INFLATION TARGETING AND FORECASTING: EVIDENCE FROM EURO AREA

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Abstract: There are different structures that enable a central bank to strengthen the performance of a monetary policy. Price stability is essential to central banks in order to promote a successful monetary policy and they have unequivocal authority in determining the way on how to achieve it. Controlling price movements between a particular bandwidth through inflation targeting, is one way that can contribute in addressing and achieving the specific goals of a monetary policy. There are different structures that enable a central bank to strengthen the performance of a monetary policy. Price stability is essential to central banks in order to promote a successful monetary policy and they have unequivocal authority in determining the way on how to achieve it. Controlling price movements between a particular bandwidth through inflation targeting, is one way that can contribute in addressing and achieving the specifics goals of a monetary policy. This paper will start by comparing the actual and forecasted inflation, based on quarterly data from OECD for the period 2010 – 2026. Price data is derived from Harmonized core inflation for the 17 member of the Euro area (EA17). For the most part of the period, inflation stud firmly below the 2% level i.e. in accordance with the objectives of the ECB, before spiking to historic levels during the COVID 19 pandemic, peaking around 5.5 percent, and stabilizing afterword's at the 2 percent level, until the end of 2026. Evaluating the forecast error, three metrics will be employed, based on the work of Czekaj et al. (2024). These methods are: mean absolute forecast error (MAE), root mean squared forecast errors (RMSE) and mean absolute percentage error (MAPE). In the case of MAE for yearly data inflation forecast was off by only 0.83 percent, meaning that inflation targeting by the ECB was in line with the expectations, because predictive inflation error was inferior of 2 percent, lower than the target set by the central bank. The same thing cannot be said for the quarterly data, where mean absolute error is 2.89 percent, considerably greater than the ECB objective. MAPE, method is used to calculate the average forecast error, with yearly and quarterly data, the results show that on average the prediction is off by 0.54 percent and 0.58 percent respectively. Considering the RMSE method, it produces on average a prediction for yearly and quarterly data, off by 1.27 and 1.34 respectively. In the case when forecast accuracy measures are considered separately, q3 and q4 quarters are the quarters where prediction accuracy is the lowest for the three methods. Examining the accuracy of forecasted measure for inflation targeting economies, the results are in line with Czekaj et al. (2024) and Schnabel (2024). Inflation targeting has contributed in stabilizing price increases with one exception, during a sudden economic shock, i.e. COVID 19 crises. Moreover, through forecasted accuracy methods this study showed that in q3 and q4 quarters the errors where the highest and volatility of errors in predicting inflation was the greatest during the shock of COVID 19 crises.
Keywords: Inflation, Central Bank, Euro Area, Prices

1. INTRODUCTION

There are different structures that enable a central bank to strengthen the performance of a monetary policy. Price stability is essential to central banks in order to promote a successful monetary policy and they have unequivocal authority in determining the way on how to achieve it. Controlling price movements between a particular bandwidth through inflation targeting, is one way that can contribute in addressing and achieving the specific goals of a monetary policy. When setting the groundwork for a distinct monetary policy, the authority of a central bank should define clearly the goals, instruments and also the macroeconomic models it will use in order to achieve its objectives. There are various variables that are debated among economists and considerate as targets to curve inflation in short and medium term, for example, exchange rate, changes of prices in a particular sector and the rate of growth in money or credit. A central bank can attain these targets by employing open market operations, a discount rate and insisting on a specific level of reserve requirements. In practice the approach used by countries to specifically target inflation is customized to their requirements, nevertheless there are certain conjectures that can be made. By far the strongest indication of an inflation targeting policy is the announcement by the central bank that in a foreseeable future it will seek to maintain inflation to an explicit level, more often to a particular range for example, between 1 and 3 percent in a horizon ranging from one to four years, Bernanke and Mishkin (1997). Analyzing the implementations of monetary policies based on the data of 26 central banks, Borio and Chavaz

(2025), followed the flexibility of numerical inflation target and the impact of two objectives, employment (or output) and financial stability. The authors point out to two main results. First, the numerical inflation targets during the years have become more stricter, but on the contrary the horizon i.e. the time period through which to achieve that target has become less strict. Second, these tendencies are more likely to manifest themselves in advanced economies rather than in emerging market economies. Inflation targeting has resulted to be an effective framework of monetary policy to contain rising prices and it is synonyms to greater independence and transparency of a central bank operating farther away from political influence. Since the 1980, the application of inflation targeting has been greeted by great success considering that during the same period the economic environment benefited from a decrease in volatility and price pressures in a global scale. The COVID 19 pandemic crises was defined by a rise in shocks hitting national economies with an unprecedented speed, provoking a sudden and unexpected changes to global economy and also causing forecast inflation errors to rise. After the rise of double-digit inflation during the pandemic, long run inflation in the advanced economies remained around 2% level, affirming inflation targeting structure as a method to stabilize prices, Schnabel (2024). Inflation targeting as a strategy since it was initiated in the early 1990 it become a dominant monetary policy approach to stabilize inflation in advanced and emerging market economies, Kiley and Mishkin (2025) highlighted the success of this framework in stabilizing expected and real inflation for the Federal Reserve and the European Central Bank (ECB). Nevertheless, the authors stated some challenges that advance economies face using this type of strategy, one of the most important is imposing a too rigid monetary rule that won't allow the monetary policy to react adequately to unanticipated events. According to a report of the Bank of International Settlements, BIS (2024), during the last decades central banks preformed successfully their role as a stabilizing entity during a period of stress to avoid an economic collapse. The report stated that in order to evaluate correctly the credibility of a monetary policy framework, central banks should observe four aspects: robustness, the ability of a framework to withstand different scenarios, realism, monetary policy must posses the right ability to asses realistically what it can or cannot do, safety margins, policy implementation should be more flexible and nimbleness, monetary policy need to respond quickly and effectively to unforeseen consequences. Inflation targeting framework can be implemented in several ways, employing point targets or having specific target ranges. Ehrmann (2021), using data from 20 economies tested the following idea does applying different targets types to inflation at short term periods affect inflation differently. The author tested point targets, point targets with tolerance bands and target ranges and concluded that target ranges are more consistent in achieving the central banks goals. Zhang and Wang (2022), studying the effects of inflation targeting in enhancing economic performance in advanced economies found that this form of monetary policy strategy does not lead to superior real GDP growth and CPI inflation. They emphasized the dynamic nature of inflation targeting framework, in the sense that upper or lower bands of the target can change depending on the guidance set by central bank. Moreover, the authors suggest that in an event of commodity price shocks inflation targeting is not a good strategy when there is a real risk of increasing rates that may not neutralize the price increases. Investigating the macroeconomic effects of the inflation targeting framework in advanced, emerging markets and developing economies, Bhalla et al. (2023), assessed its relevance. Their results suggest countries that embraced inflation targeting as a strategy to control price increases had success in only 50% of the cases. Containing inflation between fixed bands i.e. inflation target, monetary policy authority needs to apply a consistent inflation forecasting model. Bennett and Owyang (2022), considered the performance of different types of macroeconomic models such as consumer, professional, market-based, and model-based inflation forecasts. They found survey-based forecasts to be more accurate than model-based forecasts. In order to evaluate properly the consistency of empirical literature on inflation targeting studies, adopting a meta regression analysis, Balima et al. (2017), analyzed a sample of 113 studies by filtering out publication biases and concluded that inflation targeting strategy contributed in decreasing inflation and real GDP growth volatility.

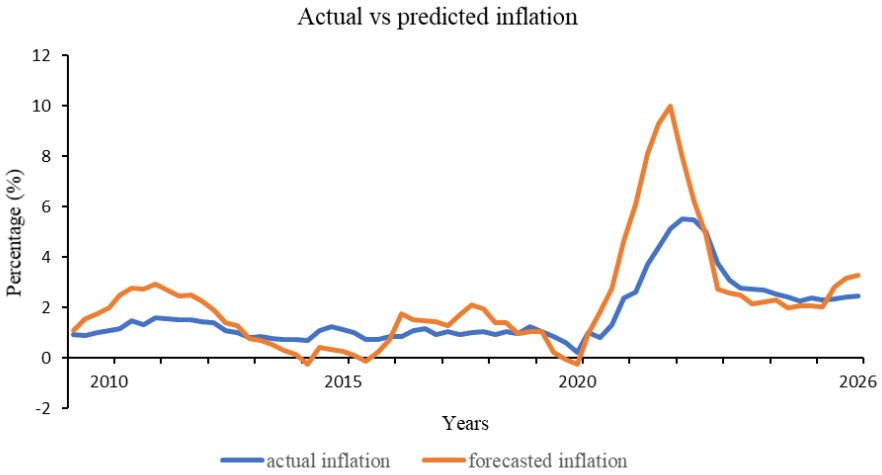
A comparative analysis between actual and predicted inflation is presented, and then forecasting accuracy measures are employed to evaluated inflation errors. This introduction section is followed by several sections, as materials and methods, results, discussions and conclusions.

2. MATERIALS AND METHODS

In this section a stylized fact of actual and forecasted inflation is presented in Figure 1, based on quarterly data from OECD for the period 2010 – 2026. Price data is derived from Harmonized core inflation for the 17 member of the Euro area (EA17). As illustrated in the graph for the most part of the period, inflation stud firmly below the 2% level i.e. in accordance with the objectives of the ECB, before spiking to historic levels during the COVID 19 pandemic, peaking around 5.5 percent, and stabilizing afterword's at the 2 percent level, until the end of 2026. Forecast inflation through the same period had underestimated and overestimated inflation, even at times becoming negative, 2014, 2015 and 2019. Same as actual inflation, the curvature of predicted inflation, even though it surpassed the

target of 2% in 2011-2012, throughout the period it remained stable and in line with ECB' goals. The pandemic crises had been an important factor that contributed in overestimating price increases. During this period the forecasted inflation peaked at 9.98 percent, before reaching more appropriate rate around 2% from 2023 to 2026.

Figure 1.



Source: Data OECD, authors' calculations

To perform a forecast accuracy analysis for harmonized core inflation a comparison of yearly and quarterly data, between predicted and actual inflation, is conducted and they are based on the data provided by the OECD inflation projection for the period 2010 – 2026. A summary of the descriptive statistics of the error, calculated as the difference between actual and forecasted inflation, is presented in table 1. Error calculations are made from a more general form of forecast error for a specific time period according to the following equation:

$$E_t = \pi_t - \hat{\pi}_t$$

where π_t is actual inflation at period t, and $\hat{\pi}_t$ is forecast inflation at period t.

From statistics it stands out the standard error of quarterly inflation data which is half that of yearly data. Considering risk, quarterly inflation error is characterized by a higher volatility than yearly data, i.e. higher standard deviation and sample variance.

Table 1. Harmonized core inflation

	HCI - Yearly	*HCI - Quarterly*
Mean	-0.48	-0.48
Standard Error	0.29	0.15
Median	-0.44	-0.29
Standard Deviation	1.21	1.26
Sample Variance	1.47	1.59
Kurtosis	7.23	4.28
Skewness	-2.29	-1.88
Range	5.30	5.95
Minimum	-4.46	-4.94
Maximum	0.84	1.02
Sum	-8.19	-32.78
Count	17	68

Source: Data OECD, authors' calculations

Evaluation furthermore the forecast error, other metrics will be employed, based on the work of Czekaj et al. (2024). These measures are: mean absolute forecast error (MAE), root mean squared forecast errors (RMSE) and mean absolute percentage error (MAPE).

The measure of mean absolute forecast error (MAE) calculates the absolute differences between each actual and predicted values of inflation and averages those differences. Specificity of this measure is that it treats all errors uniformly, which makes them more resistant to outliers and is calculated based on the following equation:

$$MAE_t = \frac{1}{n}\sum_{t=1}^{n}|\pi_t - \hat{\pi}_t|$$

Mean absolute percentage error (MAPE) is a measure of the accuracy of the prediction method, expressed as a percentage and it can be calculated by the following formula:

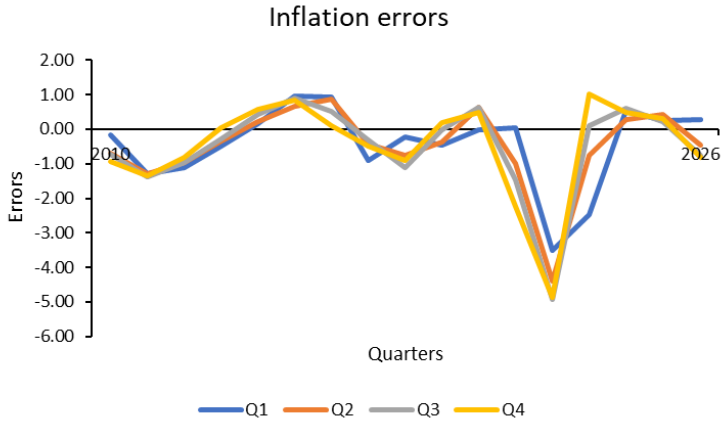
$$MAPE_t = \frac{100}{n}\sum_{t=1}^{n}\left|\frac{\pi_t - \hat{\pi}_t}{\pi_t}\right|$$

Lastly, the root mean squared forecast errors (RMSE) measure is calculated to evaluate the deviation of the prediction errors and to compare the accuracy of forecasts:

$$RMSE_t = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(\pi_t - \hat{\pi}_t)^2}$$

3. RESULTS

Figure 2.



Source: Data OECD, authors' calculations

Table 2. Forecast accuracy measures

	ERROR - Yearly	ERROR - Quarterly	q1	q2	q3	q4
MAE	0.83	2.89	0.81	0.86	0.90	0.97
MAPE	0.54	0.58	0.52	0.59	0.59	0.61
RMSE	1.27	1.34	1.21	1.26	1.41	1.47

Source: Data OECD, authors' calculations

In table 2 are shown the results of accuracy measures for inflation forecast depending on the specified timespan for the period 2010 – 2026. In the case of MAE for yearly data inflation forecast was of by only 0.83 percent, meaning that inflation targeting by the ECB was in line with the expectations, because predictive inflation error was inferior of 2 percent, lower than the target set by the central bank. The same thing can not be said for the quarterly data, where mean absolute error is 2.89 percent, considerably greater than the ECB objective. In the case, if each quarter

is taken separately, q1-q4, in the same period, forecasted errors are within targeted inflation. MAPE, method is used to calculate the average forecast error, with yearly and quarterly data, the results show that on average the prediction is off by 0.54 percent and 0.58 percent respectively. Considering the RMSE method, it produces on average a prediction for yearly and quarterly data, off by 1.27 and 1.34 respectively. When forecast accuracy measures are considered separately, q3 and q4 quarters are the quarters where prediction accuracy is the lowest for the three methods. Quarterly errors evolution in percentages in figure 2 for the 2010 – 2026 period highlights the volatility of errors in predicting inflation. During this period, they remained stable within $\pm$ 1 percent range, except the shock of COVID 19 crises, when there was an underestimation of inflation and errors spiked to -5 percent level.

4. DISCUSSIONS

The goal of this paper was to study how inflation targeting has helped euro area countries to accurately predict price evolution. Examining the accuracy of forecasted measure for inflation targeting economies, the results in the previous section are in line with Czekaj et al. (2024) and Schnabel (2024). Inflation targeting has contributed in stabilizing price increases with one exception, during a sudden economic shock, i.e. COVID 19 crises. From all the methods, only, mean absolute error method employing quarterly data, has a 2.89 percent deviation error for the inflation forecast and not in line with ECB primary goal. Furthermore, there is limitations to this study to consider, mainly due to the short period used to produce the results.

5. CONCLUSIONS

The research paper points out that inflation targeting in the euro area has an impact in containing prices within the level set by the ECB for the selected time period. A comparative analysis was conducted using Harmonized Core Inflation data based on Euro area (EA17) to present visually the differences between actual and predicted inflation. Afterword's, three methods are employed, using yearly and quarterly data, to determine the accuracy of the forecasts, Mean absolute error (MAE), Mean absolute percentage error (MAPE) and Root mean squared forecast errors (RMSE). All forecasting accuracy measures produced results in line with ECB objectives, concerning price stability, except mean absolute error which presented a 2.89 percent quarterly error. Through forecasted accuracy methods this study showed that in q3 and q4 quarters the errors where the highest and volatility of errors in predicting inflation was the greatest during the shock of COVID 19 crises.

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