	-0.0051	-0.0006	0.0001	0.0011	0.0094
SE	(0.0053)	(0.0047)	(0.0036)	(0.0036)	(0.0055)	(0.0078)
p-value	[0.3743]	[0.2832]	[0.8690]	[0.9873]	[0.8366]	[0.2315]
$E_{i,t}(\Delta ulc_{t+k})$	-0.1571	-0.1540	-0.1514	-0.1394	-0.1444	-0.2351
SE	(0.0409)	(0.0412)	(0.0417)	(0.0392)	(0.0780)	(0.0751)
p-value	[0.0001]	[0.0002]	[0.0003]	[0.0004]	[0.0644]	[0.0018]
$E_{i,t}(ur_{t+k})$	-0.0062	-0.0089	-0.0094	-0.0102	-0.0029	0.0220
SE	(0.0205)	(0.0207)	(0.0211)	(0.0214)	(0.0230)	(0.0306)
p-value	[0.7616]	[0.6682]	[0.6560]	[0.6330]	[0.8987]	[0.4715]
$E_{i,t}(\pi_{t+k})$	-0.1539	-0.1640	-0.1732	-0.1779	-0.1831	-0.5519
SE	(0.0649)	(0.0673)	(0.0695)	(0.0712)	(0.0922)	(0.2831)
p-value	[0.0178]	[0.0149]	[0.0128]	[0.0126]	[0.0474]	[0.0516]
FE	yes	yes	yes	yes	yes	yes
$\overline{R}^2$	0.4036	0.4029	0.4008	0.3985	0.3882	0.4663
$N \times T$	1361	1360	1358	1351	870	705

Note: The table provides coefficient estimates, heteroskedasticity and autocorrelation robust (HAC) standard errors (SE) according to Driscoll and Kraay (1998), p-values, adjusted R^2s ($\overline{R}^2$) and the number of observations ($N \times T$) for the following regression model:

$$\text{Anchor}_{i,t,h=5} = \beta_1 E_{i,t}(i_{t+k}) + \beta_2 E_{i,t}(\Delta op_{t+k}) + \beta_3 E_{i,t}(\Delta xr_{t+k}) + \beta_4 E_{i,t}(\Delta ulc_{t+k}) + \beta_5 E_{i,t}(ur_{t+k}) + \beta_6 E_{i,t}(\pi_{t+k}) + \xi_i + \varepsilon_{i,t}$$

where $\text{Anchor}_{i,t,h=5}$ measures the degree of anchoring of inflation expectations at period t for forecaster i over a horizon of fve-years-ahead, $E_{i,t}(.)$ stands for expectations made in period t by forecaster i and k refers to a horizon of k-quarters-ahead. i_{t+k} denotes the policy rate of the ECB, i.e., the main refinancing operations rate, Δop_{t+k} represents the percentage change in the Brent crude oil price between t and $t+k$, Δxr_{t+k} gives the percentage change in the USD/EUR exchange rate between t and $t+k$, Δulc_{t+k} is the year-on-year rate of change in unit labor costs per employee, ur_{t+k} stands for the unemployment rate, and π_{t+k} denotes the inflation rate. ξ_i and $\varepsilon_{i,t}$ refer to time-invariant forecaster-specific fixed effects (FE) and idiosyncratic errors, respectively. The regression is conducted for $\text{Anchor}_{i,t,h}$ at the horizon $h=5$ (five-years-ahead) regressed on forecasts for four factors made for four consecutive quarters ($k=1,2,3,4$) as well as the forecast for the next calendar year (annual average, $h=1$) and the calendar year after next (annual average, $h=2$). For Δulc_{t+k} forecasts for four consecutive quarters ($k=1,2,3,4$) are not available but only the forecast for the current calendar year (annual average). The latter is included in each specification for $k=1,2,3,4$. In addition, we also include forecasts for the unemployment rate and the inflation rate, which are not available for k-quarters-ahead but for h-years-ahead with $h=1,2$. For the regression models represented above we always include one-year-ahead forecasts for the unemployment rate and the inflation rate, except for the $h=2$ specification shown in the last column. In the latter case, we use two-years-ahead forecasts.

Appendix

Figure A.1: **Questionnaire of ECB Survey of Professional Forecasters**

The figure shows the first page of the questionnaire of the ECB Survey of Professional Forecasters that is send to the participants. It asks them to provide their inflation forecasts and their assumptions underlying their inflation forecasts (i.e., forecasts for the main refinancing operations rate, the Brent crude oil price, the USD/EUR exchange rate, and the unit labor costs change per employee). This has been directly taken from the website of the ECB (`https://www.ecb.europa.eu/stats/ecb_surveys/survey_of_professional_forecasters/html/about_the_survey.en.html`).

Point estimate of euro area inflation expectations*

Year-on-year change

	2018	2019	2020	Juni-2019	Juni-2020	5 years ahead (2023)
HICP inflation (%)						

** Defined on the basis of the Harmonised Index of Consumer Prices produced by Eurostat*

Probabilities of euro area HICP inflation*

Year-on-year change in the HICP

	2018	2019	2020	Juni-2019	Juni-2020	5 years ahead (2023)
<-1.0%						
-1.0 to -0.6%						
-0.5 to -0.1%						
0.0 - 0.4%						
0.5 - 0.9%						
1.0 - 1.4%						
1.5 - 1.9%						
2.0 - 2.4%						
2.5 - 2.9%						
3.0 - 3.4%						
3.5 - 3.9%						
≥ 4.0%						
Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

** Defined on the basis of the Harmonised Index of Consumer Prices produced by Eurostat. Probabilities should sum to 100%. Average of the period.*

Please report selected other information underlying your forecasts (average over the period):

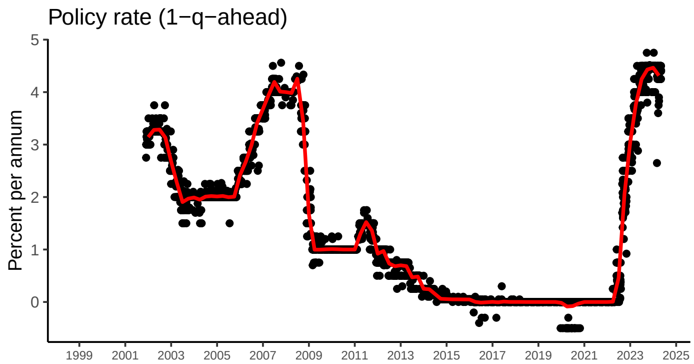
	2018Q3	2018Q4	2019Q1	2019Q2	2019	2020
ECB's interest rate (main refinancing operations)						
Brent crude oil prices (US dollars)						
USD/EUR exchange rate						

	2018	2019	2020	2023
Labour Costs (annual rate of change in whole economy compensation per employee)				

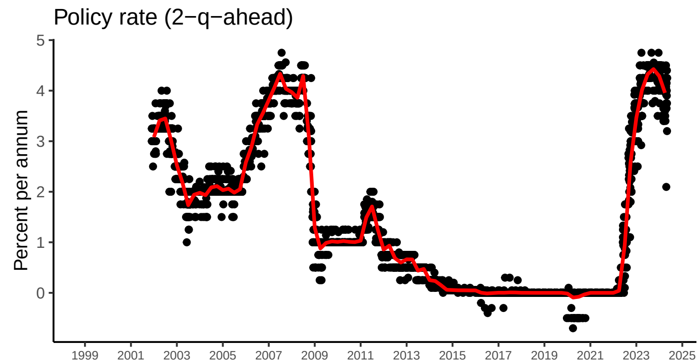
Figure A.2: **Individual policy rate expectations**

The plots visualize quarterly forecasts for the main refinancing operations rate of the ECB for each forecaster (in percent per annum) by the black dots. These are shown for different horizons k (one- to four-quarters-ahead) and h (one- and two-years-ahead) for the period from 2002Q1 to 2024Q2 taken from the ECB Survey of Professional Forecasters. Cross-sectional averages across forecasters are visualized by a red line.

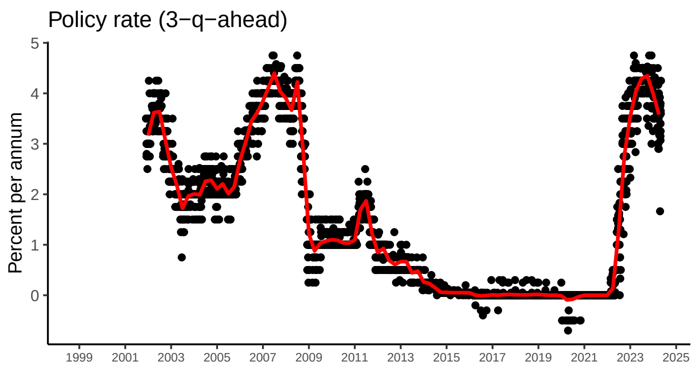
Panel (a): $k = 1$



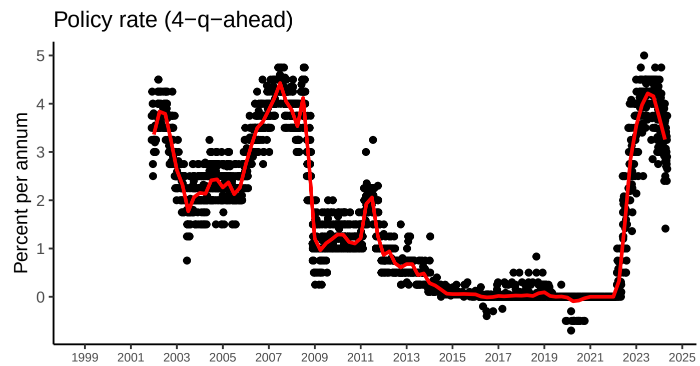
Panel (b): $k = 2$



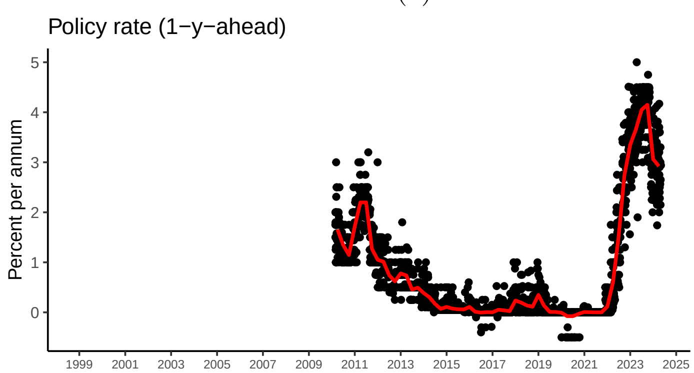
Panel (c): $k = 3$



Panel (d): $k = 4$



Panel (e): $h = 1$



Panel (f): $h = 2$

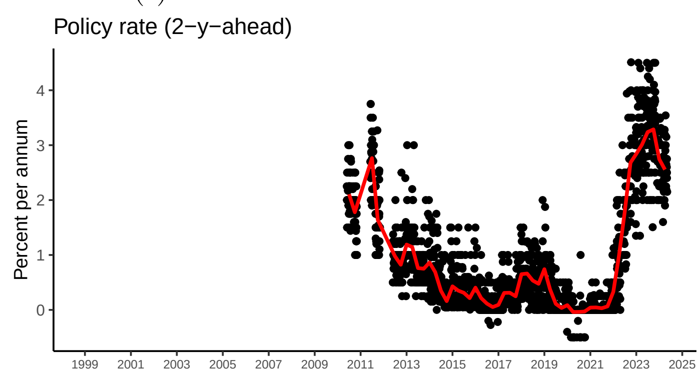
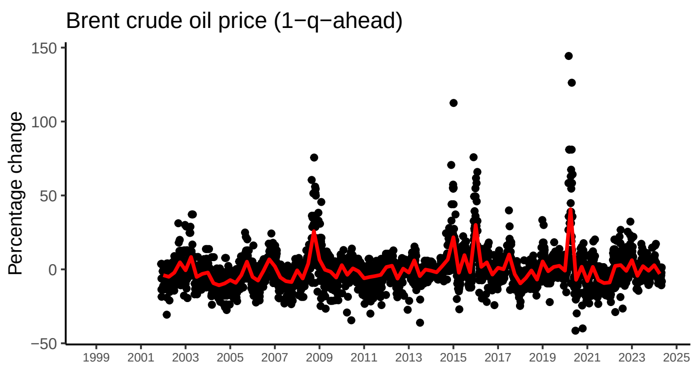


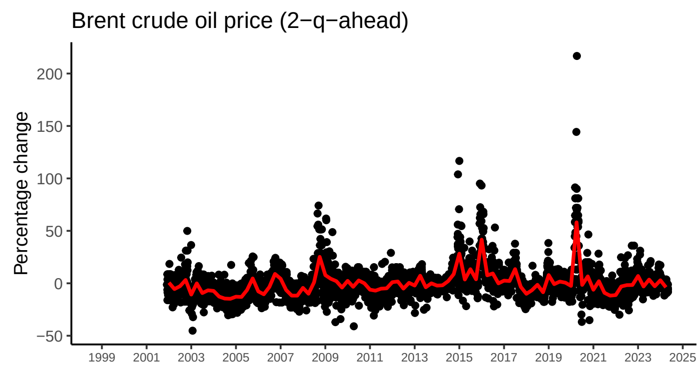
Figure A.3: **Individual Brent price change expectations**

The plots visualize quarterly forecasts for the Brent crude oil price change for each forecaster (computed as percentage change of the Brent forecast relative to the spot rate on the day the forecast had to be submitted) by the black dots. These are shown for different horizons k (one- to four-quarters-ahead) and h (one- and two-years-ahead) for the period from 2002Q1 to 2024Q2 taken from the ECB Survey of Professional Forecasters. Cross-sectional averages across forecasters are visualized by a red line.

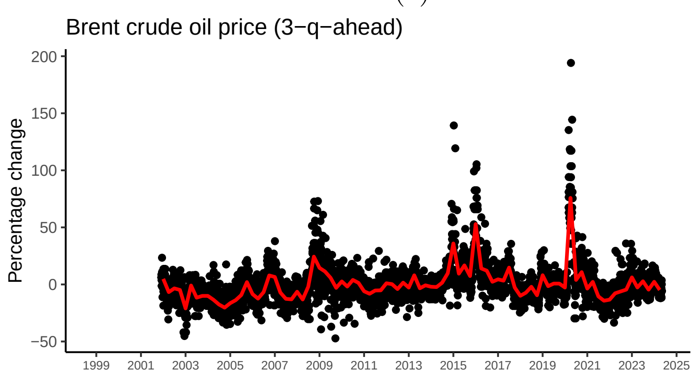
Panel (a): $k = 1$



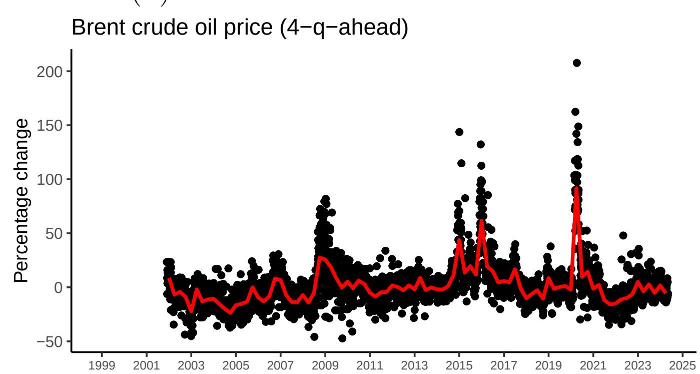
Panel (b): $k = 2$



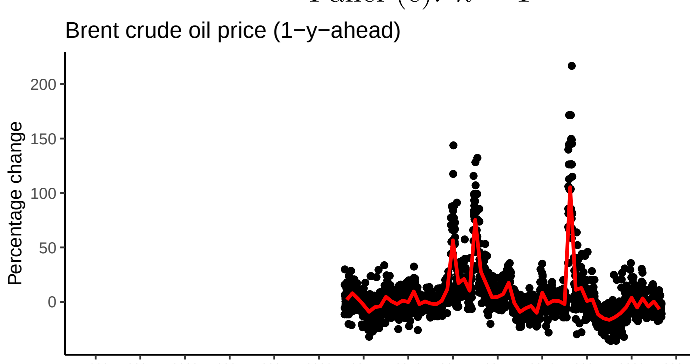
Panel (c): $k = 3$



Panel (d): $k = 4$



Panel (e): $h = 1$



Panel (f): $h = 2$

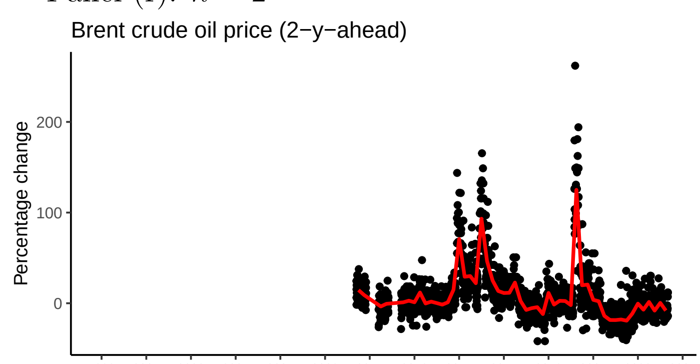


Figure A.4: **Individual USD/EUR exchange rate change expectations**

The plots visualize quarterly forecasts for the USD/EUR exchange rate change for each forecaster (computed as percentage change of the USD/EUR forecast relative to the spot rate on the day the forecast had to be submitted) by the black dots. These are shown for different horizons k (one- to four-quarters-ahead) and h (one- and two-years-ahead) for the period from 2002Q1 to 2024Q2 taken from the ECB Survey of Professional Forecasters. Cross-sectional averages across forecasters are visualized by a red line.

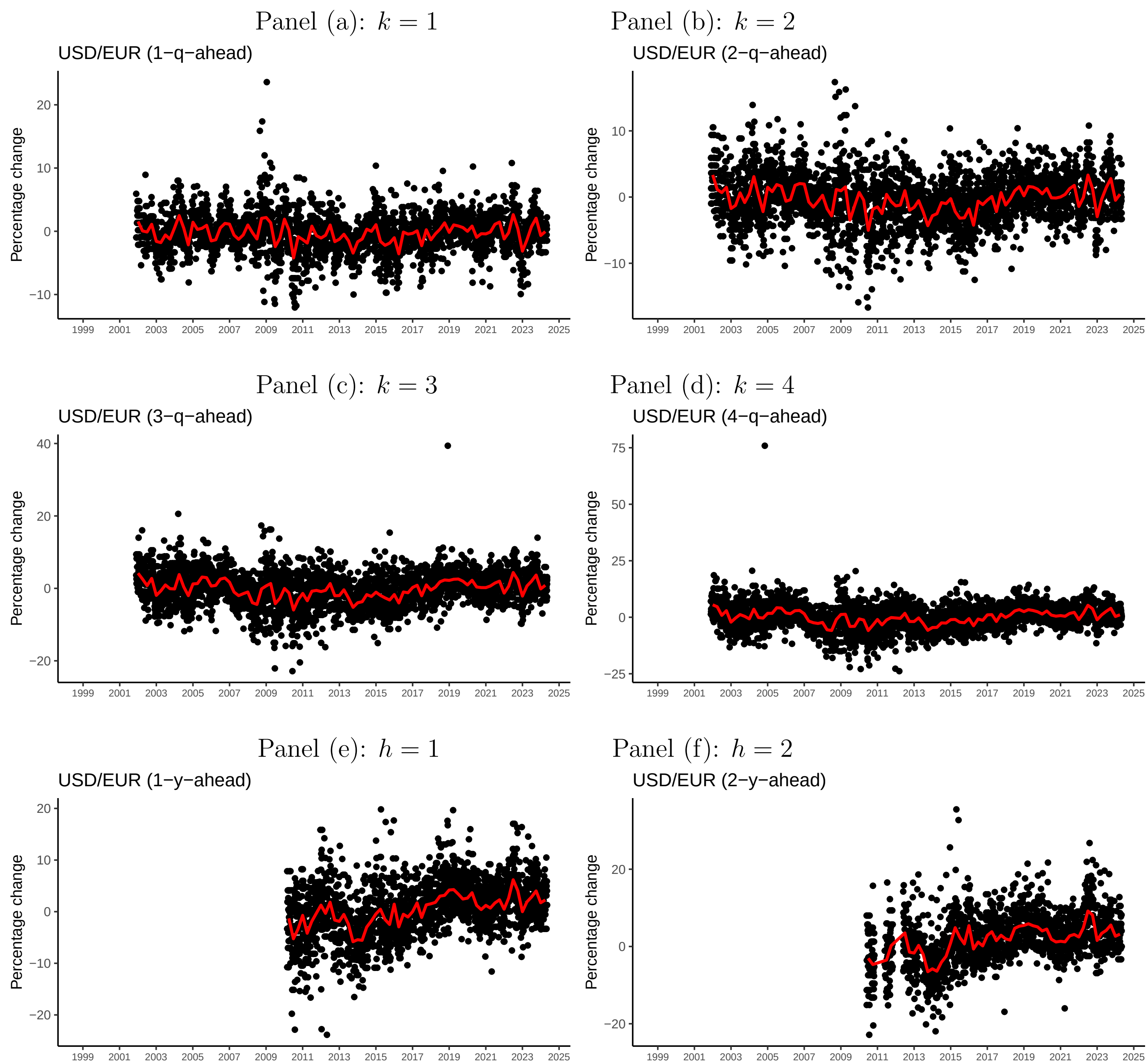


Figure A.5: **Individual unit labor costs change expectations**

The plots visualize quarterly forecasts for the unit labor costs year-on-year rate of change per employee for each forecaster by the black dots. These are shown for different horizons h (current calendar year, next calendar year, calendar year after next, and longer term forecast) for the period from 2004Q3 to 2024Q2 taken from the ECB Survey of Professional Forecasters. Cross-sectional averages across forecasters are visualized by a red line.

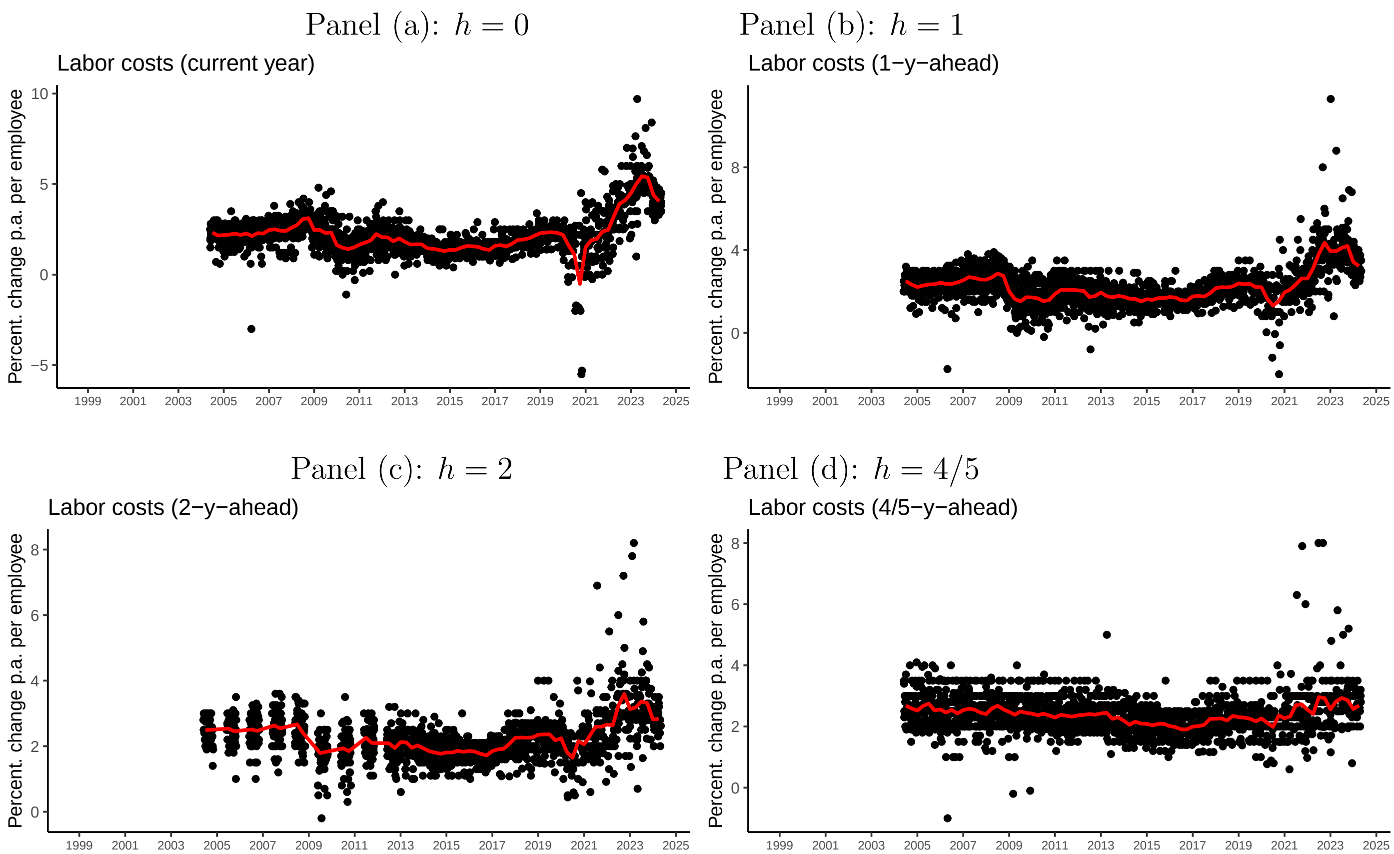
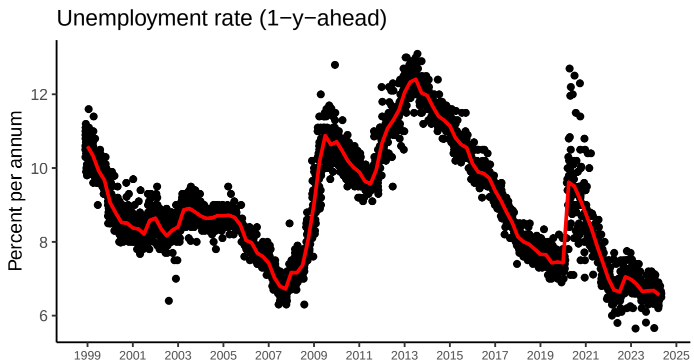


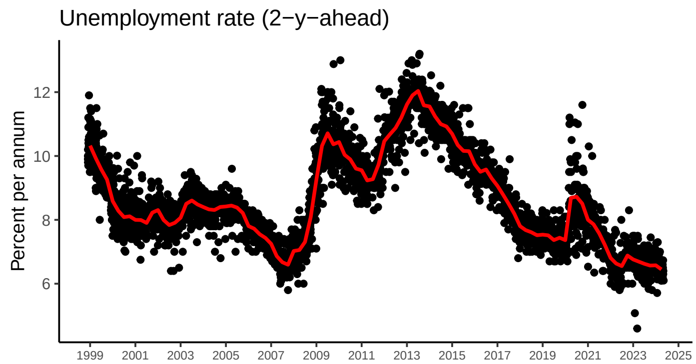
Figure A.6: **Individual unemployment rate expectations**

The plots visualize quarterly forecasts for the unemployment rate for each forecaster by the black dots. These are shown for different horizons h for the period from 1999Q1 to 2024Q2 taken from the ECB Survey of Professional Forecasters. Cross-sectional averages across forecasters are visualized by a red line.

Panel (a): $h = 1$



Panel (b): $h = 2$



Panel (c): $h = 5$

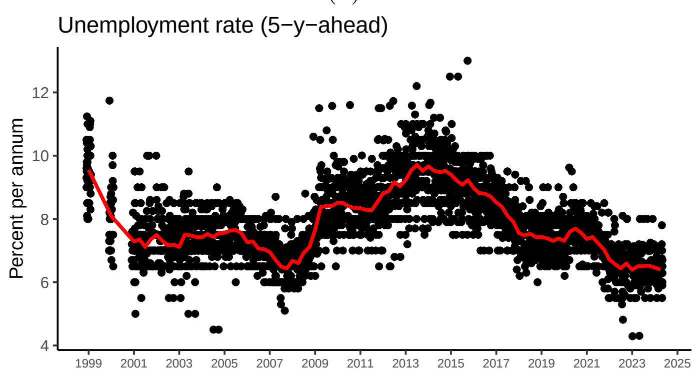


Figure A.7: **Anchoring sub-measures**

The plot visualizes the anchoring sub-measures derived in Section 3.2 on an aggregate cross-sectional mean level for the period from 1999Q1 to 2024Q2.

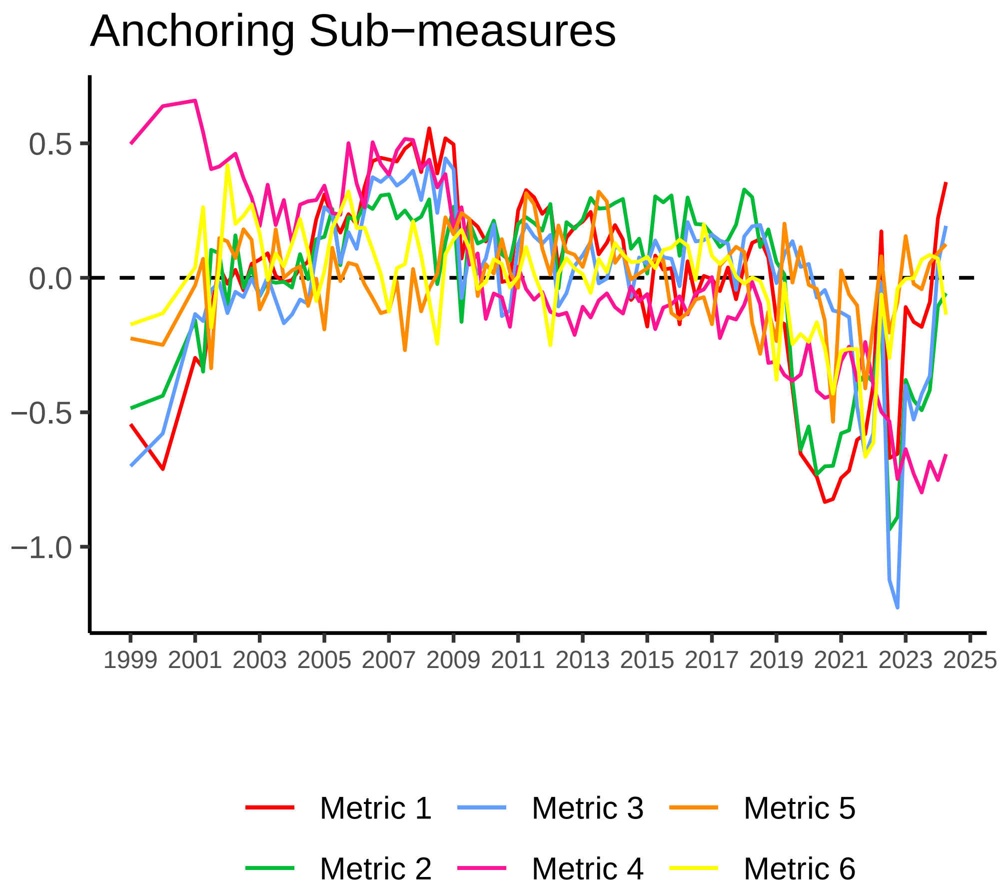


Table A.1: **Anchoring regression results: Sub-measure 1**

	$k=1$	$k=2$	$k=3$	$k=4$	$h=1$	$h=2$
$E_{i,t}(i_{t+k})$	0.2700	0.2616	0.2589	0.2430	0.1735	0.2144
SE	(0.0464)	(0.0471)	(0.0486)	(0.0478)	(0.0714)	(0.1158)
p-value	[0.0000]	[0.0000]	[0.0000]	[0.0000]	[0.0153]	[0.0645]
$E_{i,t}(\Delta op_{t+k})$	0.0034	0.0036	0.0026	0.0011	-0.0007	-0.0021
SE	(0.0036)	(0.0030)	(0.0024)	(0.0021)	(0.0019)	(0.0017)
p-value	[0.3502]	[0.2369]	[0.2718]	[0.5921]	[0.7201]	[0.2183]
$E_{i,t}(\Delta e_{t+k})$	-0.0171	-0.0170	-0.0098	-0.0087	-0.0096	0.0084
SE	(0.0101)	(0.0088)	(0.0068)	(0.0060)	(0.0092)	(0.0086)
p-value	[0.0919]	[0.0533]	[0.1482]	[0.1457]	[0.2981]	[0.3329]
$E_{i,t}(\Delta ulc_{t+k})$	-0.2365	-0.2292	-0.2232	-0.1979	-0.2874	-0.4571
SE	(0.0544)	(0.0546)	(0.0551)	(0.0531)	(0.1073)	(0.1011)
p-value	[0.0000]	[0.0000]	[0.0001]	[0.0002]	[0.0075]	[0.0000]
$E_{i,t}(ur_{t+k})$	0.0115	0.0067	0.0041	0.0019	-0.0117	0.0189
SE	(0.0373)	(0.0379)	(0.0378)	(0.0375)	(0.0367)	(0.0441)
p-value	[0.7575]	[0.8594]	[0.9137]	[0.9601]	[0.7488]	[0.6688]
$E_{i,t}(\pi_{t+k})$	-0.2641	-0.2836	-0.3018	-0.3088	-0.2831	-0.8544
SE	(0.0854)	(0.0919)	(0.0943)	(0.0955)	(0.1086)	(0.3412)
p-value	[0.0020]	[0.0021]	[0.0014]	[0.0013]	[0.0093]	[0.0125]
FE	yes	yes	yes	yes	yes	yes
$\overline{R}^2$	0.3169	0.3158	0.3129	0.3127	0.3146	0.4062
$N \times T$	1361	1360	1358	1351	870	705

Note: The table provides coefficient estimates, heteroskedasticity and autocorrelation robust (HAC) standard errors (SE) according to Driscoll and Kraay (1998), p-values, adjusted R^2s ($\overline{R}^2$) and the number of observations ($N \times T$) for the following regression model:

$$\text{Index}_{1,i,t,h=5} = \beta_1 E_{i,t}(i_{t+k}) + \beta_2 E_{i,t}(\Delta op_{t+k}) + \beta_3 E_{i,t}(\Delta xr_{t+k}) + \beta_4 E_{i,t}(\Delta ulc_{t+k}) + \beta_5 E_{i,t}(ur_{t+k}) + \beta_6 E_{i,t}(\pi_{t+k}) + \xi_i + \varepsilon_{i,t}$$

where $\text{Index}_{1,i,t,h=5}$ measures the degree of anchoring of inflation expectations at period t for forecaster i over a horizon of fve-years-ahead, $E_{i,t}(.)$ stands for expectations made in period t by forecaster i and k refers to a horizon of k-quarters-ahead. i_{t+k} denotes the policy rate of the ECB, i.e., the main refinancing operations rate, Δop_{t+k} represents the percentage change in the Brent crude oil price between t and $t+k$, Δxr_{t+k} gives the percentage change in the USD/EUR exchange rate between t and $t+k$, Δulc_{t+k} is the year-on-year rate of change in unit labor costs per employee, ur_{t+k} stands for the unemployment rate, and π_{t+k} denotes the inflation rate. ξ_i and $\varepsilon_{i,t}$ refer to time-invariant forecaster-specific fixed effects (FE) and idiosyncratic errors, respectively. The regression is conducted for $\text{Index}_{1,i,t,h}$ at the horizon $h=5$ (five-years-ahead) regressed on forecasts for four factors made for four consecutive quarters ($k=1,2,3,4$) as well as the forecast for the next calendar year (annual average, $h=1$) and the calendar year after next (annual average, $h=2$). For Δulc_{t+k} forecasts for four consecutive quarters ($k=1,2,3,4$) are not available but only the forecast for the current calendar year (annual average). The latter is included in each specification for $k=1,2,3,4$. In addition, we also include forecasts for the unemployment rate and the inflation rate, which are not available for k-quarters-ahead but for h-years-ahead with $h=1,2$. For the regression models represented above we always include one-year-ahead forecasts for the unemployment rate and the inflation rate, except for the $h=2$ specification shown in the last column. In the latter case, we use two-years-ahead forecasts.

Table A.2: **Anchoring regression results: Sub-measure 2**

	$k=1$	$k=2$	$k=3$	$k=4$	$h=1$	$h=2$
$E_{i,t}(i_{t+k})$	0.1596	0.1536	0.1519	0.1427	0.0808	0.1038
SE	(0.0566)	(0.0571)	(0.0575)	(0.0557)	(0.0691)	(0.1036)
p-value	[0.0049]	[0.0073]	[0.0084]	[0.0105]	[0.2425]	[0.3168]
$E_{i,t}(\Delta op_{t+k})$	0.0013	0.0034	0.0025	0.0010	-0.0007	-0.0016
SE	(0.0038)	(0.0030)	(0.0024)	(0.0020)	(0.0022)	(0.0020)
p-value	[0.7272]	[0.2509]	[0.2907]	[0.6168]	[0.7481]	[0.4289]
$E_{i,t}(\Delta e_{t+k})$	-0.0223	-0.0213	-0.0108	-0.0080	-0.0081	0.0071
SE	(0.0098)	(0.0100)	(0.0076)	(0.0063)	(0.0096)	(0.0090)
p-value	[0.0231]	[0.0331]	[0.1581]	[0.2048]	[0.4003]	[0.4279]
$E_{i,t}(\Delta ulc_{t+k})$	-0.2357	-0.2341	-0.2313	-0.2192	-0.0837	-0.2357
SE	(0.0578)	(0.0584)	(0.0589)	(0.0568)	(0.1117)	(0.1428)
p-value	[0.0000]	[0.0001]	[0.0001]	[0.0001]	[0.4537]	[0.0994]
$E_{i,t}(ur_{t+k})$	0.0301	0.0244	0.0239	0.0238	0.0406	0.0608
SE	(0.0372)	(0.0373)	(0.0371)	(0.0371)	(0.0432)	(0.0440)
p-value	[0.4174]	[0.5139]	[0.5209]	[0.5221]	[0.3470]	[0.1676]
$E_{i,t}(\pi_{t+k})$	-0.1620	-0.1663	-0.1769	-0.1822	-0.2624	-0.6293
SE	(0.1285)	(0.1324)	(0.1353)	(0.1364)	(0.1604)	(0.4085)
p-value	[0.2076]	[0.2093]	[0.1915]	[0.1817]	[0.1021]	[0.1239]
FE	yes	yes	yes	yes	yes	yes
$\overline{R}^2$	0.4123	0.4133	0.4110	0.4076	0.4082	0.4455
$N \times T$	1361	1360	1358	1351	870	705

Note: The table provides coefficient estimates, heteroskedasticity and autocorrelation robust (HAC) standard errors (SE) according to Driscoll and Kraay (1998), p-values, adjusted R^2s ($\overline{R}^2$) and the number of observations ($N \times T$) for the following regression model:

$$\text{Index}_{2,i,t,h=5} = \beta_1 E_{i,t}(i_{t+k}) + \beta_2 E_{i,t}(\Delta op_{t+k}) + \beta_3 E_{i,t}(\Delta xr_{t+k}) + \beta_4 E_{i,t}(\Delta ulc_{t+k}) + \beta_5 E_{i,t}(ur_{t+k}) + \beta_6 E_{i,t}(\pi_{t+k}) + \xi_i + \varepsilon_{i,t}$$

where $\text{Index}_{2,i,t,h=5}$ measures the degree of anchoring of inflation expectations at period t for forecaster i over a horizon of fve-years-ahead, $E_{i,t}(.)$ stands for expectations made in period t by forecaster i and k refers to a horizon of k-quarters-ahead. i_{t+k} denotes the policy rate of the ECB, i.e., the main refinancing operations rate, Δop_{t+k} represents the percentage change in the Brent crude oil price between t and $t+k$, Δxr_{t+k} gives the percentage change in the USD/EUR exchange rate between t and $t+k$, Δulc_{t+k} is the year-on-year rate of change in unit labor costs per employee, ur_{t+k} stands for the unemployment rate, and π_{t+k} denotes the inflation rate. ξ_i and $\varepsilon_{i,t}$ refer to time-invariant forecaster-specific fixed effects (FE) and idiosyncratic errors, respectively. The regression is conducted for $\text{Index}_{2,i,t,h}$ at the horizon $h=5$ (five-years-ahead) regressed on forecasts for four factors made for four consecutive quarters ($k=1,2,3,4$) as well as the forecast for the next calendar year (annual average, $h=1$) and the calendar year after next (annual average, $h=2$). For Δulc_{t+k} forecasts for four consecutive quarters ($k=1,2,3,4$) are not available but only the forecast for the current calendar year (annual average). The latter is included in each specification for $k=1,2,3,4$. In addition, we also include forecasts for the unemployment rate and the inflation rate, which are not available for k-quarters-ahead but for h-years-ahead with $h=1,2$. For the regression models represented above we always include one-year-ahead forecasts for the unemployment rate and the inflation rate, except for the $h=2$ specification shown in the last column. In the latter case, we use two-years-ahead forecasts.

Table A.3: **Anchoring regression results: Sub-measure 3**

	$k=1$	$k=2$	$k=3$	$k=4$	$h=1$	$h=2$
$E_{i,t}(i_{t+k})$	0.1492	0.1484	0.1464	0.1356	0.0951	0.1293
SE	(0.0538)	(0.0551)	(0.0572)	(0.0572)	(0.0909)	(0.1332)
p-value	[0.0056]	[0.0071]	[0.0106]	[0.0179]	[0.2958]	[0.3322]
$E_{i,t}(\Delta op_{t+k})$	0.0083	0.0073	0.0060	0.0038	0.0019	-0.0002
SE	(0.0037)	(0.0032)	(0.0024)	(0.0018)	(0.0020)	(0.0016)
p-value	[0.0263]	[0.0203]	[0.0134]	[0.0365]	[0.3444]	[0.9058]
$E_{i,t}(\Delta e_{t+k})$	-0.0109	-0.0073	-0.0020	0.0003	0.0076	0.0158
SE	(0.0107)	(0.0089)	(0.0065)	(0.0057)	(0.0081)	(0.0106)
p-value	[0.3087]	[0.4143]	[0.7558]	[0.9645]	[0.3508]	[0.1368]
$E_{i,t}(\Delta ulc_{t+k})$	-0.2014	-0.1999	-0.1959	-0.1809	-0.3153	-0.4927
SE	(0.0680)	(0.0682)	(0.0681)	(0.0646)	(0.1330)	(0.1157)
p-value	[0.0031]	[0.0034]	[0.0041]	[0.0052]	[0.0180]	[0.0000]
$E_{i,t}(ur_{t+k})$	-0.0720	-0.0755	-0.0786	-0.0786	-0.0827	-0.0445
SE	(0.0280)	(0.0289)	(0.0296)	(0.0299)	(0.0302)	(0.0405)
p-value	[0.0103]	[0.0092]	[0.0080]	[0.0086]	[0.0063]	[0.2732]
$E_{i,t}(\pi_{t+k})$	-0.3745	-0.3825	-0.3920	-0.3965	-0.3600	-0.9505
SE	(0.0904)	(0.0933)	(0.0957)	(0.0977)	(0.1227)	(0.3525)
p-value	[0.0000]	[0.0000]	[0.0000]	[0.0001]	[0.0034]	[0.0072]
FE	yes	yes	yes	yes	yes	yes
$\overline{R}^2$	0.3566	0.3558	0.3549	0.3513	0.3835	0.4753
$N \times T$	1361	1360	1358	1351	870	705

Note: The table provides coefficient estimates, heteroskedasticity and autocorrelation robust (HAC) standard errors (SE) according to Driscoll and Kraay (1998), p-values, adjusted R^2s ($\overline{R}^2$) and the number of observations ($N \times T$) for the following regression model:

$$\text{Index}_{3,i,t,h=5} = \beta_1 E_{i,t}(i_{t+k}) + \beta_2 E_{i,t}(\Delta op_{t+k}) + \beta_3 E_{i,t}(\Delta xr_{t+k}) + \beta_4 E_{i,t}(\Delta ulc_{t+k}) + \beta_5 E_{i,t}(ur_{t+k}) + \beta_6 E_{i,t}(\pi_{t+k}) + \xi_i + \varepsilon_{i,t}$$

where $\text{Index}_{3,i,t,h=5}$ measures the degree of anchoring of inflation expectations at period t for forecaster i over a horizon of fve-years-ahead, $E_{i,t}(.)$ stands for expectations made in period t by forecaster i and k refers to a horizon of k-quarters-ahead. i_{t+k} denotes the policy rate of the ECB, i.e., the main refinancing operations rate, Δop_{t+k} represents the percentage change in the Brent crude oil price between t and $t+k$, Δxr_{t+k} gives the percentage change in the USD/EUR exchange rate between t and $t+k$, Δulc_{t+k} is the year-on-year rate of change in unit labor costs per employee, ur_{t+k} stands for the unemployment rate, and π_{t+k} denotes the inflation rate. ξ_i and $\varepsilon_{i,t}$ refer to time-invariant forecaster-specific fixed effects (FE) and idiosyncratic errors, respectively. The regression is conducted for $\text{Index}_{3,i,t,h}$ at the horizon $h=5$ (five-years-ahead) regressed on forecasts for four factors made for four consecutive quarters ($k=1,2,3,4$) as well as the forecast for the next calendar year (annual average, $h=1$) and the calendar year after next (annual average, $h=2$). For Δulc_{t+k} forecasts for four consecutive quarters ($k=1,2,3,4$) are not available but only the forecast for the current calendar year (annual average). The latter is included in each specification for $k=1,2,3,4$. In addition, we also include forecasts for the unemployment rate and the inflation rate, which are not available for k-quarters-ahead but for h-years-ahead with $h=1,2$. For the regression models represented above we always include one-year-ahead forecasts for the unemployment rate and the inflation rate, except for the $h=2$ specification shown in the last column. In the latter case, we use two-years-ahead forecasts.

Table A.4: **Anchoring regression results: Sub-measure 4**

	$k=1$	$k=2$	$k=3$	$k=4$	$h=1$	$h=2$
$E_{i,t}(i_{t+k})$	0.0594	0.0497	0.0485	0.0388	-0.1038	-0.1360
SE	(0.0293)	(0.0286)	(0.0278)	(0.0272)	(0.0315)	(0.0411)
p-value	[0.0433]	[0.0826]	[0.0813]	[0.1536]	[0.0010]	[0.0010]
$E_{i,t}(\Delta op_{t+k})$	-0.0012	-0.0024	-0.0021	-0.0020	-0.0027	-0.0016
SE	(0.0012)	(0.0014)	(0.0013)	(0.0012)	(0.0007)	(0.0006)
p-value	[0.3152]	[0.0888]	[0.1057]	[0.0985]	[0.0002]	[0.0097]
$E_{i,t}(\Delta e_{t+k})$	0.0109	0.0066	0.0036	-0.0031	-0.0015	-0.0088
SE	(0.0076)	(0.0053)	(0.0049)	(0.0047)	(0.0052)	(0.0042)
p-value	[0.1531]	[0.2105]	[0.4632]	[0.5094]	[0.7695]	[0.0356]
$E_{i,t}(\Delta ulc_{t+k})$	-0.0296	-0.0203	-0.0180	-0.0144	0.0430	0.1026
SE	(0.0439)	(0.0437)	(0.0438)	(0.0431)	(0.0410)	(0.0660)
p-value	[0.5002]	[0.6423]	[0.6814]	[0.7389]	[0.2946]	[0.1204]
$E_{i,t}(ur_{t+k})$	-0.0267	-0.0261	-0.0272	-0.0324	0.0350	0.0390
SE	(0.0155)	(0.0156)	(0.0156)	(0.0160)	(0.0113)	(0.0098)
p-value	[0.0846]	[0.0952]	[0.0820]	[0.0425]	[0.0021]	[0.0001]
$E_{i,t}(\pi_{t+k})$	-0.0541	-0.0641	-0.0694	-0.0670	-0.0061	0.0939
SE	(0.0440)	(0.0462)	(0.0474)	(0.0471)	(0.0358)	(0.0780)
p-value	[0.2191]	[0.1657]	[0.1434]	[0.1552]	[0.8655]	[0.2292]
FE	yes	yes	yes	yes	yes	yes
$\overline{R}^2$	0.7058	0.7060	0.7061	0.7067	0.7716	0.7931
$N \times T$	1361	1360	1358	1351	870	705

Note: The table provides coefficient estimates, heteroskedasticity and autocorrelation robust (HAC) standard errors (SE) according to Driscoll and Kraay (1998), p-values, adjusted R^2s ($\overline{R}^2$) and the number of observations ($N \times T$) for the following regression model:

$$\text{Index}_{4,i,t,h=5} = \beta_1 E_{i,t}(i_{t+k}) + \beta_2 E_{i,t}(\Delta op_{t+k}) + \beta_3 E_{i,t}(\Delta xr_{t+k}) + \beta_4 E_{i,t}(\Delta ulc_{t+k}) + \beta_5 E_{i,t}(ur_{t+k}) + \beta_6 E_{i,t}(\pi_{t+k}) + \xi_i + \varepsilon_{i,t}$$

where $\text{Index}_{4,i,t,h=5}$ measures the degree of anchoring of inflation expectations at period t for forecaster i over a horizon of fve-years-ahead, $E_{i,t}(.)$ stands for expectations made in period t by forecaster i and k refers to a horizon of k-quarters-ahead. i_{t+k} denotes the policy rate of the ECB, i.e., the main refinancing operations rate, Δop_{t+k} represents the percentage change in the Brent crude oil price between t and $t+k$, Δxr_{t+k} gives the percentage change in the USD/EUR exchange rate between t and $t+k$, Δulc_{t+k} is the year-on-year rate of change in unit labor costs per employee, ur_{t+k} stands for the unemployment rate, and π_{t+k} denotes the inflation rate. ξ_i and $\varepsilon_{i,t}$ refer to time-invariant forecaster-specific fixed effects (FE) and idiosyncratic errors, respectively. The regression is conducted for $\text{Index}_{4,i,t,h}$ at the horizon $h=5$ (five-years-ahead) regressed on forecasts for four factors made for four consecutive quarters ($k=1,2,3,4$) as well as the forecast for the next calendar year (annual average, $h=1$) and the calendar year after next (annual average, $h=2$). For Δulc_{t+k} forecasts for four consecutive quarters ($k=1,2,3,4$) are not available but only the forecast for the current calendar year (annual average). The latter is included in each specification for $k=1,2,3,4$. In addition, we also include forecasts for the unemployment rate and the inflation rate, which are not available for k-quarters-ahead but for h-years-ahead with $h=1,2$. For the regression models represented above we always include one-year-ahead forecasts for the unemployment rate and the inflation rate, except for the $h=2$ specification shown in the last column. In the latter case, we use two-years-ahead forecasts.

Table A.5: **Anchoring regression results: Sub-measure 5**

	$k=1$	$k=2$	$k=3$	$k=4$	$h=1$	$h=2$
$E_{i,t}(i_{t+k})$	0.0537	0.0607	0.0647	0.0622	0.1043	0.1393
SE	(0.0411)	(0.0420)	(0.0445)	(0.0457)	(0.0644)	(0.1102)
p-value	[0.1915]	[0.1489]	[0.1459]	[0.1737]	[0.1055]	[0.2064]
$E_{i,t}(\Delta op_{t+k})$	0.0035	0.0030	0.0027	0.0017	0.0007	-0.0014
SE	(0.0024)	(0.0022)	(0.0018)	(0.0014)	(0.0014)	(0.0013)
p-value	[0.1553]	[0.1775]	[0.1279]	[0.2356]	[0.6304]	[0.2751]
$E_{i,t}(\Delta e_{t+k})$	0.0124	0.0103	0.0129	0.0130	0.0120	0.0189
SE	(0.0092)	(0.0067)	(0.0053)	(0.0050)	(0.0079)	(0.0104)
p-value	[0.1795]	[0.1249]	[0.0144]	[0.0090]	[0.1310]	[0.0710]
$E_{i,t}(\Delta ulc_{t+k})$	-0.1186	-0.1186	-0.1182	-0.1072	-0.1589	-0.2131
SE	(0.0674)	(0.0665)	(0.0664)	(0.0630)	(0.0918)	(0.1079)
p-value	[0.0786]	[0.0747]	[0.0750]	[0.0893]	[0.0837]	[0.0487]
$E_{i,t}(ur_{t+k})$	0.0099	0.0091	0.0115	0.0123	-0.0130	0.0158
SE	(0.0239)	(0.0243)	(0.0246)	(0.0244)	(0.0318)	(0.0383)
p-value	[0.6784]	[0.7094]	[0.6400]	[0.6136]	[0.6828]	[0.6803]
$E_{i,t}(\pi_{t+k})$	-0.0255	-0.0347	-0.0398	-0.0460	-0.0640	-0.4355
SE	(0.0728)	(0.0740)	(0.0754)	(0.0773)	(0.1092)	(0.3408)
p-value	[0.7267]	[0.6394]	[0.5975]	[0.5517]	[0.5577]	[0.2017]
FE	yes	yes	yes	yes	yes	yes
$\overline{R}^2$	0.0860	0.0874	0.0899	0.0894	0.1120	0.1683
$N \times T$	1361	1360	1358	1351	870	705

Note: The table provides coefficient estimates, heteroskedasticity and autocorrelation robust (HAC) standard errors (SE) according to Driscoll and Kraay (1998), p-values, adjusted R^2s ($\overline{R}^2$) and the number of observations ($N \times T$) for the following regression model:

$$\text{Index}_{5,i,t,h=5} = \beta_1 E_{i,t}(i_{t+k}) + \beta_2 E_{i,t}(\Delta op_{t+k}) + \beta_3 E_{i,t}(\Delta xr_{t+k}) + \beta_4 E_{i,t}(\Delta ulc_{t+k}) + \beta_5 E_{i,t}(ur_{t+k}) + \beta_6 E_{i,t}(\pi_{t+k}) + \xi_i + \varepsilon_{i,t}$$

where $\text{Index}_{5,i,t,h=5}$ measures the degree of anchoring of inflation expectations at period t for forecaster i over a horizon of fve-years-ahead, $E_{i,t}(.)$ stands for expectations made in period t by forecaster i and k refers to a horizon of k-quarters-ahead. i_{t+k} denotes the policy rate of the ECB, i.e., the main refinancing operations rate, Δop_{t+k} represents the percentage change in the Brent crude oil price between t and $t+k$, Δxr_{t+k} gives the percentage change in the USD/EUR exchange rate between t and $t+k$, Δulc_{t+k} is the year-on-year rate of change in unit labor costs per employee, ur_{t+k} stands for the unemployment rate, and π_{t+k} denotes the inflation rate. ξ_i and $\varepsilon_{i,t}$ refer to time-invariant forecaster-specific fixed effects (FE) and idiosyncratic errors, respectively. The regression is conducted for $\text{Index}_{5,i,t,h}$ at the horizon $h=5$ (five-years-ahead) regressed on forecasts for four factors made for four consecutive quarters ($k=1,2,3,4$) as well as the forecast for the next calendar year (annual average, $h=1$) and the calendar year after next (annual average, $h=2$). For Δulc_{t+k} forecasts for four consecutive quarters ($k=1,2,3,4$) are not available but only the forecast for the current calendar year (annual average). The latter is included in each specification for $k=1,2,3,4$. In addition, we also include forecasts for the unemployment rate and the inflation rate, which are not available for k-quarters-ahead but for h-years-ahead with $h=1,2$. For the regression models represented above we always include one-year-ahead forecasts for the unemployment rate and the inflation rate, except for the $h=2$ specification shown in the last column. In the latter case, we use two-years-ahead forecasts.

Table A.6: **Anchoring regression results: Sub-measure 6**

	$k=1$	$k=2$	$k=3$	$k=4$	$h=1$	$h=2$
$E_{i,t}(i_{t+k})$	0.0940	0.0995	0.1037	0.1064	0.1293	0.2294
SE	(0.0515)	(0.0541)	(0.0583)	(0.0602)	(0.0761)	(0.1422)
p-value	[0.0683]	[0.0664]	[0.0757]	[0.0774]	[0.0898]	[0.1072]
$E_{i,t}(\Delta op_{t+k})$	0.0035	0.0033	0.0029	0.0023	0.0020	0.0007
SE	(0.0029)	(0.0023)	(0.0018)	(0.0014)	(0.0013)	(0.0012)
p-value	[0.2349]	[0.1474]	[0.1148]	[0.1026]	[0.1314]	[0.5784]
$E_{i,t}(\Delta e_{t+k})$	-0.0014	-0.0019	0.0025	0.0069	0.0064	0.0149
SE	(0.0066)	(0.0054)	(0.0046)	(0.0056)	(0.0085)	(0.0137)
p-value	[0.8280]	[0.7327]	[0.5915]	[0.2171]	[0.4500]	[0.2771]
$E_{i,t}(\Delta ulc_{t+k})$	-0.1207	-0.1221	-0.1215	-0.1166	-0.0641	-0.1148
SE	(0.0723)	(0.0721)	(0.0724)	(0.0688)	(0.0962)	(0.1047)
p-value	[0.0954]	[0.0905]	[0.0937]	[0.0902]	[0.5056]	[0.2736]
$E_{i,t}(ur_{t+k})$	0.0098	0.0082	0.0099	0.0118	0.0142	0.0421
SE	(0.0217)	(0.0221)	(0.0240)	(0.0252)	(0.0274)	(0.0392)
p-value	[0.6506]	[0.7118]	[0.6790]	[0.6414]	[0.6058]	[0.2834]
$E_{i,t}(\pi_{t+k})$	-0.0433	-0.0527	-0.0596	-0.0670	-0.1229	-0.5359
SE	(0.0664)	(0.0681)	(0.0706)	(0.0728)	(0.0964)	(0.3832)
p-value	[0.5146]	[0.4392]	[0.3989]	[0.3575]	[0.2025]	[0.1625]
FE	yes	yes	yes	yes	yes	yes
$\overline{R}^2$	0.2229	0.2233	0.2228	0.2194	0.1910	0.2446
$N \times T$	1361	1360	1358	1351	870	705

Note: The table provides coefficient estimates, heteroskedasticity and autocorrelation robust (HAC) standard errors (SE) according to Driscoll and Kraay (1998), p-values, adjusted R^2s ($\overline{R}^2$) and the number of observations ($N \times T$) for the following regression model:

$$\text{Index}_{6,i,t,h=5} = \beta_1 E_{i,t}(i_{t+k}) + \beta_2 E_{i,t}(\Delta op_{t+k}) + \beta_3 E_{i,t}(\Delta xr_{t+k}) + \beta_4 E_{i,t}(\Delta ulc_{t+k}) + \beta_5 E_{i,t}(ur_{t+k}) + \beta_6 E_{i,t}(\pi_{t+k}) + \xi_i + \varepsilon_{i,t}$$

where $\text{Index}_{6,i,t,h=5}$ measures the degree of anchoring of inflation expectations at period t for forecaster i over a horizon of fve-years-ahead, $E_{i,t}(.)$ stands for expectations made in period t by forecaster i and k refers to a horizon of k-quarters-ahead. i_{t+k} denotes the policy rate of the ECB, i.e., the main refinancing operations rate, Δop_{t+k} represents the percentage change in the Brent crude oil price between t and $t+k$, Δxr_{t+k} gives the percentage change in the USD/EUR exchange rate between t and $t+k$, Δulc_{t+k} is the year-on-year rate of change in unit labor costs per employee, ur_{t+k} stands for the unemployment rate, and π_{t+k} denotes the inflation rate. ξ_i and $\varepsilon_{i,t}$ refer to time-invariant forecaster-specific fixed effects (FE) and idiosyncratic errors, respectively. The regression is conducted for $\text{Index}_{6,i,t,h}$ at the horizon $h=5$ (five-years-ahead) regressed on forecasts for four factors made for four consecutive quarters ($k=1,2,3,4$) as well as the forecast for the next calendar year (annual average, $h=1$) and the calendar year after next (annual average, $h=2$). For Δluc_{t+k} forecasts for four consecutive quarters ($k=1,2,3,4$) are not available but only the forecast for the current calendar year (annual average). The latter is included in each specification for $k=1,2,3,4$. In addition, we also include forecasts for the unemployment rate and the inflation rate, which are not available for k-quarters-ahead but for h-years-ahead with $h=1,2$. For the regression models represented above we always include one-year-ahead forecasts for the unemployment rate and the inflation rate, except for the $h=2$ specification shown in the last column. In the latter case, we use two-years-ahead forecasts.