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# Bayesian fan charts for U.K. inflation: Forecasting and sources of uncertainty in an evolving monetary system

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## Abstract

We estimate a Bayesian vector autoregression for the U.K. with drifting coefficients and stochastic volatilities. We use it to characterize posterior densities for several objects that are useful for designing and evaluating monetary policy, including local approximations to the mean, persistence, and volatility of inflation. We present diverse sources of uncertainty that impinge on the posterior predictive density for inflation, including model uncertainty, policy drift, structural shifts and other shocks. We use a recently developed minimum entropy method to bring outside information to bear on inflation forecasts. We compare our predictive densities with the Bank of England's fan charts.

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## 1. Introduction

The inflation-targeting regime that has prevailed in the U.K. since 1992 requires policy makers to anticipate inflation. At regular meetings with its forecast team, the Bank of England's Monetary Policy Committee (MPC) discusses prospects for inflation. After the meetings, the forecast team transforms the MPC's discussion into a projected distribution for future inflation in the absence of a policy change. The MPC and its forecast team devote substantial time and effort to preparing *fan charts* that express the Bank's subjective assessment of medium-term inflationary pressures in terms of a subjective measure of uncertainty. The fan charts reveal the MPC's subjective probability distribution for inflation, assuming that the Bank's policy instrument, a short-term nominal interest rate, is held constant. The MPC uses the fan chart to guide and justify its decisions to adjust the short term nominal interest rate to propel inflation toward the target.

The MPC intends the fan charts to describe several sources of uncertainty, including model uncertainty, that qualify its forecasts of GDP growth and inflation. Indeed, the Bank assesses risks by using multiple models and listening to a variety of views. The MPC begins by identifying important shocks that might affect the inflation forecast. For each perceived shock, the MPC forms a view of its size and consequences and considers how that view might be wrong. It then calibrates the degree of uncertainty and the balance of risks by examining alternative models to assess what the consequences might be if the central view is mistaken. Eventually, the MPC makes a judgment about whether the risks are skewed and by how much, and whether uncertainty is more or less than in the past.

This paper proposes another way to prepare fan charts. By applying modern Bayesian methods to a vector autoregression with a stochastic time-varying error structure, we construct and estimate a flexible statistical model that acknowledges diverse sources of uncertainty that include a form of model uncertainty. We construct fan charts and other policy informative statistics for U.K. macroeconomic data, and we compare our fan charts with those of the MPC.

Our objective is to articulate a formal and explicit probabilistic method for constructing fan charts. Our first step is to construct a posterior predictive density for a Bayesian vector autoregression like the one developed by Cogley and Sargent (2005). We can view the predictive density for inflation from our Bayesian VAR either as an end in itself or as an 'agnostic' benchmark density that is to be 'twisted' by bringing to bear additional sources of information and judgments. We apply a method developed by Robertson et al. (2005) that transforms one predictive density into another by constraining the twisted density to satisfy some constraints that contain the outside information. This way of incorporating outside information complements our BVAR fan chart in a way that seems to us to be congenial to Central Bank policy procedures.

Our proposal has several merits relative to others currently in use for constructing fan charts. For one, our Bayesian VAR has adaptive elements that make it attractive for forecasting in an evolving monetary system such as that of the U.K. Within the last four decades, there was the Bretton Woods system, then the breakdown and

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