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Abstract

This paper investigates the relationship between inflation and GDP growth forecast errors and the expected monetary policy stance in the euro area during the monetary policy cycle of 2022-2024, when inflation was well above the ECB's target. Under rational expectations, forecasts of monetary contractions should be unrelated to subsequent inflation and growth forecast errors. On the contrary, we find that expected monetary policy tightening has been associated with higher than projected GDP growth, suggesting a lower monetary policy effect than that factored in by (ECB/Eurosystem and IMF) forecasters. In other words, forecasters overestimated the monetary multiplier. At the same time, monetary policy tightening has been associated with lower than expected inflation, suggesting an underestimation of the monetary multiplier on inflation. Putting these two stylized facts together implies that forecasters overestimated the sacrifice ratio during the last monetary policy tightening cycle. Our findings suggest that forecasters may have inaccurately perceived the recent inflationary crisis in the euro area as predominantly supply-driven, underestimating its demand-driven component. This led to the belief that monetary policy in the euro area would be exceedingly costly in terms of output.

Keywords: forecast errors, monetary policy multipliers, sacrifice ratio.

JEL classification: C53, E27, E62, E52, E58.

Resumen

Este trabajo investiga la relación entre los errores de previsión de la inflación y el crecimiento del PIB, y el tono esperado de la política monetaria en el área del euro durante el ciclo de política monetaria de 2022-2024, cuando la inflación estaba muy por encima del objetivo del Banco Central Europeo (BCE). Bajo expectativas racionales, las previsiones de contracciones monetarias deberían ser independientes de los errores de previsión de la inflación y del crecimiento subsiguientes. Sin embargo, encontramos que las previsiones de endurecimiento de la política monetaria están asociadas con un crecimiento del PIB superior al anticipado, lo que sugiere un menor efecto de la política monetaria en la actividad que el incorporado por los expertos del BCE/Eurosistema y del FMI. En otras palabras, estas proyecciones sobreestimaron la repercusión del multiplicador de la política monetaria sobre el crecimiento. Al mismo tiempo, las previsiones de endurecimiento de la política monetaria están relacionadas con una inflación menor que la esperada, lo que sugiere la subestimación del efecto del multiplicador de la política monetaria sobre la inflación. La combinación de estos dos hechos estilizados implica que estos expertos sobreestimaron la ratio de sacrificio durante el último ciclo de endurecimiento de la política monetaria. Esta evidencia sugiere que se habría percibido la reciente crisis inflacionaria en el área del euro, de manera inexacta, como predominantemente impulsada por factores de oferta, lo que llevó a subestimar su componente de demanda y a la creencia de que la política monetaria en el área del euro sería excesivamente costosa en términos de actividad.

Palabras clave: errores de previsión, multiplicadores de política monetaria, ratio de sacrificio.

Códigos JEL: C53, E27, E62, E52, E58.

1 Introduction

This paper investigates the relationship between inflation and GDP growth forecast errors and the expected monetary policy stance in the euro area during the monetary policy cycle of 2022-2024, when inflation was well above the target of the ECB (Lane, 2024). Under rational expectations, forecasts of monetary contractions should be unrelated to subsequent inflation and growth forecast errors. On the contrary, we find that forecasters (ECB/Eurosystem's and IMF's) overestimated the impact of monetary policy on growth, given that we find a positive relation between underestimations of monetary policy restrictiveness and subsequent growth forecast errors. At the same time, we find that such underestimation is negatively associated with subsequent inflation forecast errors. This implies that, during the last monetary policy tightening cycle, forecasters overestimated the sacrifice ratio (Ball, 1994), which in monetary policy represents the cost of output lost per 1% reduction in the inflation rate.[1]

To reach these conclusions, we draw on the approach of Blanchard and Leigh (2013) and Blanchard and Leigh (2014), who addressed a related question regarding the fiscal consolidation programs planned for 2010-2011. They constructed a database of GDP forecast errors from IMF projections and regressed these against the planned fiscal stance, measured by changes in the structural fiscal balance as a percentage of potential GDP. Their study focused on European economies and found that the IMF forecasts underestimated the recessive impacts of austerity, revealing a negative correlation between the fiscal consolidation forecasts and subsequent growth prediction errors. Similarly to the 2010-2011 period, where European economies faced synchronized fiscal consolidation post-financial crisis, the 2022-2023 period saw central banks globally implementing tightening monetary measures. While Blanchard and Leigh (2013) focused on planned fiscal policies, we examine expected monetary policies, using planned fiscal policy as a control variable.[2] We focus on euro area countries and use two datasets: ECB/Eurosystem Staff projections and IMF WEO forecasts.

Blanchard and Leigh's approach has been followed by several recent studies. Brinca et al. (2021) extend Blanchard and Leigh (2013, 2014) by using the same IMF data and methodology, and adding income inequality measures from the European Union Statistics on Income and Living Conditions (EU-SILC) dataset. They find that fiscal consolidation in 2010-2011 exacerbated recessionary effects due to inequality in Europe. Similarly, Fatás

[1] In other words, how much GDP growth one has to forego to reduce inflation through monetary tightening.

[2] In central bank forecasting exercises, future fiscal policies are typically based on government plans, whereas future monetary policies are usually proxied by financial market expectations (futures), incorporated as exogenous assumptions for future interest rates.

and Summers (2018) expand Blanchard and Leigh (2013)'s methodology to broader horizons and potential output, examining fiscal consolidations during 2009-2011. They find that these consolidations had prolonged negative impacts on both actual and potential GDP, suggesting that austerity's costs extend beyond immediate GDP effects. Lewis and Pain (2014) conduct a similar analysis using OECD projections for 2007-2012. They find weak evidence that stronger projected fiscal consolidations are associated with larger GDP growth errors, particularly when Greece is included. Suyker and Mohlmann (2015) update Blanchard and Leigh (2013)'s work with data up to 2015. They find a significant negative coefficient for 2009-2011, but no such relationship for 2012-2015, suggesting that IMF forecasters correctly incorporated the impact of fiscal policy during the sovereign debt crisis but underestimated austerity costs during the financial crisis.

Few recent studies have also explored related themes. Darvas (2018) discusses significant forecasting errors by the European Central Bank (ECB) over the past five years, suggesting that shifts in behavioral relationships within ECB models may have influenced policy decisions. Granziera et al. (2024) investigates systematic forecast errors in the ECB's inflation projections and the implications these errors have for the credibility of the bank's monetary policy. On a similar note, Chahad et al. (2024) investigates ECB forecast errors in recent years, a period marked by significant challenges in predicting inflation due to large, unprecedented shocks (the COVID-19 pandemic and Russia's war against Ukraine) impacting the euro area economy. The paper delves into potential explanations for these forecast errors, analyzing the dominant role of global factors, the evolving impact of energy prices, and other exceptional shocks that contributed to the inaccuracies in inflation projections.

Our paper makes three contributions to the literature. First, it is the first study to assess how effectively the most recent cycle of monetary tightening has been incorporated into forecasts during the recent tightening period. Second, our findings contribute to the ongoing policy discussion by showing that in the euro area, expected monetary policy tightening has been associated with higher GDP growth and lower inflation than projected. This suggests that forecasters overestimated the sacrifice ratio—the cost of reducing inflation through monetary policy. Third, our paper adds to the existing literature on ECB's forecast errors by linking the errors during the monetary policy tightening period with the perceived monetary policy stance, particularly in terms of assessing the actual conduct of monetary policy during this extraordinary period. These insights not only clarify recent forecast errors but also provide valuable guidance for future monetary policy decisions.

The rest of the paper is structured as follows. In Section 2 we describe the data. Section 3 outlines the empirical framework, and in Section 4 we present our results. Finally, Section 5 outlines a number of robustness exercises, while Section 6 concludes with final observations and remarks.

2 Data

We analyze data from the ECB/Eurosystem quarterly projection database, covering 19 euro area countries[3] over 9 projection exercises from 2022Q1 to 2024Q1. Each vintage uses the database from that quarter's forecast for a specific country.[4] For robustness, we also use a similar database from the IMF biannual forecasts[5] over the same period, covering 4 biannual projection exercises (April 2022 to October 2023) for 27 advanced economies, including euro area countries.[6]

Our baseline model focuses on yearly GDP growth rate, headline inflation, and monetary policy stance. Forecast errors are defined as the difference between observed and forecasted values at a specific horizon. Given the medium-term target of monetary policy (two years ahead), our baseline model uses a two-year forecast horizon: $h = 2$. For observed GDP growth data, we use the first estimate available for forecast projections to ensure comparability across vintages. If GDP data are not yet observed, we use the latest forecast available at the time of writing, i.e., the 2024Q2 forecast exercise for ECB/Eurosystem forecasts and the April 2024 WEO for IMF forecasts.

Measuring the monetary policy stance presents several challenges due to the existence of different instruments (e.g., interest rates, balance sheet policies, central bank communication) and their lagged effects. Non-linear effects and thresholds further complicate assessment. The most common measure is the natural rate of interest gap, which is the difference between the short-term real interest rate and the natural rate of interest (*r-star*). The natural rate is the short-term real interest rate that corresponds to a neutral monetary policy stance (Taylor, 1993). If the actual interest rate is below *r-star*, the policy is expansionary; if above, it is contractionary. Ideally, we would use the gap between (expected) short-term

[3] We exclude Croatia (HR) as it joined the EMU in 2023, which would unbalance the projection panel.

[4] Country-specific Eurosystem projections are published on the respective National Central Bank websites, while euro area aggregate projections are on the ECB website.

[5] IMF forecasts are in the World Economic Outlook (WEO) and published online.

[6] The EMU countries are: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Portugal, Slovakia, Slovenia, Spain (19). The extra-EMU countries are: Australia, Canada, Japan, New Zealand, Sweden, Switzerland, United Kingdom, United States (8).

real rates and *r-star* for each economy. However, *r-star* is a theoretical and unobservable concept, requiring estimation that is model-dependent.[7] The estimation of *r-star* is debated extensively (e.g., Buncic 2024; Benigno et al. 2024; Fiorentini et al. 2018).[8] Measuring the natural interest rate is also difficult in real-time (Forbes et al., 2024). Some practitioners prefer not to use *r-star* estimates for these reasons. Alternatively, Forbes et al. (2024) use the nominal interest rate as a direct measure of the monetary policy stance, arguing it avoids the substantial measurement error of more complex measures.

Our analysis focuses on euro area countries, which should share a common natural rate of interest. Given its persistence, we approximate the natural rate of interest gap using the real short-term interest rate, with *r-star* absorbed by the constant.[9] We use projected inflation to obtain a measure of projected real interest rates as our measure of monetary stance. We also perform robustness checks using alternative measures: the nominal short-term interest rate as in Forbes et al. (2024), and the long-term real interest rate, calculated for the euro area considering the central bank's mid-term inflation objective of 2%.[10]

We include additional controls for robustness, particularly relevant post-COVID and during the energy crisis. First, we consider the fiscal policy stance, measured as in Blanchard and Leigh (2013) by the change in the general government structural fiscal balance as a percent of potential GDP, estimated in each vintage.[11] Second, given the inflationary crisis and the missed dynamics of the energy component of CPI inflation, we consider forecast errors in energy commodity prices. Energy prices are expressed as a weighted average of gas (42%) and oil (58%), consistent with the Eurosystem projections. Oil prices refer to Brent crude oil spot and futures prices, while gas prices refer to the Dutch TTF gas spot and futures prices. These are the series used in the Eurosystem projections.

[7] Lubik et al. (2024) provide estimates of *r-star* for several countries, including the euro area, using the same methodology as the Richmond Fed's estimate for the US. Other estimates can be found here.

[8] Benigno et al. (2024) state that "The measurement of *r-star* is surrounded by very high uncertainty, making it a blurry guidepost for monetary policy".

[9] In Eurosystem projections, market expectations of interest rates at the forecast exercise cutoff-date are used as proxies for future short-term interest rates. We make the same assumption. The WEO database does not provide interest rate forecasts, so we construct our measure of expected monetary policy stance using external data. We gather future short-term interest rates expected by financial markets at the IMF forecast cutoff-date for each country in the WEO database. We include extra-EMU advanced economies for which short-term interest rate futures can be collected. Further details are in Section A of the Supplementary Appendix.

[10] Using long-term interest rates as a measure for monetary policy stance relies on the idea that they reflect agents' perceptions of the future path of short-term interest rates. A rise in long-term rates suggests a tightening of monetary policy expectations. However, long-term rates also include risk premia associated with uncertain economic conditions and interest rates.

[11] For example, in the 2022Q1 exercise, the fiscal stance is the difference between the structural fiscal balance estimated in March 2022 for 2022 and for 2021.

3 Methodology

Our research examines whether GDP growth and inflation forecast errors are systematically associated with monetary policy stance forecasts. Following Blanchard and Leigh (2014), we regress two-year-ahead forecast errors for inflation and real GDP growth (2022-2024) against expected monetary policy stance. Under rational expectations and correct forecasting models, the coefficient for expected monetary policy stance should be zero. A significant non-zero coefficient suggests a bias in estimating the impact of monetary policy on the real economy and inflation. In the case of growth forecasts, a negative β indicates underestimation of the monetary multiplier, while a positive β suggests overestimation.

Consider the ECB/Eurosystem quarterly forecasts for GDP growth two years ahead. Each vintage, v, corresponds to 2022Q1-2024Q1, with t representing the years 2022, 2023, and 2024. The estimated equation is therefore

$$\Delta Y_{i,t+2} - \Delta Y^F_{i,t:t+2|v} = \alpha + \lambda_q + \beta_R R^F_{i,t:t+2|v} + \ _{i,t:t+2} \tag{1}$$

The dependent variable is the forecast error for annual GDP growth (ΔY) in year $t+2$. The annual GDP growth forecast is $\Delta Y^F_{i,t:t+2|v} = f\Delta Y_{t+2,i}|\Omega_v$, where f is the forecast conditional on Ω_v, the information set available early in each projection exercise v. $R^F_{i,t:t+2|v} = fR_{t+2,i}|\Omega_v$ represents the forecast of the short-term interest rate in $t+2$ ($R_{i,t+2}$), where the forecast is again conditional on on Ω_v. In addition, we control for energy commodity prices forecast errors, which allow to account for the inflationary crisis and the missed dynamics of the energy component of CPI inflation.[12] Finally, the specification includes quarter fixed effects, and we correct standard errors for serial correlation of type $MA(2)$ using the Newey-West procedure.[13]

Quarterly forecast exercises target yearly variables (GDP growth and inflation), making forecasts within the same calendar year non-comparable due to changing information sets and decreasing uncertainty. This is known as *fixed-event forecast*. To improve comparability, we follow Dovern et al. (2012) and shift to a fixed-horizon framework, transforming data into an average of forecasts for the current and next two calendar years (weighted by their share

[12] In the regression of forecast errors for inflation, the inclusion of forecast errors for energy prices may suffice as a global control variable. However, for the GDP growth forecast errors, we carry out a robustness check which includes euro area GDP growth forecast error as additional control variable. This would help account for potential endogeneity between forecast errors for individual countries and the monetary policy stance. Results are reported in Table C.14 of the Online Appendix.

[13] To test the robustness of the standard error estimates, we run the analysis experimenting with a higher lag. Results show, as expected, slightly bigger standard error, and strongly confirm our baseline results. This robustness analysis is available upon request.

in the forecasting horizon), serving as a proxy for the fixed horizon forecast for the next 8 quarters (two years). For more details, see Section B of the Appendix. The fixed-horizon setting ensures that different projections of the same calendar year share the same horizon, improving comparability. However, the information set changes throughout the year.[14] To account for this potential bias, we control for quarter of origin dummies in the fixed-horizon setting. The discussion above is easily transferable to IMF bi-annual WEO forecasts. The next section presents and discusses the main findings.

Table 1: Annual GDP forecast errors on monetary policy stance

	ECB/ESCB Forecasts				**IMF WEO Forecasts**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real R†	0.29***	0.28***	0.31***	0.31***	0.40***	0.47***	0.45***	0.53***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Fiscal‡		-0.14	-0.13	-0.13		0.55**	0.56**	0.55*
		(0.41)	(0.44)	(0.47)		(0.05)	(0.05)	(0.05)
Energy§			-0.01	-0.01			0.00	-0.00
			(0.29)	(0.41)			(0.49)	(0.94)
q = 2				0.07				
				(0.67)				
q = 3				-0.00				
				(0.99)				
q = 4				0.08				
				(0.73)				
half=2								-0.37
								(0.32)
Constant	-0.27**	-0.23**	-0.27**	-0.31**	-0.32**	-0.46***	-0.36*	-0.23
	(0.02)	(0.03)	(0.01)	(0.04)	(0.02)	(0.00)	(0.06)	(0.37)
Obs	171	171	171	171	76	76	76	76
R2	0.20	0.20	0.21	0.21	0.20	0.28	0.28	0.29

Note: Robust p-values in parentheses. The dependent variable is the annual GDP forecast error (observed minus forecasted). Two-year horizon considered. Data transformed to fixed-horizon setting. Sample: 19 euro area countries.

† *Real R* refers to real short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

[14] Specific features may be associated with projection exercises of specific quarters. For instance, first and third quarter forecasts are conducted by the ECB, while others are jointly realized by all Eurosystem central banks.

4 Results

Table 1 shows how annual growth forecast errors are associated with monetary policy forecasts. The table has two panels: one with ECB/Eurosystem data and another with IMF WEO data. The first column in each panel reports the baseline specification, regressing only monetary policy stance on GDP growth. Subsequent columns add relevant controls one at a time.

We control for planned fiscal policy stance (columns (2) and (6)), as governments have taken anti-inflationary measures and withdrawn some COVID support initiatives. We also control for forecast errors in energy prices due to their significant role during the inflationary period. The last column includes quarter of origin dummies to account for differences across projection exercises (ECB/Eurosystem dataset) of half-yearly dummies (IMF WEO dataset).

Table 2: Annual inflation forecast errors on monetary policy stance

	ECB/ESCB Forecasts				**IMF WEO Forecasts**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real R†	-0.32***	-0.30***	-0.46***	-0.42***	-0.53***	-0.47***	-0.46***	-0.11
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.56)
Fiscal‡		0.37	0.32	0.28		0.49**	0.48**	0.40**
		(0.12)	(0.16)	(0.20)		(0.03)	(0.03)	(0.04)
Energy§			0.03***	0.03***			-0.00	-0.01**
			(0.00)	(0.00)			(0.86)	(0.01)
q = 2				-0.65***				
				(0.00)				
q = 3				-0.62**				
				(0.01)				
q = 4				-0.96***				
				(0.00)				
half=2								-1.66***
								(0.00)
Constant	-0.07	-0.17*	0.10	0.55***	-0.04	-0.16	-0.19	0.38*
	(0.39)	(0.09)	(0.36)	(0.00)	(0.71)	(0.17)	(0.34)	(0.07)
Obs	171	171	171	171	76	76	76	76
R2	0.17	0.20	0.37	0.42	0.24	0.29	0.29	0.41

Note: Robust p-values in parentheses. The dependent variable is the annual inflation forecast error (observed minus forecasted). Two-year horizon considered. Data transformed to fixed-horizon setting. Sample: 19 euro area countries.

† *Real R* refers to real short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

Table 3: IMF WEO forecast errors on monetary policy stance

	GDP forecast error				Inflation forecast error			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real R†	0.01	-0.00	-0.00	-0.00	0.07***	0.03	0.03	0.05**
	(0.25)	(0.85)	(0.97)	(0.96)	(0.00)	(0.11)	(0.14)	(0.04)
RR×EA¶	0.39***	0.42***	0.41***	0.40***	-0.56***	-0.49***	-0.49***	-0.23
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.14)
Fiscal‡		0.23	0.25	0.25		0.46***	0.45***	0.28*
		(0.24)	(0.22)	(0.23)		(0.01)	(0.01)	(0.05)
Energy§			0.00	0.00			-0.00	-0.01***
			(0.40)	(0.41)			(0.90)	(0.00)
half=2				0.05				-1.46***
				(0.85)				(0.00)
Constant	-0.30***	-0.39***	-0.30**	-0.31	0.08	-0.11	-0.13	0.36**
	(0.00)	(0.01)	(0.05)	(0.10)	(0.45)	(0.27)	(0.42)	(0.03)
Obs	108	108	108	108	108	108	108	108
R2	0.20	0.22	0.23	0.23	0.21	0.26	0.26	0.41

Note: Robust p-values in parentheses. The dependent variable is the annual inflation and GDP growth forecast error (observed minus forecasted). Two-year horizon considered. Data transformed to fixed-horizon setting. Sample: advanced economies with available short-term interest rate futures (19 EMU countries and 8 extra-EMU countries: AUS, CAN, JPN, NZL, SWE, CHE, GBR, USA).

† *Real R* refers to real short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

¶ Short-term real interest rate forecast errors interacted with a dummy equal to one if the country belongs to the euro area.

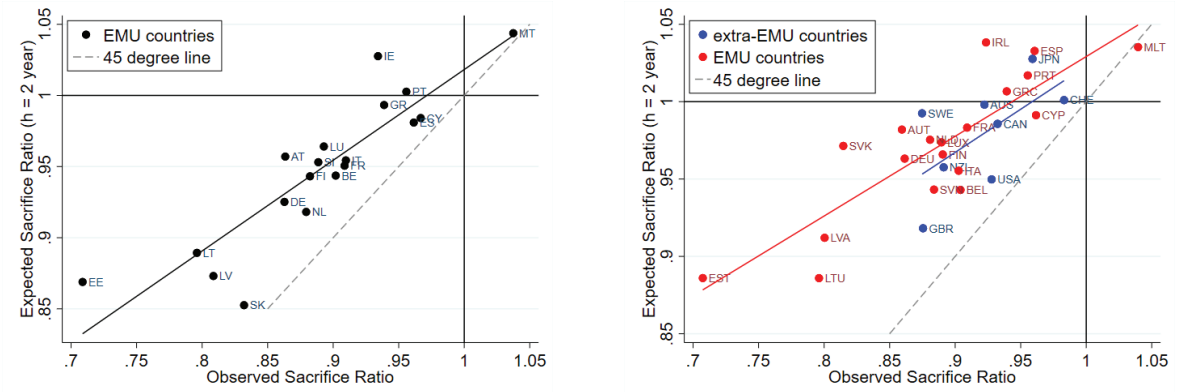
The baseline analysis focuses on two-year-ahead forecasts, using data transformed to the fixed-horizon structure.

In all specifications, the coefficients for the monetary policy stance are positive ($\beta_R > 0$) and significant, indicating a positive association between monetary policy forecast and growth forecast errors. This suggests that the growth effect of monetary policy has been milder than forecasters assumed. This result is robust across specifications and forecasters, holding for both ECB/Eurosystem and IMF projections.

Table 2 has a similar structure but considers inflation forecast error as the dependent variable. Here, the coefficients for monetary policy stance errors are negative ($\beta_R < 0$) and significant, indicating a negative association between monetary policy forecast and inflation forecast errors. This suggests that the effect of monetary policy has been stronger than forecasters assumed. This finding is also robust across model specifications and datasets of forecasts.

Figure 1: Sacrifice ratio across countries

(a) ECB/ESCB forecasts **(b) IMF WEO forecasts**



Note. The sacrifice ratio is computed here as the ratio between the output loss/gain and the price loss/gain over a two-year horizon (100=2021). Fixed event data. The gray dashed line represents the 45-degree line. The vertical axis shows the expected sacrifice ratio two years ahead, based on the April 2022 IMF WEO forecast (Fig.1a) and the June ECB/ESCB forecast (Fig.1b). The horizontal axis shows the observed sacrifice ratio for 2024, based on the April 2024 IMF WEO forecast (Fig.1a) and the June 2024 ECB/ESCB forecast (Fig.1b).

Table 3 focuses on IMF WEO forecasts, which cover a larger group of countries compared to the ECB/Eurosystem: 29 advanced economies, 19 of which belong to the euro area. We interact the monetary policy stance variable with a dummy indicator equal to one for euro area countries. While β_R is not significant in all specifications, the interaction is always significant, indicating that for the IMF forecast, the bias in monetary multipliers comes only from the euro area. In other words, IMF forecasters correctly incorporated the impact of monetary policy for extra-euro area countries but missed the monetary multiplier for euro area countries, similarly to ECB/Eurosystem staff.

In summary, our findings for the euro area indicate that expected monetary policy tightening have been associated with (i) higher GDP growth and (ii) lower inflation than projected. This implies that forecasters overestimated the sacrifice ratio – the cost of output lost per 1% reduction in inflation – during the last monetary policy tightening. Figure 1 illustrates this using IMF WEO and ECB/Eurosystem projections. The vertical axis shows the projected sacrifice ratio before the monetary tightening began in July 2022 (IMF: April 2022, ECB: June 2022), while the horizontal axis shows the observed sacrifice ratio based on the latest data (IMF: April 2024, ECB: June 2024). Comparing the linear fits for EMU and extra-EMU countries with the 45-degree line (grey dashed line), we see that most points lie above this line. This indicates that the observed sacrifice ratio was lower than expected, suggesting that forecasters overestimated the costs of disinflation.

5 Robustness analysis

We carry out several robustness analyses, reported in Section C of the Supplementary Appendix. First, we consider the one-year horizon or pool one-year and two-year horizons to increase sample size, which is limited in our setting (see Tables C.1 and C.2 for GDP and inflation, respectively).

Second, we switch to the fixed-event setting, performing the analysis (i) controlling for quarter of origin dummies, or (ii) considering only one specific quarter of origin at a time. Both options ensure comparability across forecast exercises, although option (ii) drastically reduces observations. Results based on ECB/Eurosystem forecasts are in Tables C.3 and C.4 for GDP and inflation, respectively. Tables C.5 and C.6 display the same results based on IMF WEO projections.

Third, we consider a subset of ECB projection exercises where all observed values of variables are available, avoiding the need to proxy them with the last available forecast of June 2024 (see Tables C.7 and C.8).

Fourth, we consider alternative proxies for monetary policy stance: (i) short-term nominal interest rates as in Forbes et al. (2024) (see Tables C.9 and C.10); (ii) add in the specification long-term real interest rates, which provide insights into agents' perceptions of the future path of real short-term rates (see Table C.11).

Fifth, we add country fixed effects to the baseline analysis (see Tables C.12 and C.13 for GDP growth and inflation, respectively). This corresponds to estimating different average forecast errors for each country, implying that forecast errors can vary across countries.

Finally, we carry out a robustness check which includes euro area GDP growth forecast error as additional control variable. This would help account for the potential endogeneity between country-specific GDP growth forecast errors and the monetary policy stance. Results are robust and are reported in Table C.14 of the Appendix.

All results confirm that our main findings are robust to alternative specifications, sample selections, and definitions of monetary policy stance. The only exception is the analysis based on the fixed-event setting, where results for GDP confirm our baseline results, but results for inflation are not always consistent and sometimes change sign. Given the comparability limitations and small sample size of fixed events, we take the results from this robustness exercise with caution.

6 Conclusions

This paper studies the role of monetary policy during this last tightening cycle in the euro area. We find a positive association between monetary policy stance forecasts and growth forecast errors. This suggests that the effect of monetary policy has been milder than forecasters assumed, implying it may have been less effective than initially thought. In inflation regressions instead, the coefficient associated with monetary policy stance is negative and significant, suggesting that that forecasters have underestimated monetary multipliers. These results are robust across various specifications, robustness checks, and forecasting exercises (ECB/Eurosystem and IMF forecasts). Finally, we find that IMF forecasters have incorrectly quantified the monetary multiplier only for euro area countries, not for extra-EMU countries. Putting all this together, our interpretation is that for euro area countries, the sacrifice ratio, or disinflation cost, has been lower than expected.

We rationalize our findings based on several factors. Forecasters may have faced uncertainty regarding new elements that reduced the impact of monetary policy on GDP, such as excess savings from the COVID-19 period, ample liquidity in the financial system, and households' fixed-term rate indebtedness accompanied by private deleveraging in the euro area. Additionally, the underestimation of the sacrifice ratio aligns with the hypothesis that the implied Phillips curve is steeper than assumed in forecasts. Estimating the slope of the Phillips curve is uncertain. Recent policy discussions have questioned the validity of the latest Phillips curve estimations, which suggested a relatively flat curve and a high sacrifice ratio. However, factors such as anchored inflation expectations and accelerated repricing by firms, observed during the recent monetary tightening cycle, align with a steeper Phillips curve (Escriva, 2024).

Our findings suggest that forecasters may have inaccurately perceived the recent inflationary crisis in the euro area as predominantly supply-driven, underestimating its demand-driven component. This led to the belief that monetary policy in the euro area would be exceedingly costly in terms of output. However, recent evidence, including that presented by Giannone and Primiceri (2024), suggests that demand factors also significantly contribute to inflation dynamics.

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Appendix

A Details on interest rates used in the WEO database

To construct a projection for interest rates, we use interest rate futures, in line with the literature.[15] This section report in detail which interest rate futures we consider for each country.

- **Euro area**
  - Interest rate futures are those of the 3-month EURIBOR, as quoted on EUREX.
  - At the beginning of a year, there are interest rate futures for that same year with monthly expiration.[16] For subsequent years, interest rate futures are only available with quarterly expiration, that is, March, June, September, and December. Therefore we take 12 months averages for the current year and 4 months-averages for the following years.
- **Japan**
  - Interest rate futures refer to the 3-month Euroyen rates and TONA [17] as listed on 'Tokyo-Financial'.
  - Interest rate futures consistently expire on a quarterly basis. For this reason, we take 4 months-averages for each year.
- **United Kingdom**
  - Interest rate futures are based on the 3-month SONIA as quoted on Euronext Liffe.
  - Interest rate futures typically expire on a quarterly basis. As a result, in the majority of instances, the averaging process is conducted every quarter.
- **United States**
  - Interest rate futures are based on the 3-month SOFR as quoted on the Chicago Mercantile Exchange.

[15] Interest rate futures are financial contracts between the buyer and seller agreeing to the future delivery of an interest-bearing asset.

[16] Except for those expiring in July (trading begins in mid-January), August (trading begins in mid-February), September (trading starts in April), and October (trading starts in May).

[17] For the 2023 WEO, the rates are those of the 3-month TONA, which are quoted in the same source as the previous ones.

- The interest rate futures have quarterly expiration until 2022, but from 2023 onwards, they are monthly. The method of averaging is largely akin to the approach used for the United Kingdom.

- **Australia**
  - The closest futures interest rates are those based on 90-day bank bills, as quoted on ASX Trade24.
  - Interest rate futures are set to expire every quarter.

- **Canada**
  - The future interest rate refers to the interest rate of 90-day bank deposits, as quoted in Montreal.
  - Until 2022 (included), the expiration of interest rate futures was set on a monthly basis. However, a shift to a quarterly expiration cycle was implemented starting from the end of 2023.

- **New Zealand**
  - The interest rate futures are based on the 90-day bank bill rate as quoted on ASX Trade24.
  - The interest rate futures have quarterly expiration,so it is averaged every three months and rates are only available for the current year and the following two years.

- **Switzerland**
  - The interest rate futures is based on the 3-month SARON as quoted on ICE.
  - Interest rate futures contracts have quarterly expirations, and data is available for the current year and the following three years.

- **Sweden**
  - Interest rate futures are on the 3-month STIBOR, as quoted on Nasdaq.
  - Futures contracts expire quarterly, and there is data available for the current year and the following two years.

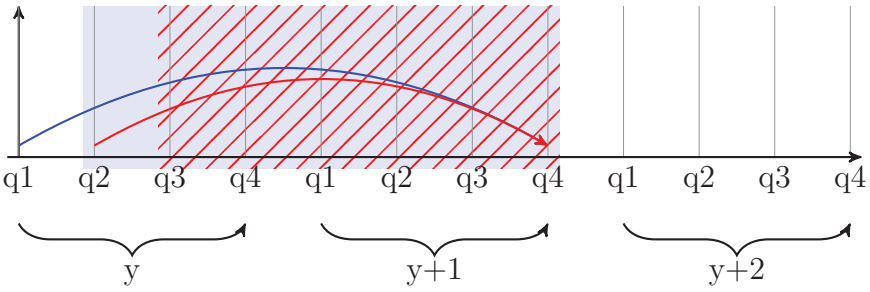
B Fixed-Event and Fixed-Horizon Forecasts

Suppose that one wants to compare $y+1$ GDP forecast realized in the first quarter of year y with those published in the subsequent quarters of year y. The comparison is not fully correct because the information set within the year used to elaborate the forecast differs. More formally, since the quarterly forecast exercises target yearly variables (GDP growth and inflation), the different forecasts that are elaborated along the same calendar year are not comparable since the information set changes over time, with uncertainty decreasing over the calendar year. This setting is known as *fixed-event forecast*.[18]

As a first approximation, one can tackle this problem by controlling for the information set used to formulate the forecast. In our case, this means controlling for quarter dummies of forecast origin. Alternatively, we can estimate the model by the quarter in which each projection exercise is conducted. We include both exercises in our list of robustness checks.

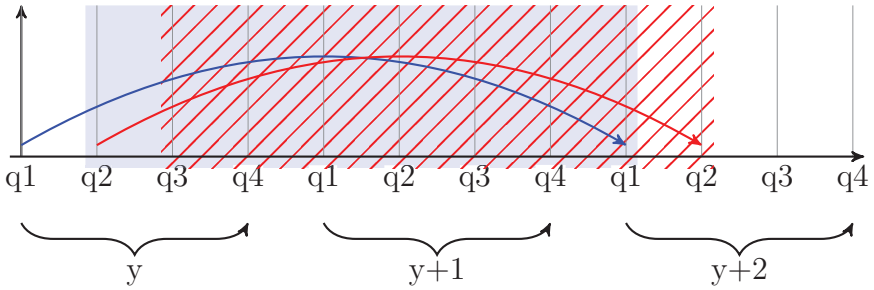
A more correct way to tackle this issue is to move away from the fixed-event forecast setting towards the fixed-horizon forecasts, in which one compares forecasts with the same forecast horizon and thus, comparable information sets. The difference between the two settings is shown in Figure B.1, in an example for two projection exercises (carried out in the first and second quarter of year y) at one-year horizon ($y+1$). In both panels, the arrows represents the horizon of each projection exercise, and its corresponding area reflects the actual horizon implied from the exercise. In the fixed-event setting (Figure B.1a), the forecast exercise carried out in the second quarter implies a one quarter shorter horizon than the exercise closed one quarter before. This boils down to comparability issues. By contrast, the fixed-horizon setting (Figure B.1b) ensures horizons with the same length across exercises, which restores the comparability across forecasts.

Figure B.1: Fixed-events vs fixed horizon forecasts



(a) Fixed event

[18] In a *fixed-event forecast*, the researcher fixes the target event to forecast - in this case $y+1$ GDP growth - and compares projections realized at different points in time.



(b) Fixed horizon

Note: The arrow represents the projection exercise. The begin of the arrow indicates the origin of the forecast, and the end of the arrow indicates the forecast target (horizon). The figure only shows, as an example, two projection exercises at one-year horizon. The blue (red) arrow represents the forecast exercise carried out in $q1$ ($q2$) of year y to forecast the outlook one-year ahead ($y+1$). The light blue (red) area represents the horizon ahead in $q1$ ($q2$) of year y.

To move to fixed horizon setting, we follow Dovern et al. (2012), and approximate the fixed horizon forecast for the next 8 quarters (two years, i.e. the medium term horizon) as an average of the forecasts for the current and next two calendar years weighted by their share in forecasting horizon, according to the following equation, in which q correspond with the projection exercise:

$$\tilde{\hat{x}}_{y+2|y} = \frac{4-q}{8}\hat{x}_{y|y} + \frac{4}{8}\hat{x}_{y+1|y} + \frac{q}{8}\hat{x}_{y+2|y} \tag{B.1}$$

In particular, say that, in year y, we dispose of (fixed-event) 4 different quarterly GDP forecasts for $y+1$ and $y+2$, elaborated in each quarter q of y. The fixed-horizon forecast is fixed at two years (8 quarters), and is represented by the shaded areas in Figure B.1b. Hence, the fixed-horizon forecast for the projection exercise carried out in the first quarter of y is given by the weighted average of the fixed-event forecasts for the current year y ($\hat{x}_{y|y}$) and for the two subsequent years ($\hat{x}_{y+1|y}$ and $\hat{x}_{y+2|y}$), weighted by the corresponding share in the forecast horizon.

$$\begin{aligned}
\tilde{\hat{x}}_{y+2|y,q1} &= \frac{3}{8}\hat{x}_{y|y} + \frac{4}{8}\hat{x}_{y+1|y} + \frac{1}{8}\hat{x}_{y+2|y} \\
&\quad [...] \\
\tilde{\hat{x}}_{y+2|y,q4} &= \frac{1}{8}\hat{x}_{y|y} + \frac{4}{8}\hat{x}_{y+1|y} + \frac{3}{8}\hat{x}_{y+2|y}
\end{aligned}$$

Note that the fixed-horizon setting ensures that different projections of the same calendar year share the same horizon. This improves comparability across projections. Nevertheless,

the information set upon which projections are formulated changes along the calendar year.[19] To account for this possible source of bias, we additionally control for quarter of origin dummies in the fixed-horizon setting.

[19] In addition, there could be specific features associated with projection exercises of specific quarters. For instance, first and third quarter forecasts are carried out by the ECB, as opposed to the other projections, which are jointly realized by all Eurosystem central banks.

C Robustness

Table C.1: Annual GDP growth forecast errors on monetary policy stance on at different horizons

	ECB/ESCB Forecasts								IMF WEO Forecasts							
	1 year ahead				1 & 2 years ahead				1 year ahead				1 & 2 years ahead			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Real R†	0.142***	0.149***	0.163***	0.167***	0.173***	0.175***	0.186***	0.181***	0.192**	0.226***	0.222***	0.338**	0.231***	0.272***	0.262***	0.312***
	(0.001)	(0.001)	(0.001)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.018)	(0.008)	(0.004)	(0.011)	(0.000)	(0.000)	(0.000)	(0.001)
Fiscal‡		0.099	0.107	0.125		0.027	0.032	0.040		0.448*	0.452*	0.433*		0.462**	0.475**	0.463**
		(0.332)	(0.294)	(0.236)		(0.786)	(0.743)	(0.689)		(0.054)	(0.067)	(0.079)		(0.012)	(0.013)	(0.016)
Energy§			-0.004	-0.007			-0.003	-0.003			0.000	-0.005			0.001	-0.001
			(0.467)	(0.359)			(0.440)	(0.636)			(0.907)	(0.361)			(0.574)	(0.808)
q = 2				0.003				0.023								
				(0.991)				(0.866)								
q = 3				-0.282				-0.005								
				(0.461)				(0.981)								
q = 4				0.066				0.172								
				(0.825)				(0.266)								
half=2												-0.803				-0.325
												(0.122)				(0.279)
Constant	-0.121	-0.145	-0.175	-0.164	-0.231**	-0.237**	-0.262***	-0.310***	-0.204	-0.328	-0.308	-0.005	-0.302**	-0.425***	-0.364**	-0.251
	(0.391)	(0.291)	(0.209)	(0.405)	(0.022)	(0.012)	(0.006)	(0.010)	(0.363)	(0.159)	(0.253)	(0.989)	(0.024)	(0.003)	(0.021)	(0.244)
Observations	171	171	171	171	342	342	342	342	76	76	76	76	152	152	152	152
R-squared	0.0757	0.0803	0.0844	0.0904	0.0988	0.0990	0.101	0.104	0.0654	0.142	0.142	0.168	0.0892	0.162	0.164	0.170

Note: Robust pval in parentheses. The dependent variable is annual GDP growth forecast error (difference between GDP growth observed and forecasted). Two-years ahead horizon considered. The sample refers to euro area countries (19).

† *Real R* refers to real short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

Table C.2: Annual inflation forecast errors on monetary policy stance at different horizons

	ECB/ESCB Forecasts								IMF WEO Forecasts							
	1 year ahead				1 & 2 years ahead				1 year ahead				1 & 2 years ahead			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Real R†	-0.286***	-0.264***	-0.394***	-0.381***	-0.291***	-0.268***	-0.397***	-0.369***	-0.499***	-0.462***	-0.493***	-0.144	-0.482***	-0.438***	-0.450***	-0.141
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.366)	(0.000)	(0.000)	(0.000)	(0.235)
Fiscal‡		0.291*	0.212	0.195		0.316**	0.250*	0.223*		0.486**	0.522**	0.465**		0.490***	0.505***	0.434***
		(0.083)	(0.133)	(0.172)		(0.025)	(0.058)	(0.083)		(0.022)	(0.016)	(0.012)		(0.003)	(0.002)	(0.002)
Energy§			0.040***	0.032***			0.036***	0.026***			0.004	-0.012**			0.002	-0.011***
			(0.000)	(0.000)			(0.000)	(0.000)			(0.398)	(0.023)			(0.566)	(0.001)
q = 2				-0.882***				-0.754***								
				(0.000)				(0.000)								
q = 3				-0.903***				-0.831***								
				(0.004)				(0.000)								
q = 4				-0.865***				-0.971***								
				(0.002)				(0.000)								
half=2												-2.418***				-1.995***
												(0.000)				(0.000)
Constant	-0.182*	-0.251**	0.031	0.538***	-0.110	-0.191**	0.099	0.593***	-0.382**	-0.517***	-0.360	0.552*	-0.175	-0.306***	-0.234	0.460**
	(0.066)	(0.026)	(0.777)	(0.001)	(0.104)	(0.015)	(0.244)	(0.000)	(0.036)	(0.007)	(0.178)	(0.069)	(0.104)	(0.005)	(0.164)	(0.012)
Observations	171	171	171	171	342	342	342	342	76	76	76	76	152	152	152	152
R-squared	0.204	0.230	0.472	0.516	0.188	0.213	0.414	0.462	0.254	0.306	0.315	0.450	0.240	0.290	0.292	0.423

Note: Robust pval in parentheses. The dependent variable is annual inflation forecast error (difference between inflation observed and forecasted). Two-years ahead horizon considered. The sample refers to euro area countries (19).

† *Real R* refers to real short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

Table C.3: Annual GDP growth forecast errors on monetary policy stance at different horizons. Fixed event data

	2 years ahead							1 & 2 years ahead						
	(1) Full sample	(2) Full sample	(3) Full sample	(4) Origin Q1	(5) Origin Q2	(6) Origin Q3	(7) Origin Q4	(8) Full sample	(9) Full sample	(10) Full sample	(11) Origin Q1	(12) Origin Q2	(13) Origin Q3	(14) Origin Q4
Real R†	0.434***	0.419***	0.249**	0.448***	0.667***	0.645***	0.222	0.254***	0.233***	0.180**	0.705***	0.226*	0.136	0.119
	(0.000)	(0.000)	(0.021)	(0.002)	(0.000)	(0.000)	(0.122)	(0.002)	(0.004)	(0.045)	(0.000)	(0.094)	(0.143)	(0.189)
Fiscal‡		-0.085	-0.115	0.196	-0.168	-0.064	-0.303		-0.257**	-0.259**	-0.348*	-0.427**	-0.157	-0.077
		(0.524)	(0.381)	(0.277)	(0.524)	(0.741)	(0.135)		(0.019)	(0.018)	(0.077)	(0.021)	(0.284)	(0.615)
Energy§			0.023***							0.008				
			(0.000)							(0.222)				
q = 2	-0.414***	-0.415***	-0.267**					-0.169	-0.159	-0.126				
	(0.001)	(0.002)	(0.013)					(0.210)	(0.239)	(0.336)				
q = 3	-0.462***	-0.459***	0.269*					0.198	0.215	0.461**				
	(0.002)	(0.002)	(0.067)					(0.230)	(0.198)	(0.021)				
q = 4	-0.260	-0.228	0.082					0.492***	0.485***	0.572***				
	(0.181)	(0.238)	(0.614)					(0.007)	(0.007)	(0.000)				
Constant	-0.290***	-0.287***	-0.270***	-0.298***	-0.708***	-0.809***	-0.438***	-0.688***	-0.628***	-0.617***	-0.468***	-0.738***	-0.522***	-0.266**
	(0.001)	(0.001)	(0.003)	(0.000)	(0.000)	(0.000)	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.021)
Observations	171	171	171	57	38	38	38	342	342	342	114	76	76	76
R-squared	0.189	0.192	0.281	0.252	0.227	0.247	0.122	0.118	0.138	0.143	0.344	0.160	0.067	0.037

Note: Robust pval in parentheses. The dependent variable is annual GDP growth forecast error (difference between GDP growth observed and forecasted). Fixed-event structure considered. The sample refers to euro area countries (19).

† *Real R* refers to real short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

Table C.4: Annual inflation growth forecast errors on monetary policy stance at different horizons. Fixed event data

	2 years ahead							1 & 2 years ahead						
	(1) Full sample	(2) Full sample	(3) Full sample	(4) Origin Q1	(5) Origin Q2	(6) Origin Q3	(7) Origin Q4	(8) Full sample	(9) Full sample	(10) Full sample	(11) Origin Q1	(12) Origin Q2	(13) Origin Q3	(14) Origin Q4
Real R†	0.269**	0.234*	0.263*	-0.191*	-0.005	0.167	0.817***	-0.112*	-0.105	-0.065	-0.828***	-0.266	0.020	0.188***
	(0.019)	(0.083)	(0.080)	(0.077)	(0.974)	(0.205)	(0.000)	(0.088)	(0.102)	(0.442)	(0.000)	(0.119)	(0.797)	(0.000)
Fiscal‡		-0.214	-0.208	-0.328**	-0.324	-0.262	0.014		0.087	0.088	-0.002	0.268	0.059	-0.191**
		(0.128)	(0.134)	(0.043)	(0.189)	(0.131)	(0.903)		(0.461)	(0.451)	(0.994)	(0.270)	(0.755)	(0.041)
Energy§			-0.004							-0.006				
			(0.490)							(0.341)				
q = 2	-0.042	-0.043	-0.069					-0.249	-0.252	-0.277*				
	(0.691)	(0.679)	(0.483)					(0.117)	(0.114)	(0.078)				
q = 3	-0.226*	-0.220*	-0.344*					-0.901***	-0.906***	-1.092***				
	(0.084)	(0.097)	(0.057)					(0.000)	(0.000)	(0.000)				
q = 4	-0.694***	-0.613***	-0.666***					-1.142***	-1.139***	-1.205***				
	(0.000)	(0.002)	(0.001)					(0.000)	(0.000)	(0.000)				
Constant	0.224**	0.231**	0.228**	0.198**	0.196	0.030	-0.432***	0.581***	0.561***	0.552***	0.374***	0.161	-0.243*	-0.311***
	(0.018)	(0.014)	(0.018)	(0.012)	(0.122)	(0.821)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.247)	(0.054)	(0.001)
Observations	171	171	171	57	38	38	38	342	342	342	114	76	76	76
R-squared	0.186	0.208	0.211	0.095	0.057	0.090	0.661	0.118	0.120	0.123	0.287	0.140	0.002	0.194

Note: Robust pval in parentheses. The dependent variable is annual inflation forecast error (difference between inflation observed and forecasted). Fixed-event structure considered. The sample refers to euro area countries (19).

† *Real R* refers to real short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

† Energy price forecast error.

Table C.5: Annual GDP growth forecast errors on monetary policy stance at different horizons. Fixed event data. IMF WEO forecasts.

	2 years ahead					1 & 2 years ahead				
	(1) Full sample	(2) Full sample	(3) Full sample	(4) Origin H1	(5) Origin H2	(6) Full sample	(7) Full sample	(8) Full sample	(9) Origin H1	(10) Origin H2
Real R†	0.555***	0.601***	0.453***	0.622**	0.546***	0.347***	0.396***	0.308**	0.958***	0.236
	(0.000)	(0.000)	(0.005)	(0.012)	(0.001)	(0.003)	(0.007)	(0.032)	(0.000)	(0.130)
Fiscal‡		0.188	0.257	0.089	0.304		0.300	0.317	0.528*	0.288
		(0.603)	(0.513)	(0.820)	(0.508)		(0.212)	(0.188)	(0.061)	(0.329)
Energy§			0.009***					0.005*		
			(0.001)					(0.089)		
half=2	-0.264	-0.272	0.246			0.399**	0.446**	0.705***		
	(0.109)	(0.100)	(0.128)			(0.027)	(0.014)	(0.002)		
Constant	-0.625***	-0.669***	-0.448***	-0.639***	-0.925***	-0.867***	-0.988***	-0.862***	-0.827***	-0.581***
	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Observations	76	76	76	38	38	152	152	152	76	76
R-squared	0.140	0.147	0.274	0.181	0.106	0.135	0.158	0.175	0.312	0.092

Note: Robust pval in parentheses. The dependent variable is annual GDP growth forecast error (difference between GDP growth observed and forecasted). Fixed-event structure considered. The sample refers to euro area countries (19).

† *Real R* refers to real short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

Table C.6: Annual inflation forecast errors on monetary policy stance at different horizons. Fixed event data. IMF WEO forecasts.

	2 years ahead					1 & 2 years ahead				
	(1) Full sample	(2) Full sample	(3) Full sample	(4) Origin H1	(5) Origin H2	(6) Full sample	(7) Full sample	(8) Full sample	(9) Origin H1	(10) Origin H2
Real R†	0.515***	0.514***	0.608***	0.366	0.729***	-0.118	-0.055	0.205	-0.520	0.078
	(0.000)	(0.001)	(0.000)	(0.109)	(0.000)	(0.302)	(0.646)	(0.146)	(0.109)	(0.470)
Fiscal‡		-0.003	-0.046	-0.013	-0.041		0.381**	0.329*	0.339	0.236
		(0.992)	(0.859)	(0.979)	(0.831)		(0.042)	(0.068)	(0.246)	(0.192)
Energy§			-0.006**					-0.015***		
			(0.027)					(0.000)		
half=2	-0.603***	-0.603***	-0.931***			-0.900***	-0.840***	-1.604***		
	(0.001)	(0.001)	(0.000)			(0.000)	(0.000)	(0.000)		
Constant	0.249*	0.249	0.110	0.231	-0.474***	0.646***	0.493***	0.123	0.290*	-0.269**
	(0.098)	(0.119)	(0.465)	(0.200)	(0.004)	(0.001)	(0.007)	(0.476)	(0.088)	(0.035)
Observations	76	76	76	38	38	152	152	152	76	76
R-squared	0.160	0.160	0.222	0.077	0.286	0.0930	0.125	0.245	0.128	0.034

Note: Robust pval in parentheses. The dependent variable is annual inflation forecast error (difference between inflation observed and forecasted). Fixed-event structure considered. The sample refers to euro area countries (19).

† *Real R* refers to real short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

Table C.7: Annual GDP growth errors on monetary policy stance only with observed values.

	ECB/ESCB Forecats				IMF WEO Forecasts			
	1 years ahead				1 years ahead			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real R†	0.346***	0.362***	0.362***	0.390***	0.382***	0.381**	0.446**	0.446**
	(0.001)	(0.001)	(0.002)	(0.002)	(0.009)	(0.013)	(0.016)	(0.016)
Fiscal‡		0.113	0.108	0.091		0.349	0.322	0.322
		(0.465)	(0.489)	(0.582)		(0.330)	(0.347)	(0.347)
Energy§			0.002	0.005			0.008	0.008
			(0.781)	(0.714)			(0.234)	(0.234)
q = 2				0.418				
				(0.172)				
q = 3				0.470				
				(0.601)				
q = 4				-				
half=2								-
Constant	1.053**	1.061**	1.106**	1.117**	0.584	0.332	1.374	1.374
	(0.033)	(0.031)	(0.024)	(0.038)	(0.310)	(0.626)	(0.187)	(0.187)
Observations	76	76	76	76	38	38	38	38
R-squared	0.190	0.196	0.197	0.211	0.141	0.181	0.213	0.213

Note: Robust pval in parentheses. The dependent variable is annual GDP growth forecast error (difference between GDP growth observed and forecasted). Fixed-horizon structure considered. The sample refers to euro area countries (19). Based on subset of projection exercises in which all observed values of variables are available and there is not need to proxy them with the last available forecast of June 2024.

† *Real R* refers to real short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

Table C.8: Annual inflation forecast errors on monetary policy stance only with observed values.

	ECB/ESCB Forecasts 1 years ahead				IMF WEO Forecasts 1 years ahead			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real R†	-0.333**	-0.258	-0.237*	-0.154	-0.428**	-0.430**	-0.133	-0.133
	(0.035)	(0.133)	(0.051)	(0.183)	(0.014)	(0.010)	(0.355)	(0.355)
Fiscal‡		0.542*	0.369**	0.154		0.514	0.391*	0.391*
		(0.055)	(0.039)	(0.374)		(0.113)	(0.054)	(0.054)
Energy§			0.050***	0.094***			0.036***	0.036***
			(0.000)	(0.000)			(0.000)	(0.000)
q = 2				-0.711**				
				(0.033)				
q = 3				3.184***				
				(0.000)				
q = 4				-				
half=2								-
Constant	-0.197	-0.160	1.329***	2.350***	0.381	0.011	4.762***	4.762***
	(0.759)	(0.808)	(0.003)	(0.000)	(0.476)	(0.984)	(0.000)	(0.000)
Observations	76	76	76	76	38	38	38	38
R-squared	0.0883	0.153	0.585	0.698	0.117	0.174	0.613	0.613

Note: Robust pval in parentheses. The dependent variable is annual inflation forecast error (difference between inflation observed and forecasted). Fixed-horizon structure considered. The sample refers to euro area countries (19). Based on subset of projection exercises in which all observed values of variables are available and there is not need to proxy them with the last available forecast of June 2024.

† *Real R* refers to real short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

Table C.9: Annual GDP growth forecast errors on monetary policy stance using nominal short term interest rate.

	ECB/ESCB Forecats				IMF WEO Forecasts			
	2 years ahead				2 years ahead			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Nominal ST rate†	0.289***	0.278***	0.306***	0.306***	0.269*	0.364**	0.356**	0.253
	(0.000)	(0.000)	(0.000)	(0.000)	(0.053)	(0.015)	(0.015)	(0.206)
Fiscal‡		-0.142	-0.132	-0.127		0.444	0.498	0.496
		(0.409)	(0.443)	(0.468)		(0.156)	(0.112)	(0.115)
Energy§			-0.006	-0.006			0.005	0.006
			(0.286)	(0.405)			(0.176)	(0.115)
q = 2				0.069				
				(0.673)				
q = 3				-0.003				
				(0.989)				
q = 4				0.080				
				(0.727)				
half=2								0.283
								(0.352)
Constant	-0.265**	-0.226**	-0.273**	-0.309**	-1.391***	-1.803***	-1.542***	-1.325**
	(0.024)	(0.030)	(0.010)	(0.035)	(0.003)	(0.001)	(0.002)	(0.017)
Observations	171	171	171	171	76	76	76	76
R-squared	0.198	0.203	0.210	0.211	0.0427	0.0955	0.128	0.131

Note: Robust pval in parentheses. The dependent variable is annual GDP growth forecast error (difference between GDP growth observed and forecasted). The sample refers to euro area countries (19). Monetary policy stance approximated with nominal short term interest rate.
† *Nominal ST R* refers to nominal short term interest rate forecast.
‡ *Fiscal* refers to fiscal stance forecast.
§ *Energy* refers to energy price forecast errors.
$***p < 0.01, **p < 0.05, *p < 0.1$.

Table C.10: Annual inflation forecast errors on monetary policy stance using nominal short term interest rate.

	ECB/ESCB Forecasts 2 years ahead				**IMF WEO Forecasts** 2 years ahead			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Nominal ST R†	-0.324***	-0.297***	-0.459***	-0.418***	-1.306***	-1.262***	-1.258***	-1.502***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Fiscal‡		0.373	0.316	0.277		0.202	0.171	0.166
		(0.122)	(0.164)	(0.201)		(0.148)	(0.244)	(0.261)
Energy§			0.033***	0.025***			-0.003	0.001
			(0.000)	(0.001)			(0.200)	(0.699)
q = 2				-0.652***				
				(0.001)				
q = 3				-0.624**				
				(0.011)				
q = 4				-0.957***				
				(0.001)				
half=2								0.671***
								(0.005)
Constant	-0.069	-0.170*	0.104	0.553***	3.882***	3.695***	3.543***	4.056***
	(0.390)	(0.094)	(0.359)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	171	171	171	171	76	76	76	76
R-squared	0.172	0.196	0.370	0.422	0.689	0.697	0.704	0.718

Note: Robust pval in parentheses. The dependent variable is annual inflation forecast error (difference between inflation observed and forecasted). The sample refers to euro area countries (19). Monetary policy stance approximated with nominal short term interest rate.

† *Nominal ST R* refers to nominal short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

Table C.11: Annual GDP growth and inflation forecast errors on monetary policy stance on using real short and long term interest rate.

	ECB/ESCB Forecats 2 years ahead							
	GDP growth				inflation			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real ST R†	0.240***	0.221**	0.248**	0.252**	-0.030	0.032	-0.129	-0.133
	(0.003)	(0.013)	(0.012)	(0.019)	(0.703)	(0.679)	(0.178)	(0.194)
Real LT R¶	0.167	0.188	0.170	0.173	-1.004***	-1.073***	-0.967***	-0.916***
	(0.156)	(0.144)	(0.208)	(0.230)	(0.000)	(0.000)	(0.000)	(0.000)
Fiscal‡		-0.179	-0.167	-0.167		0.580***	0.514***	0.486***
		(0.327)	(0.366)	(0.382)		(0.001)	(0.001)	(0.002)
Energy§			-0.004	-0.006			0.026***	0.024***
			(0.416)	(0.406)			(0.000)	(0.000)
q = 2				-0.006				-0.257
				(0.974)				(0.108)
q = 3				-0.088				-0.175
				(0.716)				(0.307)
q = 4				-0.024				-0.407**
				(0.919)				(0.046)
Constant	-0.470**	-0.448**	-0.464**	-0.452**	1.166***	1.095***	1.189***	1.309***
	(0.020)	(0.016)	(0.012)	(0.018)	(0.000)	(0.000)	(0.000)	(0.000)
Observations	171	171	171	171	171	171	171	171
R-squared	0.209	0.217	0.222	0.222	0.452	0.509	0.617	0.626

Note: Robust pval in parentheses. The dependent variable is annual GDP growth and inflation forecast error (difference between observed and forecasted). The sample refers to euro area countries (19). Monetary policy stance approximated with both real short term and long term interest rate.
† *Real ST R* refers to real short term interest rate forecast errors. ¶ *Real LT R* refers to real long term interest rate forecast.
‡ *Fiscal* refers to fiscal stance forecast.
§ *Energy* refers to energy price forecast errors.
$***p < 0.01, **p < 0.05, *p < 0.1$.

Table C.12: Annual GDP growth forecast errors on monetary policy stance on including country fixed effects.

	ECB/ESCB Forecasts 2 years ahead				IMF WEO Forecasts 2 years ahead			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real ST R†	0.269***	0.262***	0.295***	0.290***	0.274***	0.263***	0.241***	0.179*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.099)
Fiscal‡		-0.084	-0.062	-0.049		-0.064	-0.011	-0.000
		(0.687)	(0.764)	(0.809)		(0.722)	(0.956)	(1.000)
Energy§			-0.005*	-0.004			0.002*	0.004
			(0.059)	(0.246)			(0.093)	(0.143)
q = 2				0.071				
				(0.545)				
q = 3				0.041				
				(0.822)				
q = 4				0.122				
				(0.533)				
half=2								0.180
								(0.551)
Observations	171	171	171	171	76	76	76	76
R-squared	0.702	0.703	0.709	0.710	0.845	0.846	0.853	0.854

Note: Robust pval in parentheses. The dependent variable is annual GDP growth forecast error (difference between observed and forecasted). The sample refers to euro area countries (19). Country fixed effects included (not reported in the table).

† *Real ST R* refers to real short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

Table C.13: Annual inflation forecast errors on monetary policy stance including country fixed effects.

	ECB/ESCB Forecasts 2 years ahead				**IMF WEO Forecasts** 2 years ahead			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Real ST R†	-0.404***	-0.335***	-0.579***	-0.581***	-0.825***	-0.654***	-0.677***	-0.364
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.236)
Fiscal‡		0.918**	0.745**	0.650**		1.033**	1.089**	1.037**
		(0.017)	(0.021)	(0.036)		(0.024)	(0.020)	(0.016)
Energy§			0.038***	0.037***			0.002	-0.004
			(0.000)	(0.000)			(0.489)	(0.416)
q = 2				-0.673***				
				(0.000)				
q = 3				-0.251				
				(0.240)				
q = 4				-0.629**				
				(0.017)				
half=2								-0.907
								(0.163)
Observations	171	171	171	171	76	76	76	76
R-squared	0.272	0.332	0.551	0.588	0.497	0.552	0.558	0.574

Note: Robust pval in parentheses. The dependent variable is annual inflation forecast error (difference between observed and forecasted). The sample refers to euro area countries (19). Country fixed effects included (not reported in the table).

† *Real ST R* refers to real short term interest rate forecast.

‡ *Fiscal* refers to fiscal stance forecast.

§ *Energy* refers to energy price forecast errors.

$***p < 0.01, **p < 0.05, *p < 0.1$.

Table C.14: Annual GDP growth forecast errors on monetary policy stance including euro area GDP growth forecast error.

	ECB/ESCB Forecasts 2 years ahead			
	(1)	(2)	(3)	(4)
Real R†	0.346***	0.334***	0.337***	0.332***
	(0.000)	(0.000)	(0.000)	(0.000)
Fiscal‡		-0.120	-0.119	-0.121
		(0.490)	(0.493)	(0.488)
Energy§			-0.002	0.005
			(0.658)	(0.464)
q = 2				-0.261
				(0.267)
q = 3				0.169
				(0.512)
q = 4				0.074
				(0.750)
euro area GDP growth forecast error	1.002*	0.960	0.841*	1.523*
	(0.088)	(0.108)	(0.078)	(0.054)
Constant	-1.906**	-1.803*	-1.624**	-2.691**
	(0.048)	(0.066)	(0.044)	(0.042)
Observations	171	171	171	171
R-squared	0.215	0.218	0.219	0.224

Note: Robust pval in parentheses. The dependent variable is annual inflation forecast error (difference between observed and forecasted). The sample refers to euro area countries (19).
† *Real ST R* refers to real short term interest rate forecast.
‡ *Fiscal* refers to fiscal stance forecast.
§ *Energy* refers to energy price forecast errors.
$***p < 0.01, **p < 0.05, *p < 0.1$.

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