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The macroeconomic and fiscal implications of inflation forecast errors☆

Harris Dellas[a,b], Heather D. Gibson[b], Stephen G. Hall[b,c], George S. Tavlas[b,c,*]

[a] University of Bern, Switzerland
[b] Bank of Greece, 21 E Venizelos Ave, Athens, 10250, Greece
[c] University of Leicester, United Kingdom

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ABSTRACT

The accuracy of inflation forecasts has important implications for macroeconomic stability and real interest rates in economies with nominal rigidities. Erroneous forecasts destabilize output, undermine the conduct of monetary policy under inflation targeting and affect the cost of both short and long-term government borrowing. We propose a new method for forecasting inflation that combines individual forecasts using time-varying-coefficient estimation along with an alternative method based on neural nets. Its application to forecast data from the US and the euro area produces superior performance relative to the standard practice of using individual or linear combinations of individual forecasts, especially during periods marked by structural changes.

1. Introduction

Forecasts of inflation play a key role in at least three areas of macroeconomics – the determination of economic activity, the formation of asset prices, and the conduct of monetary policy. Specifically, inflation forecasts form the basis of price-wage setting so that forecast errors lead to a Phillips-curve relationship. They also matter for nominal asset prices and rates of return when agents are risk averse; the volatility of inflation forecasts impacts on the inflation risk-free rate while the cyclicality of forecast errors affects inflation risk premia. These effects on real interest rates matter for savings and investment decisions and affect, among other things, the cost of short-term and long-term government borrowing and, thus, the level and dynamics of public debt. Finally, inflation forecasts provide a key input for monetary policy under inflation targeting; forecast errors by the central bank can lead to sub-optimal policies, creating inefficient variations in aggregate economic activity and inflation.

In this paper, we use a standard model to illustrate – and to offer a rough quantification of – the aforementioned effects of inflation forecasts on macroeconomic stability and asset prices. Having demonstrated the mechanisms through which forecast errors work in the macroeconomy, we then propose a new empirical strategy for improving the accuracy of inflation

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* Corresponding author at: Bank of Greece, 21 E Venizelos Ave, Athens, 10250, Greece.
E-mail address: gtavlas@bankofgreece.gr (G.S. Tavlas).

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forecasts. We use the forecasting results from this methodology to quantify the potential importance of forecast errors on aggregate quantities, prices and welfare.

It has long been recognized that it is hard to forecast inflation, especially during periods marked by high inflation variability and/or structural change.[1] To appreciate this point, consider the following example. The European Central Bank (ECB), whose main objective is to achieve a (headline) inflation rate of close to, but below, 2% in the medium term, announces inflation projections on a quarterly basis. During the 12 quarters from 2012:Q1 through 2014:Q4, the ECB's 2-year ahead (that is, for the period 2014:Q1 through 2016:Q4) inflation forecast showed an average projected inflation rate of 1.5%, close to the ECB's objective.[2] The actual outcome, however, was an average inflation rate of 0.2%, far below the ECB's objective. Clearly, had the ECB access to more accurate inflation forecasts, its monetary policy stance would have been quite different from that which, in fact, prevailed.

The empirical literature has utilized numerous methods to forecast inflation.[3] In what follows, we focus on two branches of the recent literature – that which focuses on single-equation models and allows these models to incorporate structural breaks (typically, a single shift in the parameters), and that which emphasizes the linear combination of forecasts based on the forecasts of others.

1.1. Rolling windows and structural breaks

The aim of the forecasting literature on structural breaks is to identify periods of instability in the data.[4] To do so, researchers often use fixed, rolling windows – for example, 20 quarterly observations – that move through the data, re-estimating the parameters of the model at each window. The intuition here is that, if a break has occurred in the data, forecasts that use only pre-break data will provide inferior forecasts than forecasts that utilize post-break data. A problem that is encountered is the following: if the window is too short, the parameter estimates will be inefficient; however, if the window is too long so that it incorporates a large data sample before the break, the estimates will be inconsistent. Therefore, researchers have aimed to use small amounts of data prior to the break to minimize the loss of efficiency. The balance between inefficiency and inferior forecast performance has been the subject of considerable discussion about the optimal forecast window.

Forecast combinations. Beginning with the work of Granger (1969), who argued that forecast accuracy can be improved by using a covariance method of combining forecasts rather than using any individual forecast, and the work of Granger and Ramanathan (1984), who proposed a regression-based methodology for combining forecasts, a large literature has established the overall superiority of combining linear forecasts.[5] The intuition underlying this finding is straightforward: combining forecasts achieves diversification gains – combinations of forecasts based on, say, different information sets, pools together different sources of information and, therefore, should result in lower expected loss (for example, lower expected error variance). Also, given it is likely that some models will be misspecified over certain periods of time – for example, some models may adjust faster to regime changes than other models – combining forecasts from a number of models may offer some insurance against "breaks" or other unknown sources of misspecification (Elliott and Timmermann, 2008, p. 42; González-Rivera, 2013, Chapter 9).

In what follows, we aim to extend both of the above strands of the literature. We argue that combinations of forecasts themselves are likely to be subject to structural breaks, and we propose extending forecast combinations to a *nonlinear* context; In particular, we show that combinations of forecasts based on weights derived using time-varying-coefficient (TVC) forecasts produce superior forecasts than combinations derived using a linear framework. As an alternative nonlinear method, we also use a simple neural net as a method of combining forecasts.[6] We combine forecasts of inflation for (1) the euro area and (2) the United States based on TVC and compare those combinations with combinations generated with linearly-derived weights. The results indicate that forecast accuracy is generally improved using the nonlinear combinations. Moreover, the TVC model works better than the other methods when there is signs of structural instability while the neural net works better when the system appears to be a stable nonlinear one.

The reason underlying the improvement in performance is that TVC can accommodate structural change, both in the actual inflation process and the forecasting process (that is, forecasters may change the *way* they forecast). The former arises from changes in the macroeconomic environment (monetary policy conduct, changes in the transmission mechanism, globalization, etc.); the latter arises from changes in the identity of the individual forecasters, within the combination as well as their forecasting tools. As shown below, the weights of the forecast combinations in our sample exhibit significant instability, suggesting the presence of either one or both of these sources of instability.

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[1] Within the context of the late-1970s and early-1980s, a period marked by high inflation variability, Tobin (1981, p. 391) observed: "We have not done well in modeling the inflation process." More recently, González-Rivera (2013, p. 185) noted: "In fact, inflation rates are notoriously difficult to predict." For a recent example of the difficulty in forecasting inflation see Medel et al. (2016).

[2] The inflation projections varied within the narrow range of 1.3%–1.6%.

[3] See Stock and Watson (2008) for a comprehensive evaluation of several prototype inflation forecasting models that pay special attention to Phillips-curve inflation forecasts; see, also, Faust and Wright (2013).

[4] See Rossi (2013b) for a survey of this literature.

[5] For literature reviews, see Timmermann (2006) and Elliott and Timmermann (2008).

[6] We are grateful to a referee for the suggestion to apply a neutral net to forecast combinations.