



## Evaluating the effect of monetary policy on unemployment with alternative inflation forecasts

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### ABSTRACT

This paper explores the role that inflation forecasts play in the uncertainty surrounding the estimated effects of alternative monetary rules on unemployment dynamics in the euro area and the US. We use the inflation forecasts of 8 competing models in a standard Bayesian VAR to analyse the size and the timing of these effects, as well as to quantify the uncertainty relative to the different inflation models under two rules. The results suggest that model uncertainty can be a serious issue and strengthen the case for a policy strategy that takes into account several sources of information. We find that combining inflation forecasts from many models not only yields more accurate forecasts than those of any specific model, but also reduces the uncertainty associated with the real effects of policy decisions. These results are in line with the model-combination approach that central banks already follow when conceiving their strategy.

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### 1. Introduction

In this paper we investigate the role that inflation forecasts play in the uncertainty surrounding the estimated effects of alternative monetary rules on unemployment dynamics in the euro area and the US. The study focuses on two main issues: the size and timing of the effect of monetary policy on unemployment, and the uncertainty associated with this effect.

The effect that a given policy measure might have on unemployment substantially depends on the considerable uncertainty a central bank must cope with when formulating its policy. In this paper we consider model (and parameter) uncertainty, and focus on the uncertainty related to the possibility of correctly predicting the time path of inflation and therefore the price level. Producing comparative evidence on the relative ability of alternative models to forecast inflation helps not only improve the ability of monetary authorities to set interest rates, but also understand the effects of monetary policy on unemployment for each alternative set of forecasts.

Our paper explicitly deals with these issues. In particular, we (i) explore the out-of-sample forecast performance of a set of linear and non-linear competing models of inflation rate determination over horizons from 1 to 8 quarters; (ii) evaluate the effect of the policy rate on unemployment in a Bayesian VAR, where the inflation forecast is one

of the endogenous variables, and parameter uncertainty is accounted for; (iii) employ standard simulation analysis to quantify the model uncertainty surrounding the estimated effect on unemployment of a shock to the interest rate under two different policy rules.

To measure uncertainty, we use the concept of *reaction dispersion*, similar to the *outcome dispersion* proposed by Brock et al. (2007). Starting from different model specifications we compute a distribution of possible reactions of unemployment rate to monetary policy shock. The variance of this distribution – which measures the sensitivity of the dynamic response of unemployment to the model choice – is our measure of uncertainty.

Model uncertainty plays a dual role here: on the one hand it reflects the choice of the competing models to forecast inflation; on the other hand, we specify two alternative monetary rules, with the central bank reacting either to inflation forecasts and unemployment, or just to inflation.

Three main questions are asked in the paper: (i) Can we quantify model uncertainty on the real effects of a monetary policy shock? (ii) Which kind of estimated effect is associated with the best inflation forecast? And (iii) does a forecast combination reduce this uncertainty?

The remainder of the paper is structured as follows. Section 2 presents a review of the recent literature. Section 3 analyses the forecasting properties over different horizons of eight competing models by employing alternative econometric techniques. Section 4 examines the role of heterogeneous inflation forecasts on the estimated effects of monetary policy on unemployment, under different monetary policy rules. Section 5 presents empirical measures of model and

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parameter uncertainty based on the concept of reaction dispersion. Finally, Section 6 summarizes the paper's main findings and their policy implications.

## 2. An overview of the recent literature

As outlined in the *Introduction*, the present paper deals with two major challenges for monetary authorities. The first issue is related to the possibility of correctly predicting the inflation rate. The second one is related to the uncertainty associated with the magnitude and the timing of the effect that a monetary policy shock has on real activity (namely unemployment). Both issues have been extensively studied in the monetary policy literature.

Concerning the first issue, a common research strategy followed in the literature, consists of forecasting the inflation rate by selecting a single model specification. The selection is usually made either by computing standard in-sample information criteria, (such as the well-known Akaike, Schwarz, and Hannan and Quinn criteria) or by employing some out-of-sample measures of accuracy (such as the root mean square error). *Stock and Watson (1999)*, for instance, compare several linear models and show that short-run forecasts of US inflation produced by the Phillips curve perform reasonably well.

An alternative strategy consists of combining different forecasting models by placing weights on individual forecasts according to some updating scheme. The idea behind the combination of forecasting techniques is that no forecasting method is fully appropriate for all situations. The combination accounts for the time-varying forecasting ability of alternative models in that a single forecasting model might only be optimal conditional on given realizations, information set, model specification or sample period. By combining methods, one can compensate for the weakness of each forecasting model under particular conditions.

While there is broad consensus that appropriate combinations of individual forecasts often improve forecast accuracy (see for example *Hendry and Clements, 2002; Stock and Watson, 2004, 2006; Timmermann, 2006*), the literature has not yet converged to a particular set of forecast weights to be implemented when constructing combined time series. *Ang et al. (2007)* examine the out-of-sample performance of several methods of forecasting U.S. inflation and find little evidence that combining forecasts produces more accurate forecasts when compared with survey-based predictions. *Kapetanios et al. (2008)* use UK quarterly data and show that forecast combinations obtained by placing equal weights to individual forecasts or by employing a Bayesian model averaging scheme generally improve GDP growth and CPI inflation forecast accuracy.

The second issue analysed in the paper has also been widely discussed in the literature. In fact, a great amount of literature aims at evaluating the effects of monetary policy shocks on the unemployment dynamics (e.g. *Christiano et al., 1996; Stock and Watson, 2001*). Although with notable differences, most studies conclude that the effects of a given policy measure on unemployment might largely depend on the uncertainty a central bank must cope with when formulating its policy. A growing literature analyses how central banks should take uncertainty into account in their decision-making process. Three types of uncertainty are usually identified: data, parameter, and model uncertainty.

*Orphanides (2002)*, for instance, focuses on whether data uncertainty, reflected in a substantial difference between real-time and final estimates of inflation and the unemployment, might produce misleading policy recommendations. Others, such as *Sack (2000)*, *Orphanides and Williams (2007)*, and *Kimura and Kurozumi (2007)* analyse the effect that parameter uncertainty might have on the formulation of monetary policy. Finally, *Levin et al. (2003)*, *Altavilla and Ciccarelli (in press)*, and *Brock et al. (2007)* concentrate on model uncertainty. Our approach in this paper concentrates on model and parameter uncertainty.

Both strands of the literature (monetary policy effects and uncertainty) are explored here in a unified framework which first analyses the forecasting performance of a set of linear and non-linear models, and then evaluates the effect that the use of alternative forecasting models might have on the monetary policy transmission mechanism as running from policy rate to unemployment. More specifically, the paper discusses the model selection versus model-combination strategy by employing accuracy measures and testing for equal predictive accuracy of the individual forecasts. It then analyses how model and parameter uncertainty might influence the effect of a monetary policy shock on unemployment. The uncertainty is related to the different model the central bank might use when forecasting the future path of the inflation rate, to the uncertainty of the reference model parameter estimates, and to the particular reaction function the central bank follows.

Finally, we compare the results for two economies, i.e. the euro area and the US, which notably show differences in the labour market functioning. As remarked by *Blanchard and Wolfers (2000)*, the evolution of labour market variables might be explained by jointly analysing the economic shocks and the institutional changes that occurred in a given country.

During the sample period covered in the empirical analysis (1970–2005) both the euro area and the US economy have been hit by a number of shocks: the two oil shocks of the 1970s, the total factor productivity decrease of the early 1970s, the rise in interest rates in the 1980s, the skills-based change in labour demand of the 1990s and the global economic slowdown in 2001. These shocks substantially influenced the level and the duration of unemployment. However, whether the increase in the unemployment rate, following exogenous shocks, becomes a permanent feature of a given economy mostly depends upon their labour market institutions.

In fact, explanations of why monetary policy shocks might have heterogeneous effects on the unemployment performance of different countries have mainly focused on the presence of nominal rigidities (e.g. *Jonsson, 1997; Blanchard and Gali, 2007, 2008*), and changes in labour market institutions (e.g. *Faia, 2008*).

Several empirical studies (e.g. *Decressin and Fatás, 1995; Blanchard and Wolfers, 2000*) have also highlighted that countries with flexible labour markets, such as the US, prevent temporary increases in unemployment from becoming structural. On the contrary, in countries with labour market rigidities, such as most European countries, temporary shocks translate into permanent increases in unemployment. More specifically, these studies emphasise that the euro area is characterised by a low degree of labour mobility, high employment costs, generous unemployment benefits and a rigid wage formation systems.

Recent studies such as *Clar et al. (2007)*, *Christoffel and Kuester (2008)* and *Christoffel et al. (2009)* have analysed the role of these rigidities as potential explanatory factors of the cross-country difference in monetary policy transmission. The results suggest that the degree of wage flexibility substantially influences the rate of inflation and unemployment dynamics.

Overall, the results of these studies suggest that the size and the propagation of the effect that a monetary policy shock might have on labour market variables in general and on unemployment in particular crucially depend on the institutional arrangements in the labour market. In particular, a more flexible labour market environment should make monetary policy more effective.

Our analysis can contribute to assess whether, in an economy characterised by a lower degree labour market rigidity, such as the US, the speed of monetary transmission is higher than in an economy characterised by a more sclerotic labour market, such as the euro area.

## 3. Forecasting inflation

A significant fraction of the uncertainty a central bank faces in defining its strategy is related to the possibility of correctly predicting inflation. In fact, in selecting the current level of interest rates central

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