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OUT OF THE ELB:
EXPECTED ECB POLICY RATES AND THE TAYLOR RULE

by Marco Bernardini* and Alessandro Lin*

Abstract

We compare the path of the ECB policy rate (deposit facility rate) expected by financial market analysts with simple monetary policy rules based on their own expectations regarding inflation and the economic activity. To this end, we adopt a thick-modelling approach to account for uncertainty surrounding the exact parametrization of the rule according to analysts. We show that, since the ECB monetary policy moved away from the effective lower bound (ELB) and stopped providing explicit forward guidance on the future path of the policy rate, policy rate expectations have become largely aligned with those implied by the rules. We also document three additional findings. First, growing perceptions of downward demand-side risks since spring 2023 have been associated with an adjustment of analysts' rate expectations to slightly-below rule-implied rates. Second, the significant and continuous upward revisions of expected ECB rates observed during the 2022-23 rate hiking cycle have mainly resulted from upward revisions of expected inflation and expectations of a higher long-run policy rate. Third, analysts' rate expectations appear to be shaped more by expectations regarding core inflation rather than those of headline inflation.

JEL Classification: E52, E40.
Keywords: monetary policy rules, expectations, ECB's survey of monetary analysts, effective lower bound.

Contents

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1. Introduction[1]

Interest rate rules are simple formulas that relate the level of the monetary policy rate to measures of inflation and economic activity. The most prominent example is the so-called Taylor rule (Taylor, 1993), which postulates that the policy rate reacts positively to the deviations of current inflation from target (more than one-to-one according to the so-called "Taylor principle") and is negatively associated with measures of current economic slack. Over time, several refinements have been introduced to deal with specific issues (e.g., the presence of history-dependence or inertia and the effective lower bound), which have led to a vast literature.

While central banks do not mechanically follow any specific rule, interest rate rules are regularly consulted by central banks[2] and used by scholars to describe how the central bank sets its policy rate. Two main reasons can explain their attractiveness. First, they are explicit and simple in their formulations, which make them a type of benchmark that is relatively easy to communicate, to interpret, and to study through the lenses of macroeconomic models. Second, they have proved to perform well in tracking the historical evolution of official policy rates,[3] which makes them good candidates when forming forecasts about their evolution.

In this paper, we study to what extent financial analysts follow the simple logic of the Taylor rule to form their policy rate expectations. Understanding this process is key for monetary policy. The expected path of the policy rate is in fact a key driver of long-term interest rates, which in turn influence spending and investment decisions of firms, households, and governments, and ultimately economic activity and inflation. In this respect, a large majority of macroeconomic models implicitly assume that, when the policy rate is not constrained by its effective lower bound (ELB), private agents form their policy rate expectations by simply applying the logic of the Taylor rule to expected inflation and economic activity. To verify to what extent this assumption holds in the data, and in particular among financial experts, we use the results of the ECB's Survey of Monetary Analysts (SMA) over the period 2021-23 to compare participants' expected path of the ECB policy rate (*expected path*) at different horizons with the path implied by simple Taylor rules based on the corresponding expectations on key macroeconomic variables (*rule-implied path*). The rule-implied paths are calibrated considering a large range of parameter values (equally weighted and centred around standard textbook values), which yields a wide set of possible rules (15129).

We document four main findings. First, we show that since June 2022, when the Governing Council of the ECB announced its intention to raise the policy rate above the ELB and stopped providing explicit guidance on future policy intentions, the expected path increased and became remarkably aligned with the rule-implied path. Second, growing perceived risks of negative demand shock since spring 2023, initially amplified by fears about financial stability linked to the bank failures in the United States and Switzerland, have been associated with an adjustment of analysts' rate expectations

[1] The views expressed in this paper are those of the authors and do not necessarily reflect those of Banca d'Italia or the Eurosystem. We benefited from useful comments and inputs by Martina Cecioni, Giuseppe Ferrero, Stefano Neri, and Alessandro Secchi. We thank Lara D'Arrigo and Ivano Galli for assistance with the data.

[2] See for instance "Principles for the Conduct of Monetary Policy" and "Policy Rules and How Policymakers Use Them" on the Fed Board's website.

[3] See for instance Taylor (1999), Blattner, and Margaritov (2010), and Bernanke (2015). This statement of course applies to periods in which the policy rate was not constrained by its effective lower bound.

slightly below rule-implied rates. Third, the significant and continuous upward revisions of expected rates observed during the 2022-23 rate hiking cycle have mainly resulted from upward revisions of expected inflation and expectations of a higher long-run rate. Finally, analysts' rate expectations appear to be shaped more by expectations on core inflation rather than those on headline inflation.

The remainder of the paper is structured as follows. In the next section we describe how we construct the rule-implied paths. Section 3 compares expected and rule-implied rates over the period 2021-23. Section 4 analyses the drivers of the significant and continuous revisions in ECB rate expectations observed during the 2022-23 rate hiking cycle. Section 5 discusses four alternative interest rate rules. Section 6 concludes.

2. Survey-based thick-modelling approach

We consider a generalized specification that nests several policy rate rules proposed in the literature. In particular, we focus on the following "inertial" rule:

$$i_t^R = \rho i_{t-1} + (1-\rho)[i^* + \phi_\pi(\pi_t - \bar{\pi}) + \phi_x(x_t - x^*)], \tag{1}$$

where t denotes the current quarter, i^R is the (end of quarter) policy rate implied by the rule, i is the (end of quarter) realized policy rate, i^* is the long-run equilibrium (nominal) rate, π is the inflation rate, $\bar{\pi}$ is the inflation target of the ECB, and x is a measure of economic activity with long-run value x^*. Three parameters complete the rule. First, ϕ_π governs the reactivity of monetary policy to the inflation gap: the higher its value the more aggressive the reaction of the policy rate to deviations of inflation from its target.[4] Second, ϕ_x disciplines the reaction of the policy rate to the economic activity gap (such as the output gap or *minus* the unemployment gap) and the relative sensitivity of the central bank to different shocks: for a given value of ϕ_π, the higher its value the stronger the reaction to demand disturbances (which move the gaps in the same direction) as opposed to supply ones (which move the gaps in opposite directions). Finally, ρ governs the interest rule's inertia or backward sluggishness. In Section 5 we also consider alternative specifications among which forward-looking rules (i.e., rules in which inflation and economic activity do not enter contemporaneously but with a lead) and first-difference rules (i.e., simple rules that do not rely on long-run equilibrium values).

To assess to what extent analysts form their rate expectations consistently with a Taylor rule logic, we project the rule in equation (1) over a 2-year horizon. That is, for each survey round we iterate the expression in equation (1) forward as follows:

$$E_s i_{t+h}^R = \rho E_s i_{t+h-1}^R + (1-\rho)[E_s i^* + \phi_\pi(E_s \pi_{t+h} - \bar{\pi}) + \phi_x(E_s x_{t+h} - E_s x^*)], \tag{2}$$

with $h = 0, \dots, 8$, and $E_s i_{t-1}^R = i_{t-1}$[5], where E_s is the expectation operator as of survey round s.

[4] The reactivity to inflation is also the main topic of Cuciniello (2023). He uses financial markets data on inflation linked swaps around HICP data releases to show a significant increase (since 2022) in the ECB's responsiveness to inflation as perceived by markets.

[5] Notice that over the projection horizon (i.e., for $h > 0$) the imputed lagged policy rate is the one prescribed by the rule itself in the previous quarter. An alternative approach would be to use the one expected by analysts. This would however mechanically improve the matching and make little sense in light on the main question in this work.

We proxy the variables in equation (2) using the ECB's SMA. Since April 2019, the SMA is conducted 8 times a year, in the weeks preceding the monetary policy meetings of the ECB Governing Council. Following a two-year pilot phase, aggregate survey results have been regularly published on the ECB's website since June 2021.[6] Among other questions, financial analysts that participate in the survey are asked about their expectations on policy rates, headline and core inflation, unemployment rate, and real GDP growth. Table 1 describes how the variables reported in equation (2) are measured using the ECB's SMA.

Table 1. Specification of the Taylor rule: a survey-based approach

	Variable	Object
$E_s i^R_{t+h}$	ECB's deposit facility rate (DFR)	rule-implied policy rate
i_{t-1}		last official rate in the quarter prior to survey quarter
$E_s i^*$		median long-run expectation from the ECB's SMA
$E_s \pi_{t+h}$	euro-area core-HICP inflation	median h-quarter ahead expectation from the ECB's SMA
$\bar{\pi}$		set to 2%
$E_s x_{t+h}$	euro-area unemployment rate (multiplied by the Okun factor[7])	median *h*-quarter ahead expectation from the ECB's SMA
$E_s x^*$		median long-run expectation from the ECB's SMA

Notes: the table summarises how the variables in equation (2) are measured.

We measure i with the median expected deposit facility rate (DFR), π with the median expected core-HICP inflation rate and x with the median expected unemployment rate.[7] Core inflation is chosen because of its tendency to be a better indicator of future headline inflation than current headline itself and, therefore, to be more consistent with the medium-term orientation of the ECB (on this see also Section 5). We choose the unemployment gap over the real GDP growth gap because the former provides a more direct measure of economic slack than the latter. Long-run equilibrium values are proxied by long-run expectations, which – as defined in the SMA – refer to the horizon over which the effects of all shocks are vanished and, as a result, the economy is in equilibrium. The inflation target $\bar{\pi}$ is set to 2% (on this see also Section 5).

We calibrate the parameters in equation (2) using a large range of values. We compute a wide set of possible rules (15129 in total) by considering equally weighted and evenly spaced parameter values. The calibration is summarised in Table 2. The parameters are centred around standard textbook values. ϕ_π is set to be between 1 and 2, while ϕ_x is chosen between 0 and 1. The degree of inertia ρ is set between 0.75 and 0.95.[8]

[6] See Brand and Hutchinson (2022) for an introduction to the ECB's SMA.

[7] The unemployment rate gap is pre-multiplied by a factor equal to $-2.5 = -1/0.4$. The 0.4 coefficient is based on the most recent estimate of the Okun coefficient for the euro area provided by Foroni and Furlanetto (2022).

[8] This is justified by the empirical finding that rules with inertia track historical movement in policy rates much more closely than rules without it (Erceg et al., 2012). In addition to be more realistic from an empirical viewpoint, inertial rules are also found to be close to optimal in forward-looking theoretical models (see for instance Woodford, 2003).

Table 2. Calibration of the Taylor rule: a thick-modelling approach

	Parameter	TR benchmark	Min value	Max value	Step value
$\boldsymbol{\rho}$	degree of inertia	0.85	0.75	0.95	0.025
$\boldsymbol{\phi_\pi}$	reaction to the inflation gap	1.50	1.00	2.00	0.025
$\boldsymbol{\phi_x}$	reaction to the resource gap	0.50	0.00	1.00	0.025

Notes: the table summarises the range of parameters used to compute equation (2). The combinations of all the possible parameters gives us a total of 15129 rules.

Our survey-based thick-modelling approach for the calibration of the Taylor rule provides five key advantages over alternative approaches. First, it considers explicitly the parameter uncertainty surrounding the exact specification of the rule and implicitly allows for the possibility of time-variation in the parameters. Second, the model is internally consistent as all data refer to a homogeneous group of agents characterized by a high degree of sophistication and with access to a large amount of information. Third, only information available shortly before the meeting of the ECB Governing Council is used. This provides robustness over the use of realized data, which are typically published with a substantial time lag and subject to revisions. Fourth, the analysis is not confounded by the presence of risk premia, as it would be the case using financial market data. Fifth, the long-run equilibrium ("star") values are not assumed to be constant over time.[9]

3. Comparison between expected and rule-implied rates

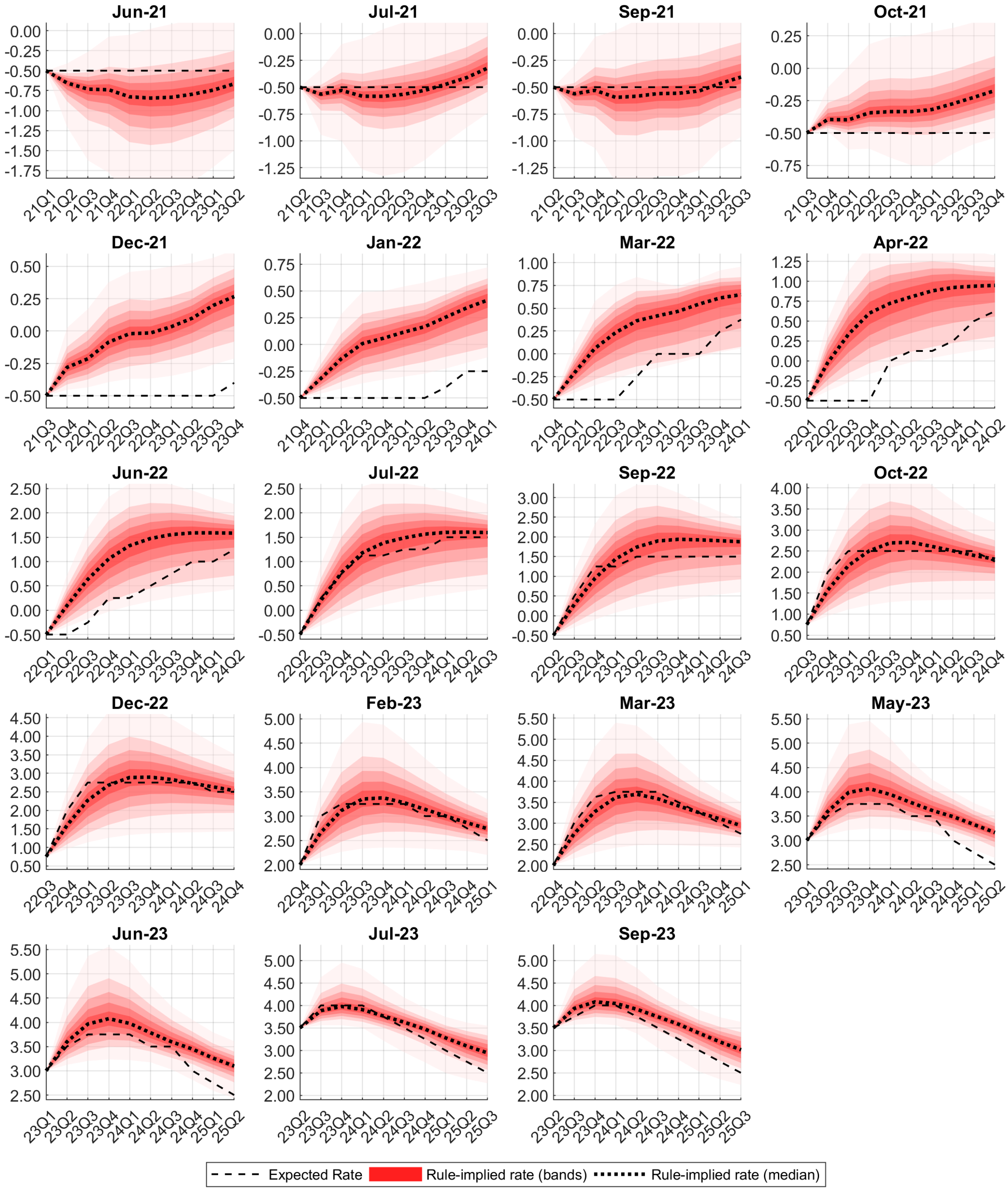
Figures 1 and 2 compare SMA expected rates with rule-implied rates. Figure 1 juxtaposes, survey-by-survey, expected (black dashed line) and rule-implied policy rate paths (red bands and black dotted line). Figure 2 summarises this information by showing the average deviation between expected and rule-implied rates since the first publicly-available round of the ECB's SMA (June 2021). Denoting the deviation for round s at horizon h with $\varepsilon_{s,t+h}$, for each survey s we compute the average deviation (or bias) as follows:

$$Bias_s = \frac{1}{(1+8)}\sum_{h=0}^{8}(E_s i_{t+h} - E_s i_{t+h}^R) = \frac{1}{(1+8)}\sum_{h=0}^{8}\varepsilon_{s,t+h}. \quad (3)$$

[9] The new version of the Fed's staff inertial rule also considers a time-varying natural rate (Erceg et al., 2016).

Figure 1: Expected ECB policy rates against rule-implied rates

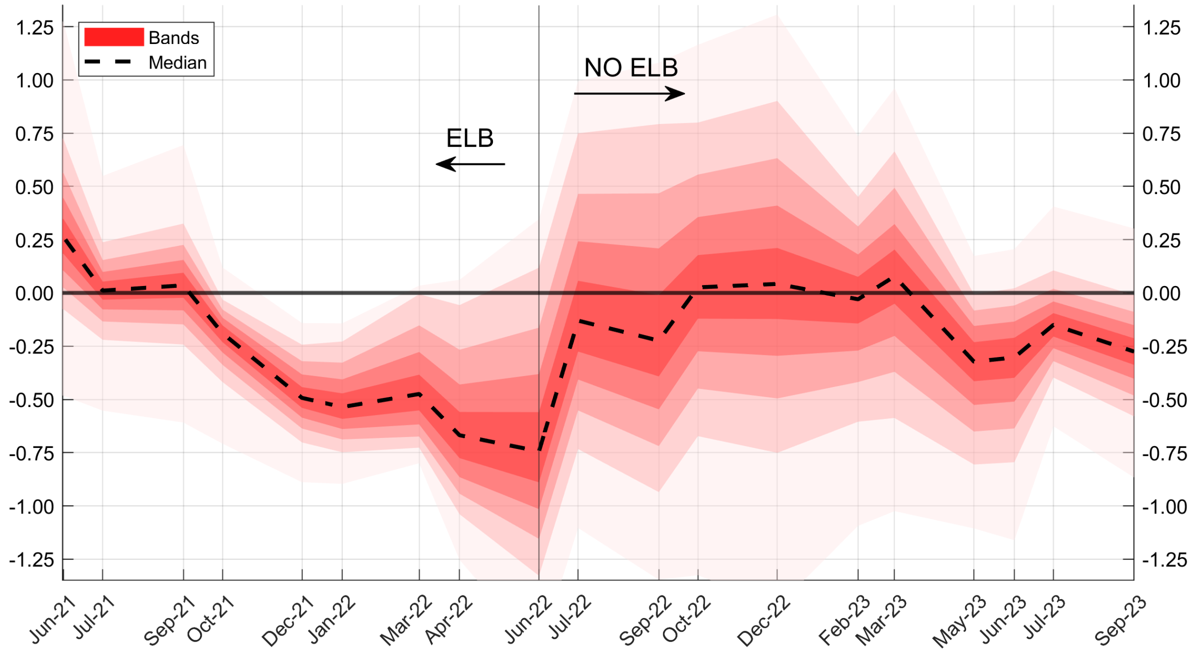
(*percentages*)



Source: ECB's SMA and authors' calculations on the ECB's SMA. *Notes*: each panel corresponds to a given round of the ECB's SMA and compares the expected median policy rate path (black dashed line) against its rule-implied counterpart (red bands and black dotted line). The latter corresponds to the values prescribed by equation (2). The x-axis refers to a given horizon, ranging from the calendar quarter prior to the survey quarter ($h = -1$) to two years ahead ($h = 8$). The red band shows the entire distribution of the 15129 rule-implied rates.

Figure 2: Deviation of SMA expected rates from rule-implied rates

(*percentage points*)



Source: authors' calculations on the ECB's SMA. *Notes*: the figure shows the average deviation between the rule-implied rates and the expected rates over time. The bias is computed as in equation (3). The x-axis refers to a given round of the ECB's SMA. The red bands show the entire distribution of the bias associated with the 15129 rules considered.

Since June 2022, when the ECB Governing Council announced its intention to start a phase of policy rate hikes, moving them above the effective lower bound (ELB), analysts' rate expectations have become largely aligned with the Taylor rule. Until the April 2022 meeting, the ECB Governing Council provided the public with its expectation of the policy rate path: that is, it repeatedly stated – albeit in different forms[10] – that, given the inflation and the economic outlook, it expected the policy rate to remain broadly unchanged at its current level in subsequent meetings. As clearly shown in Figure 1, such a strong guidance, combined with the use of other unconventional tools (e.g., asset purchases),[11] induced analysts to expect a largely unresponsive policy rate, thereby driving the elevated divergence between expected and rule-implied rates observed until the June-22 SMA. Since the start of the rate hiking cycle, however, SMA expected rates have quickly become very close to the policy rate path suggested by the Taylor rules (i.e., within 25 bps; Figure 2). During this period the ECB stopped to provide explicit forward guidance on the rate path. While in some cases it stated that it expected the policy rate to be increased going forward, its communication did not convey insights on the exact trajectory. With the policy rates becoming again the primary instrument of monetary policy and in the absence of a strong guidance, one possible interpretation of

[10] Over this period the ECB adopted both calendar and state-dependent forward guidance. In either case, however, the main message was that policy rate was expected to remain broadly unchanged over the coming meetings.

[11] Over this period, the monetary policy stance was accommodated mainly using balance-sheet tools. During the Covid-19 pandemic the stance was eased primarily through an increase in the size of the ECB's balance sheet. During the 2022 high-inflation period, instead, the expectation of a fixed rate was driven by the announced "sequencing" of the normalization process, according to which net asset purchases would need to be phased-out before raising the policy rate.

this result is that financial analysts may have (re)considered the Taylor rule as a simple way to form their expectations on the policy rate.

This finding is corroborated by conducting an alternative exercise in which we identify the rule's parameter values that deliver the smallest deviation from SMA expected rates. In more detail, we look for the rule that minimises the root mean squared deviation between expected and rule-implied rates, $RMSD_s = \sqrt{\frac{1}{(1+8)}\sum_{h=0}^{8}\left(E_s i_{t+h} - E_s i_{t+h}^R\right)^2}$, before and after the July 2022 survey.[12] For this analysis, we also increase the parameter space reported in Table 2 so that we can find an interior solution. The identified parameter values for the two subsamples are reported in Table 3. For surveys before July 2022, the degree of inertia that minimises the average RMSD is 0.95 and the reactions to inflation and economic activity turn out to be subdued with respect to conventional Taylor rule values. This just reflects the fact that, following the forward guidance provided by the ECB Governing Council, analysts' rate expectations were anchored at the ELB for most of this period. For surveys from July 2022 onwards, instead, the parameter values that optimise the fit have become very much in line with the conventional Taylor rule values.

Table 3. Rule that optimises the forecast fit

	Parameter	TR benchmark	Pre – July 2022	Post – July 2022
$\boldsymbol{\rho}$	degree of inertia	0.85	0.95	0.80
$\boldsymbol{(1-\rho)\phi_\pi}$	(effective) reaction to the inflation gap	0.23	0.10	0.22
$\boldsymbol{(1-\rho)\phi_x}$	(effective) reaction to the resource gap	0.08	0.01	0.07

Source: ECB's SMA and authors' calculations on the ECB's SMA. *Notes:* the table reports the calibrations of the Taylor rule that minimise the root mean squared deviation in the surveys until June 2022 and in the surveys starting from July 2022. We consider range of parameters larger than those used in the baseline so that an internal solution can be found. In particular, $\phi_\pi \in \{0.750, \dots, 3.000\}$, $\phi_x \in \{-0.500, \dots, 1.500\}$, and $\rho \in \{0.750, \dots, 1.100\}$. The table also reports the benchmark values used in the literature on Taylor rules, which also constitute the central values of our thick-modelling calibration as described in Table 2.

Although remaining close to rule-implied levels, since the bank failures of March 2023 in the United States and in Switzerland analysts' rate expectations have adjusted slightly-below them. Upon the failures of Silicon Valley Bank (SVB) and Credit Suisse, SMA analysts' rate expectations fell slightly below rule-implied rates (May-23 SMA). The increase in uncertainty and the determination signalled by the ECB Governing Council in addressing the possible spill-overs of the banking crisis in the euro area[13] may have induced analysts to price a lower terminal rate, in line with

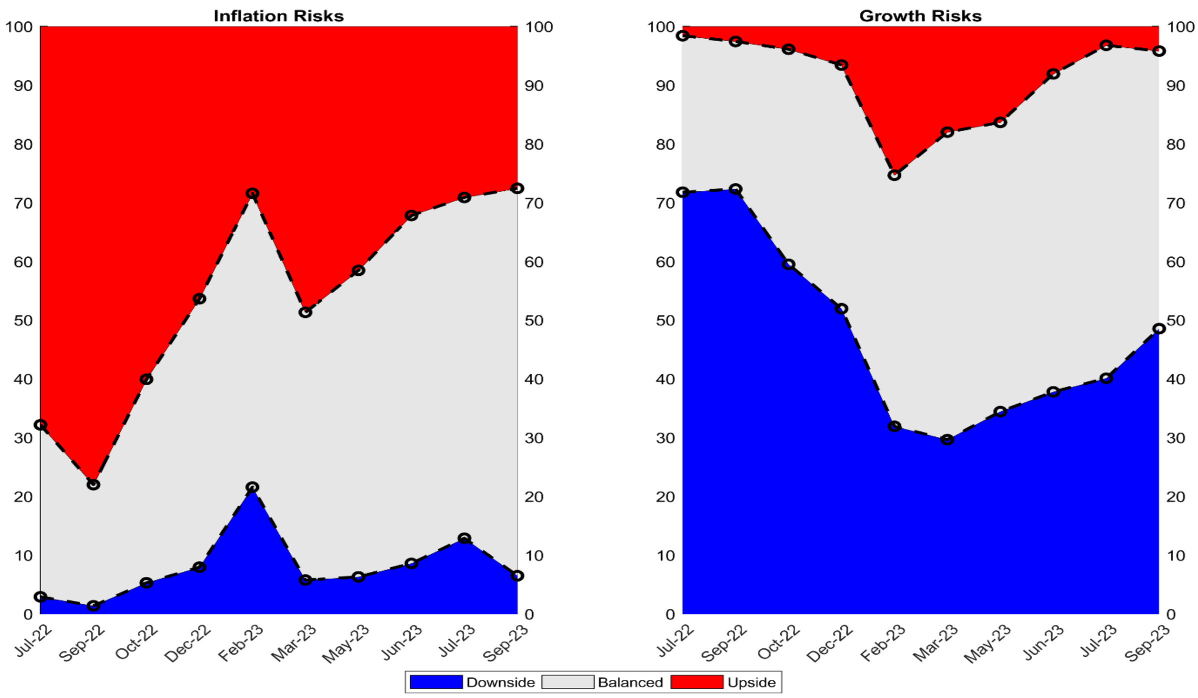
[12] This approach is conceptually different from a traditional estimation procedure that estimates the parameters from realized data. Instead, here the focus is on finding the rule that optimises the (out-of-sample) forecast fit.

[13] In the March 2023 policy meeting, the ECB Governing Council stopped mentioning the expectation of further rate hikes in the press release. During the press conference, President Lagarde clarified that the change in communication was justified by the "impossibility" to determine whether additional rate hikes were appropriate given the increased uncertainty on the economic outlook and on the transmission of monetary policy through the banking sector amid the

the Brainard (1967) attenuation principle. As time progressed and banking tensions eased, analysts' rate expectations gradually re-aligned towards rule-implied levels, although not completely. A possible explanation for the small but persistent deviation can be found in the emergence of other type of risks, such as those of an overtightening of financing conditions stemming from a rapid pass-through of the policy rate hikes through the banking sector (Bottero and Conti, 2023). Notice that since our rule-implied rates are constructed using median responses to the SMA, they do not take into account possible asymmetries in the risk profiles as expected by analysts. Deviations between expected and rule-implied paths may therefore be partly due to the unaccounted perceptions of asymmetric risks, especially those stemming from aggregate demand shocks (which move inflation and real activity in opposite directions).[14]

Figure 3: Balance of risks for inflation and economic activity

(*percentage of respondents*)



Source: authors' calculations on the ECB's SMA. *Notes:* the figure reports the evolution of the share of analysts who report the balance of risks surrounding their projections for inflation and GDP growth to be on the upside (red), balanced (grey), or on the downside (blue) over the following three calendar years. Responses for each calendar year are weighted by the number of quarters that fall in the analysed horizon.

Figure 3 provides suggestive evidence that growing perceptions of downward risks to the aggregate demand may explain the deviation of expected ECB rates from rule-implied rates observed since spring 2023. In the SMA, analysts are also asked to assess the balance of risks surrounding their projections for euro area inflation and growth over the next three calendar years.

failures of Silicon Valley Bank and Credit Suisse. For details, see for instance the first question in the March 2023 ECB Governing Council press conference.

[14] In this regard, Istrefi and Sestieri (2019) document that over the period 2003-2019 rate-cuts decisions were typically made during periods when the ECB signalled downside risks to growth not accompanied by upside risks to inflation.

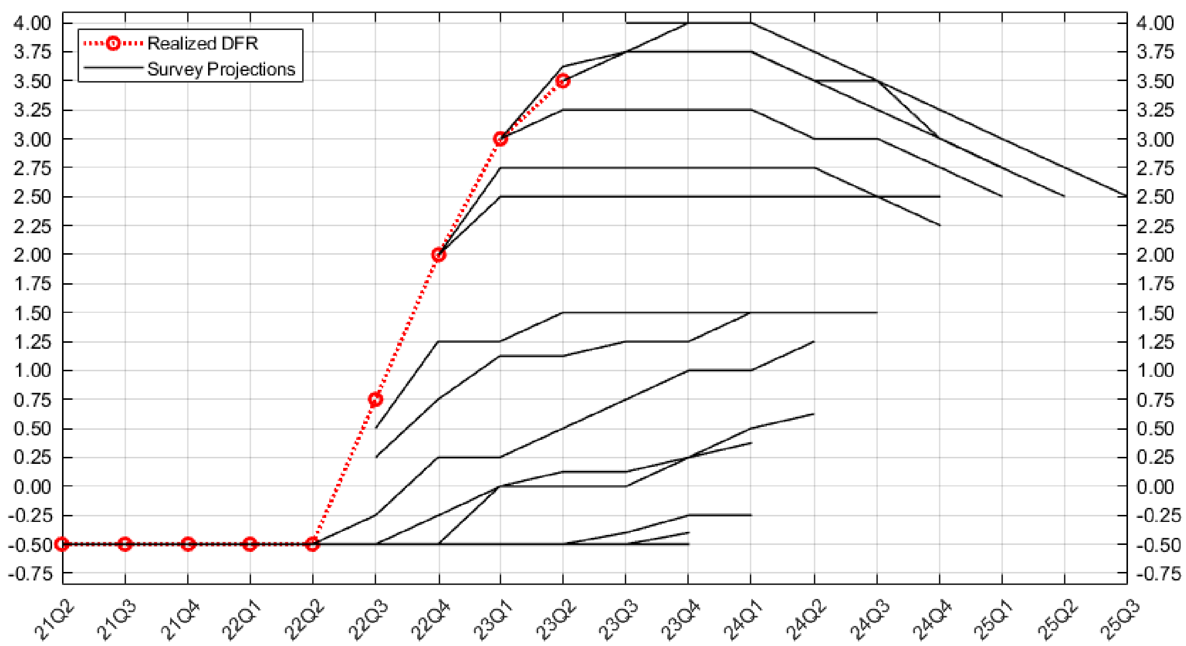
The published statistics include, for each year, the share of analysts who report their risks on the upside, balanced, or on the downside. Figure 3 shows the evolution of those shares since the July 2022 survey, where the responses for each calendar year are weighted by the quarters that fall in the analysed horizon.[15] Around the beginning of the policy normalisation, risk perceptions were largely on the downside for growth and on the upside for inflation, a symptom of perceived negative supply risks. As time progressed, these perceptions largely reabsorbed on the back of positive energy news and improving global economic conditions compared to what expected during the pandemic. Such a dynamics turned around in spring 2023, in light of negative inflation news and hawkish comments by most policy makers. Consistent with growing perceived negative demand risks, since the May 2023 survey upside inflation risks decreased and downside growth risks increased.

4. Drivers of expected ECB policy rates during the 2022-23 hiking cycle

The 2022-23 rate hiking cycle was characterized by significant and continuous revisions of expected ECB rates by financial analysts. Figure 4 shows that, round by round, financial analysts adjusted their rate expectations upwards. Since July 2022, the cumulative revision has been substantial, amounting to around 2.5 percentage points, from 1.5% to 4%, when considering the peak (also known as "terminal") rate in each survey round.

Figure 4: Revisions of expected ECB policy rates

(*percentages*)



Source: ECB's SMA. *Notes:* the figure reports the evolution of the ECB policy rate (DFR; red) and the projections for the same rate under all the available rounds of the SMA (black).

The survey-based thick-modelling approach can be used to analyse the drivers of the revisions in expected ECB rates. In particular, starting from equation (2) and taking differences between

[15] For example, in the March 2023 survey the responses related to 2023 are weighed by 3/9, those related to 2024 by 4/9, and those related to 2025 by 2/9.

expectations formed at two different survey rounds, revisions of the *expected* rate path can be decomposed into the contribution of (*i*) revisions of expected inflation, (*ii*) revisions of the economic activity outlook, (*iii*) unexpected deviations of the policy rate in the previous quarter, (*iv*) updates to the long-run equilibrium policy rate, and (*v*) changes in the unexplained term (or bias). The exact expression is shown in equation (4):

$$
\begin{aligned}
\underbrace{E_s i_{t+h} - E_{s-p} i_{t+h}}_{revision\ of\ the\ expected\ rate\ path} \\
= \quad & \underbrace{\rho^{h+1}\left(i_{t-1} - E_{s-p} i_{t-1}\right)}_{revision\ of\ the\ previous-quarter\ policy\ rate} \\
& + \underbrace{(1-\rho)\left(E_s i^* - E_{s-p} i^*\right) \sum_{i=0}^{h} \rho^{h-i}}_{revision\ of\ the\ equilibrium\ policy\ rate} \\
& + \underbrace{(1-\rho)\phi_\pi \sum_{i=0}^{h} \rho^{h-i} \left(E_s \pi_{t+i} - E_{s-p} \pi_{t+i}\right)}_{revision\ of\ the\ expected\ inflation\ outlook} \\
& + \underbrace{(1-\rho)\phi_x \sum_{i=0}^{h} \rho^{h-i} \left[E_s (x_{t+i} - x^*) - E_{s-p} (x_{t+i} - x^*)\right]}_{revision\ of\ the\ expected\ real\ outlook} \\
& + \underbrace{\left[\sum_{i=0}^{h} \rho^{h-i} \left(\varepsilon_{s,t+i} - \varepsilon_{s-p,t+i}\right)\right] - \rho^{h+1} \varepsilon_{s-p,t-1},}_{unexplained\ term}
\end{aligned}
\tag{4}
$$

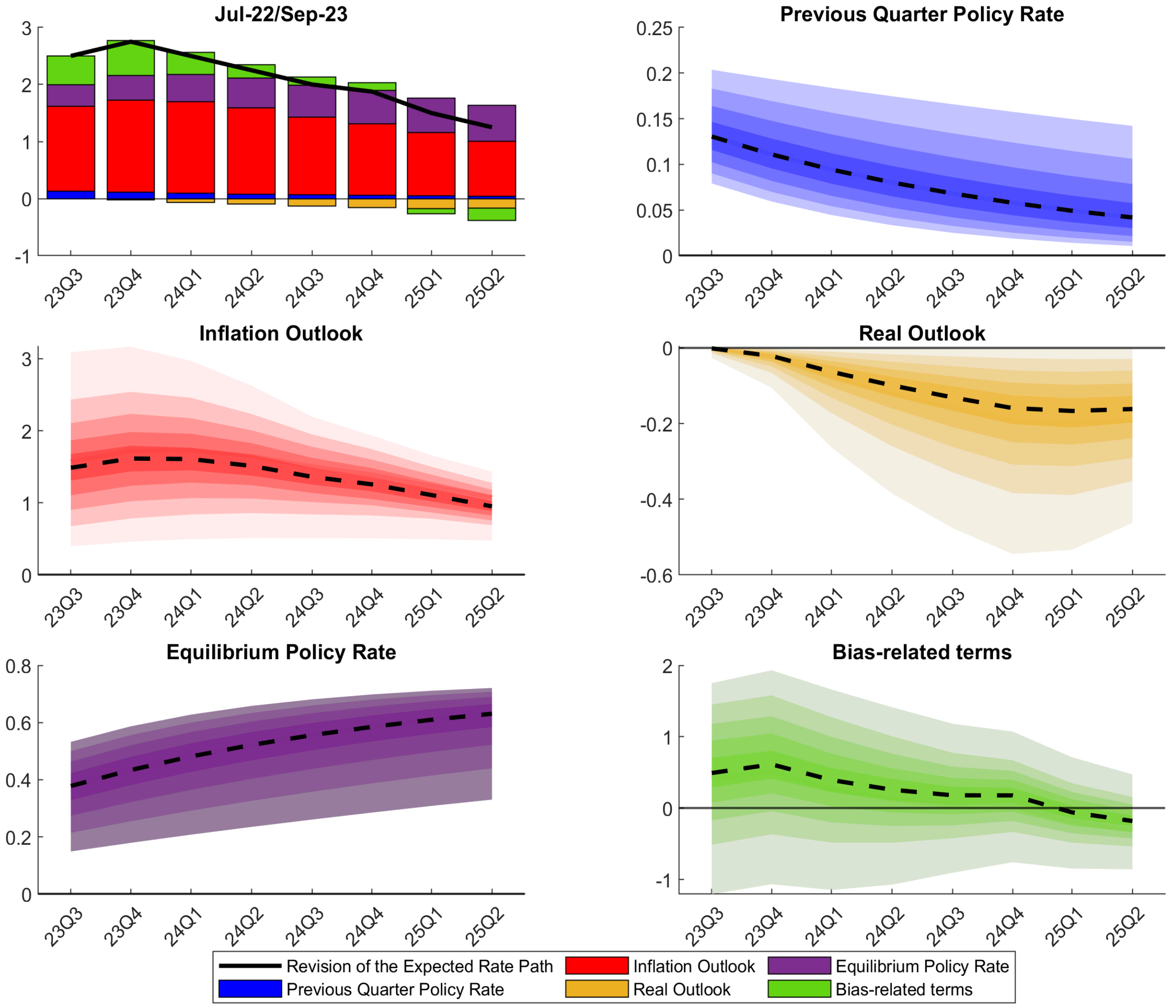
where p indicates the distance (in number of rounds) between two surveys and recall that $\varepsilon_{s,t+h} = E_s i_{t+h} - E_s i^R_{t+h}$ is the difference between *expected* and *rule-implied* rates. Figure 5 shows the decomposition for the period July-22 – September-23.

The substantial upward revision of the expected rate path during the 2022-23 hiking cycle has mainly resulted from repeated upward revisions of inflation expectations. The cumulative revision in expected inflation accounts for more than half of the overall effect.

Noticeably, however, a non-negligible share of the upward movement of the expected policy rate curve (around 1/3 on average) has been associated with an upward revision of the long-run equilibrium policy rate, which over the analysed period has been revised up from 1.25% to 2% (see Figure A1 in the Appendix). While it remains much lower than two decades ago (estimated at around 4% according to most sources), this upward revision is substantial. The debate on the possible drivers of such increase is still open. According to some (see for instance Blanchard and Summers, 2023), an increase in the long-run equilibrium rate may be rationalized by expectations of a rise in the demand for loanable funds (driven by the green transition, the renewal of an excessively-obsolete capital stock, additional defence spending required by rising geopolitical fragmentation) in a context of elevated public and private debts as well as by expectations of a decrease in the supply of loanable funds (by retirees in advance economies who, after having accumulated savings for retirement, are now beginning to spend those savings).

Figure 5: Drivers of revisions in expected ECB policy rates (2022-23 hiking cycle)

(*percentage points*)



Source: authors' calculations on the ECB's SMA. *Notes:* the top left panel provides the decomposition of the cumulative revision in expected ECB policy rates into the contribution of five factors. Each bar represents the median contribution of each factor across the 15129 specifications. The other panels show, for each factor, the entire distribution. In both cases, the x-axis refers to a given horizon, ranging from the quarter in which the latest survey (September-23 SMA) is conducted ($h = 0$) to two years ahead ($h = 8$).

5. Alternative interest rate rules

In this section we compare the rule-implied rates under the baseline with those associated with four alternative rule specifications. First, we consider a rule in which contemporaneous core inflation is replaced by contemporaneous headline inflation. This intends to reproduce the original specification of the rule proposed by Taylor (1993). Second, we compute a forward-looking rule, in which 1-year ahead headline inflation replaces contemporaneous core inflation. This provides an alternative, more direct, way of modelling the medium-term orientation of the ECB Governing Council. In particular, we consider the following specification:

$$i_t^R = \rho i_{t-1} + (1-\rho)[i^* + \phi_\pi(\pi_{t+k} - \bar{\pi}) + \phi_x(x_{t+k} - x^*)], \tag{5}$$

where $k = 4$ and π is proxied by headline instead of core inflation. Notice that this rule nests the baseline rule in equation (1) for $k = 0$. Third, we consider a rule in which the inflation target is proxied by the long-run inflation expectation:

$$i_t^R = \rho i_{t-1} + (1-\rho)[i^* + \phi_\pi(\pi_t - \pi^*) + \phi_x(x_t - x^*)], \tag{6}$$

where π^* replaces the term $\bar{\pi} = 2$ in equation (1). This exercise is motivated by the fact that long-run inflation expectations reached 2% only in late 2022 (see Figure A1 in the Appendix). Finally, we analyse a first-difference specification (Orphanides, 2003), which does not rely on long-run ("star") equilibrium values. We consider the following specification:

$$i_t^R = i_{t-1} + \phi_\pi^{FD}(\pi_t - \bar{\pi}) + \phi_g^{FD} g_t, \tag{7}$$

where g is the annual growth rate of real GDP from the ECB's SMA. The two parameters of the rule ϕ_π^{FD} and ϕ_g^{FD} are both centred around 0.1 and range between 0 and 0.2, with a step value of 0.01.

Overall, the alternatives considered appear to do a worse job at explaining analysts' rate expectations over the ECB's 2022-23 rate hiking cycle. Table 4 reports the median of the bias and root mean squared deviation, averaged across surveys. Figures A2-A5 in the Appendix show the underlying results. When considering current looking or forward looking headline inflation, the bias measure over this period is much larger (around 80 bps in absolute value). The first difference rules, despite having a similar bias (i.e., around 25 bps), display a much larger root mean squared deviation (around 1 pp). Finally, when we proxy the inflation target with the long-run inflation median expectation, the two measures remain substantially unchanged.

Table 4. Fit of alternative rules

(*percentage points*)

	Bias		Root mean squared deviation	
	Pre – July 2022	**Post – July 2022**	**Pre – July 2022**	**Post – July 2022**
Baseline	-0.31	-0.13	0.43	0.44
(*i*) Contemporaneous headline inflation	-1.02	-0.77	1.08	0.90
(*ii*) Forward-looking headline inflation	-0.34	0.76	0.43	0.80
(*iii*) Long-run inflation	-0.46	-0.15	0.53	0.45
(*iv*) First-difference rule	-1.71	-0.26	1.83	1.02

Source: authors' calculations on the ECB's SMA. *Notes:* each row corresponds to a certain specification and the columns correspond to different fit measures (bias and root mean squared deviation) and different survey samples. Each box reports the average across surveys of the median bias and root mean squared deviation.

6. Conclusions

The Taylor rule certainly disguises the complexity of the underlying judgments that central banks must continually make to take good policy decisions. As argued by Bernanke (2015) monetary policy should indeed be systematic, not automatic.

Yet, to the extent that the simple logic of the Taylor rule is used by financial analysts and market participants to form their policy rate expectations, this tool can be useful for central banks. In this respect, we find that since the ECB Governing Council started to normalise its monetary policy in the summer of 2022, parting ways from the ELB, financial analysts' expectations of the ECB rate have become remarkably aligned with the rule-implied ones, suggesting that they may be considering the Taylor rule as a simple starting point to form their expectations of the future path of the policy rate.

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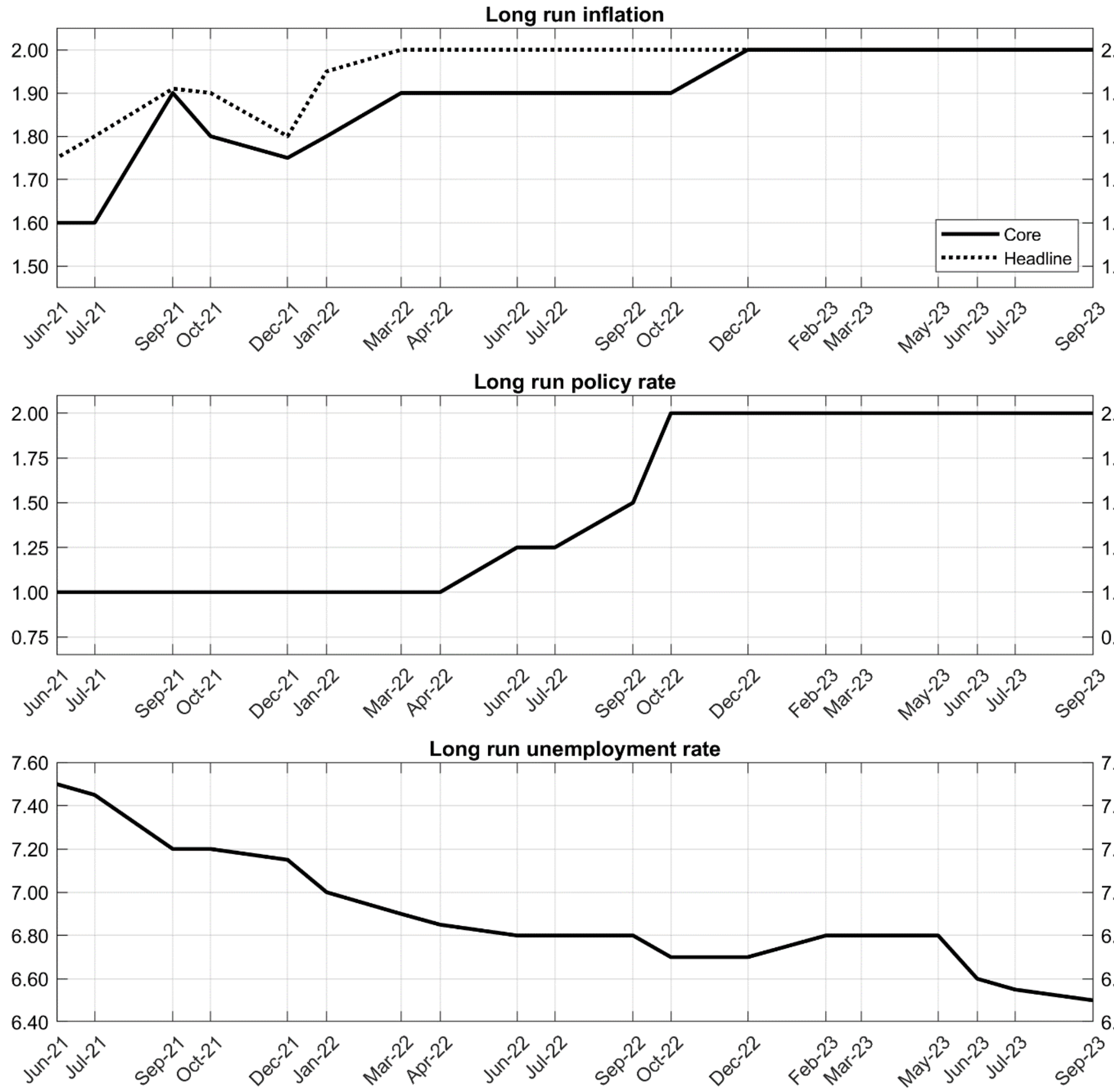
Appendix

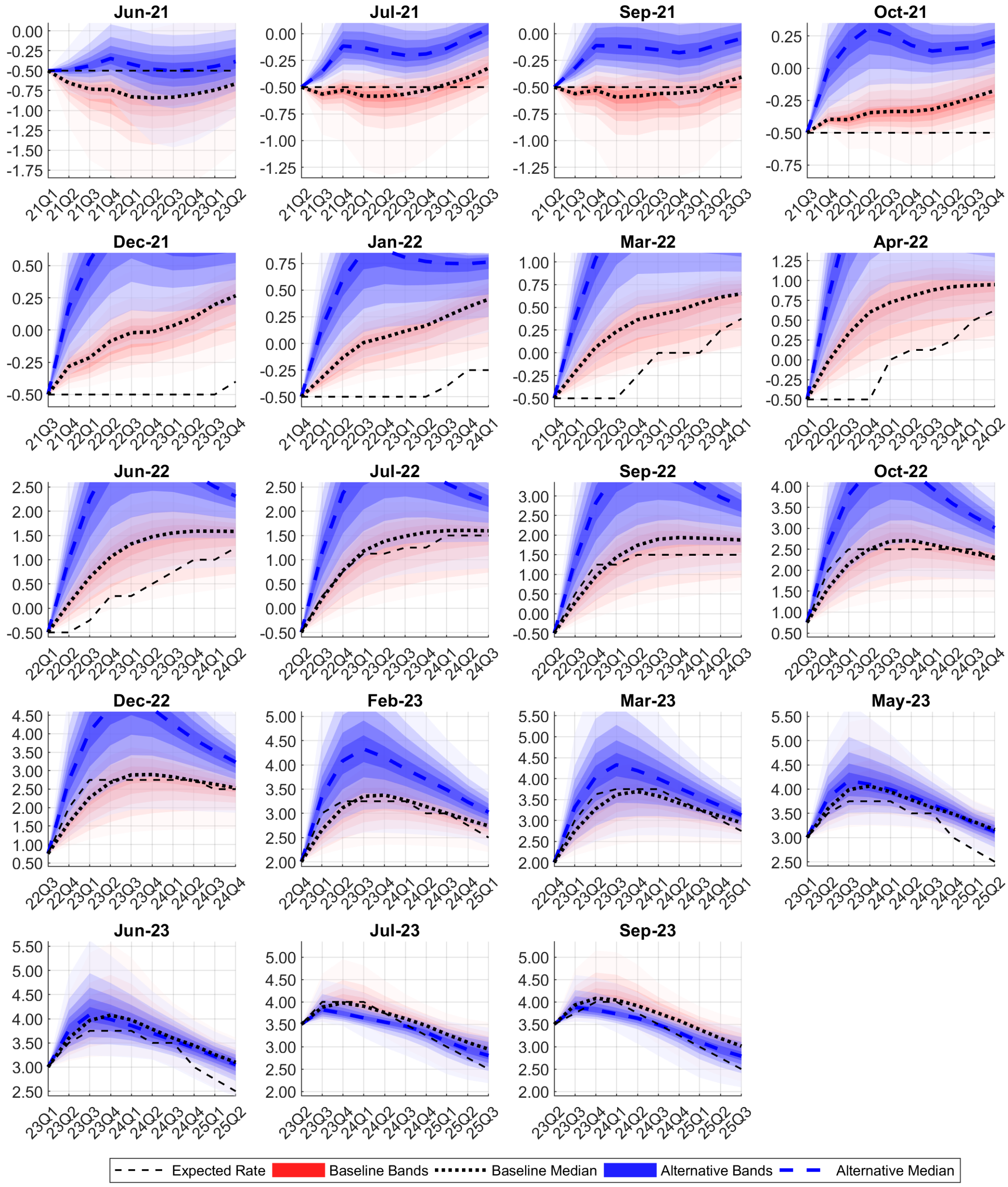
Figure A1: Long-run expectations
(*percentages*)



Source: ECB's SMA. *Notes*: the figure shows the long run expectations of core and headline HICP inflation, DFR, and unemployment rate. The x-axis refers to a given round of the ECB's SMA. As clarified in the survey, such long-run values must be interpreted as the horizon over which the effects of all shocks have vanished (which can be interpreted as around ten years). This is the reason why these long-run values are used to proxy for the long-run equilibrium values that appear in equations (1) and (2).

Figure A2: Using headline inflation in current-looking rules

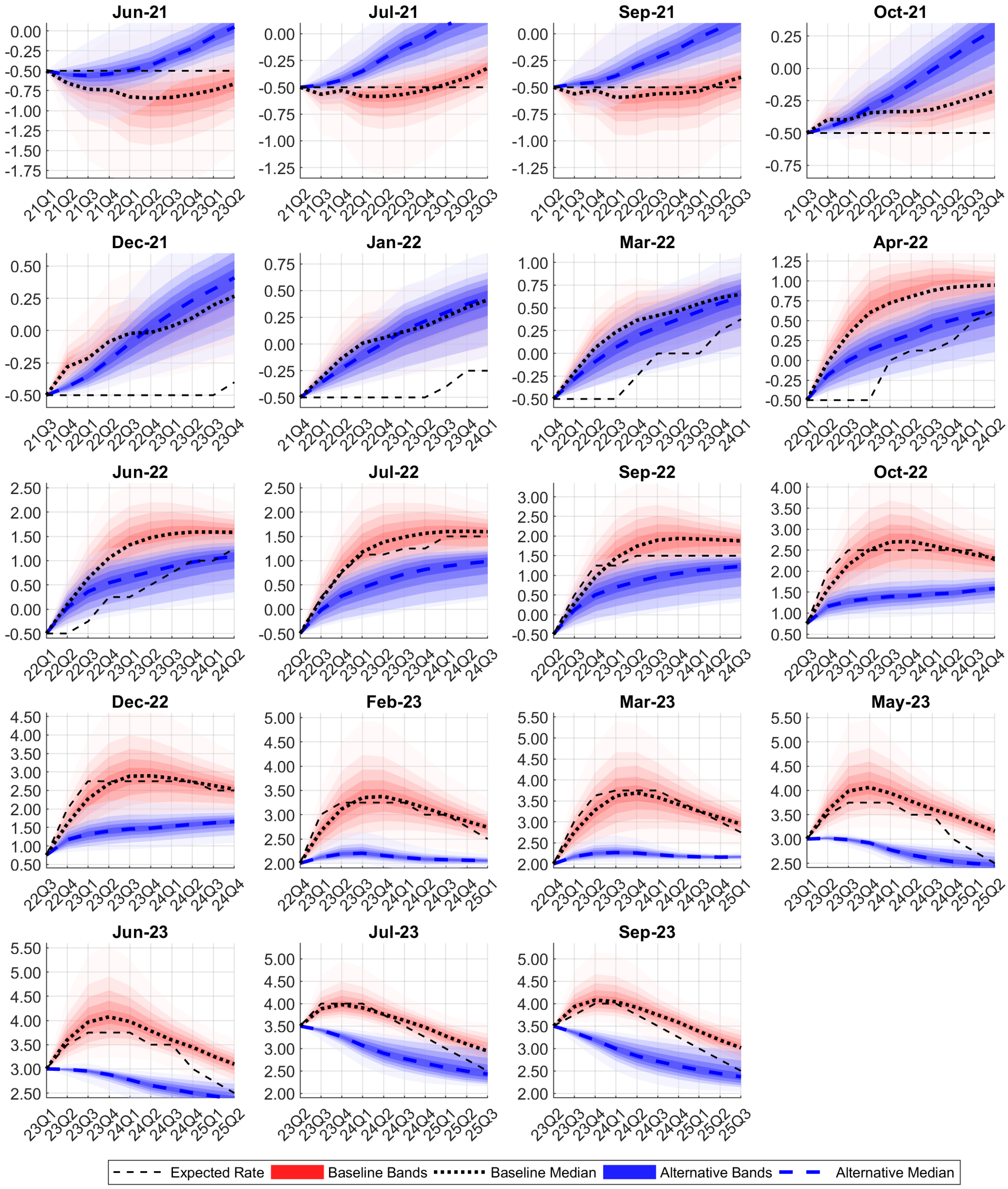
(percentages)



Source: ECB's SMA and authors' calculations on the ECB's SMA. *Notes*: each panel corresponds to a given round of the ECB's SMA and compares the expected policy rate path (black dashed line) against its rule-implied counterpart under the baseline (red bands and black dotted line) and the alternative specification (blue bands and blue dashed line). The latter correspond to the values prescribed by equation (2) when using core and headline inflation, respectively. The x-axis refers to a given horizon, ranging from the calendar quarter prior to the survey quarter ($h = -1$) to two years ahead ($h = 8$). Both bands show the entire respective rule-implied rate distributions.

Figure A3: Using headline inflation in forward-looking rules

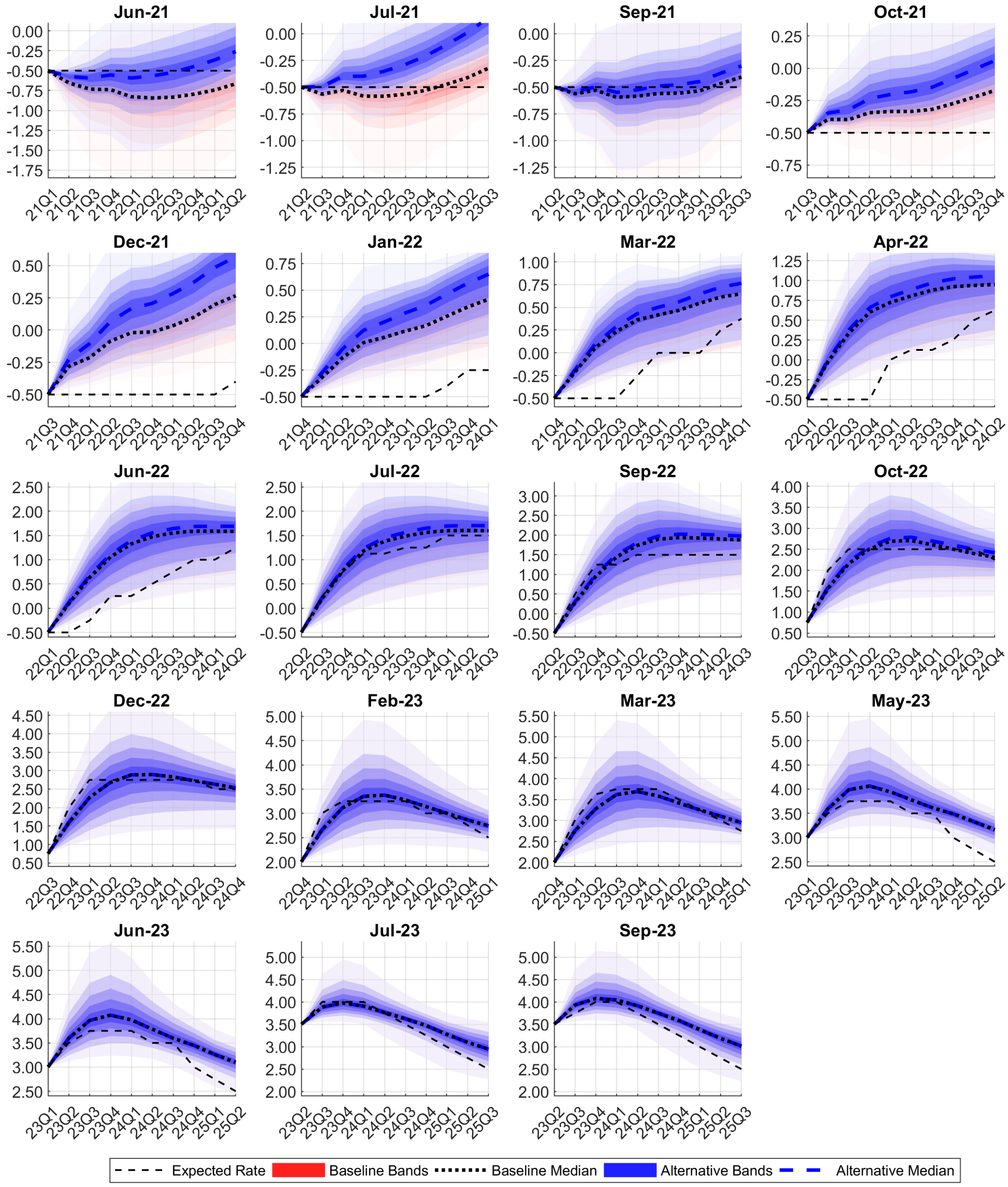
(percentages)



Source: ECB's SMA and authors' calculations on the ECB's SMA. *Notes*: each panel corresponds to a given round of the ECB's SMA and compares the expected policy rate path (black dashed line) against its rule-implied counterpart under the baseline (red bands and black dotted line) and the alternative specification (blue bands and blue dashed line). The latter correspond to the values prescribed by equations (2) and (5). The x-axis refers to a given horizon, ranging from the calendar quarter prior to the survey quarter ($h = -1$) to two years ahead ($h = 8$). Both bands show the entire respective rule-implied rate distributions.

Figure A4: Proxying the inflation target with the expected long-run inflation rate

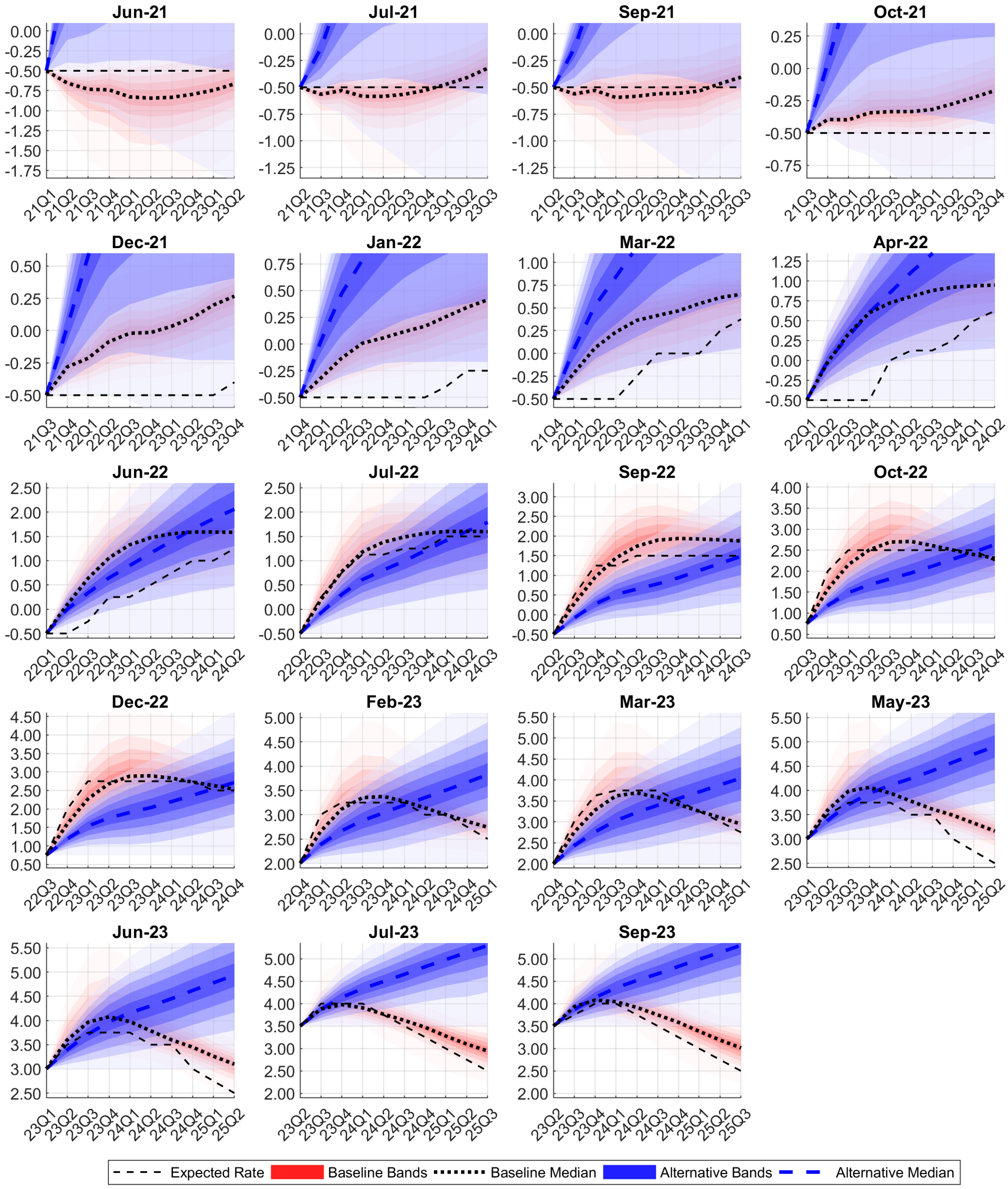
(percentages)



Source: ECB's SMA and authors' calculations on the ECB's SMA. *Notes*: each panel corresponds to a given round of the ECB's SMA and compares the expected policy rate path (black dashed line) against its rule-implied counterpart under the baseline (red bands and black dotted line) and the alternative specification (blue bands and blue dashed line). The latter correspond to the values prescribed by equations (2) and (6). The x-axis refers to a given horizon, ranging from the calendar quarter prior to the survey quarter ($h = -1$) to two years ahead ($h = 8$). Both bands show the entire respective rule-implied rate distributions.

Figure A5: Using first-difference rules

(percentages)



Source: ECB's SMA and authors' calculations on the ECB's SMA. *Notes*: each panel corresponds to a given round of the ECB's SMA and compares the expected policy rate path (black dashed line) against its rule-implied counterpart under the baseline (red bands and black dotted line) and the alternative specification (blue bands and blue dashed line). The latter correspond to the values prescribed by equations (2) and (7). The x-axis refers to a given horizon, ranging from the calendar quarter prior to the survey quarter ($h = -1$) to two years ahead ($h = 8$). Both bands show the entire respective rule-implied rate distributions.