

# Have economic models' forecasting performance for US output growth and inflation changed over time, and when?

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## Abstract

We evaluate various economic models' relative performance in forecasting future US output growth and inflation on a monthly basis. Our approach takes into account the possibility that the models' relative performance can vary over time. We show that the models' relative performance have, in fact, changed dramatically over time, for both revised and real-time data, and investigate possible factors that might explain such changes. In addition, this paper establishes two empirical stylized facts. Specifically, most predictors for output growth lost their predictive ability in the mid-1970s, and became essentially useless over the last two decades. When forecasting inflation, on the other hand, fewer predictors are significant, and their predictive ability worsened significantly around the time of the Great Moderation.

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## 1. Introduction

This paper investigates whether the relative performance of competing models for forecasting US output growth and inflation have changed over time. While there is widespread empirical evidence of the existence of parameter instability in forecasting GDP growth and inflation (as documented by Clark & McCracken, 2005, and Stock & Watson, 2003, for example), there has been little work formally testing

whether the models' relative performance have actually changed over time. D'Agostino, Giannone, and Surico (2006) undertake a forecast comparison of various models, and note a sizeable decline in the relative predictive accuracies of popular forecasting methods based on large data sets of macroeconomic indicators; they associate this decline with the fall in the volatility of most macroeconomic time series (the "Great Moderation"). Interestingly, they also note that most of the full-sample predictability of US macroeconomic series comes from the years before 1985, which constitute a large portion of the full sample. However, their analysis is limited to two sub-samples, and they do not formally test for a change in the relative performance

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(that is, the differences between the two sub-periods that they document may be due solely to sampling variability, rather than being a significant change), nor do they formally study the evolution of the relative performance over time. To fill this gap in the literature, this paper presents a comprehensive analysis of forecast comparisons of various representative models for predicting future output growth and inflation, and assesses whether their performance has changed over time. Our analysis has the advantage of estimating the time of the reversal in the predictive ability precisely, which provides valuable information for uncovering possible economic causes of the reversals.

In order to assess how the models' relative forecasting performance have changed over time, this paper goes beyond the seminal works of Clark and McCracken (2001), Clark and West (2006), Diebold and Mariano (1995), and West (1996). In fact, these papers only compare the relative forecasting performance of the competing models on average over the forecasting sample. Giacomini and Rossi (*in press*) notice that this procedure, by focusing on the average performance, involves a loss of information. In particular, it may hide important reversals in the models' relative performance over time. They propose a Fluctuation test for assessing equal predictive ability that takes into account the possibility that the relative performance may have changed over time, as well as a One-time Reversal procedure for estimating the time of the reversal. We apply these techniques to empirically investigate whether the relative performance of competing models for forecasting US industrial production growth and consumer price inflation have changed over time. We focus on the models considered by Clark and McCracken (2005) and Stock and Watson (2003), but use monthly data for industrial production rather than quarterly data for GDP, as well as monthly data for inflation. Following the practice of Stock and Watson (2003, Section 4), throughout the paper we will refer to the growth rate of industrial production as output growth. In particular, we focus on predicting the  $h$ -period-ahead output growth and inflation using both autoregressive terms and lagged values of important economic explanatory variables, one at a time. In particular, we use interest rates, interest spreads, money supply, unemployment, and indices of leading indicators, among others. These series have been found to have predictive content for

output growth and inflation at different time periods. Using both fully revised and real-time data, we find substantial reversals in the relative forecasting performance. This analysis, however, is still silent about the economic reasons for the occurrence of such reversals. However, using the Giacomini and Rossi (*in press*) procedure, we can estimate the times of the reversals in the relative performance, which allows us to relate such changes to the economic events happening at that time.

Our main empirical findings are as follows. First of all, we document that, overall, there is empirical evidence that the economic predictors have forecasting ability in the early part of the sample, but that this predictive ability disappears in the later part of the sample. This happens notwithstanding the general result that some explanatory variables help in forecasting output growth and inflation beyond a simple autoregression over the full sample. We note that the results that we present in this paper are very robust, and could be made even more striking by a more conservative choice of the bandwidth parameter for the estimate of the variance, or by using a Fluctuation test based on the Clark and West (2006) test statistic.

Second, we find empirical evidence in favor of a wide range of instabilities, with sharp reversals in the relative performance of the various models. In particular, when forecasting output growth, we find that interest rates and the spread were useful predictors in the mid-1970s, but that their performance worsened at the beginning of the 1980s. Similar results hold for money growth (M2), the index of supplier deliveries, and the index of leading indicators. The results are similar when forecasting inflation, with two notable exceptions. On the one hand, the empirical evidence of the models' predictive ability for inflation is weaker than that for output growth over the full sample. On the other hand, the evidence of predictive ability in most variables breaks down around 1984, which the literature agrees to be the beginning of the Great Moderation. This includes models with predictors such as employment and unemployment measures, among others, thus implying that the predictive power of the Phillips curve disappeared at around the time of the Great Moderation.

Third, we document the robustness of our results to the use of real-time data (Croushore & Stark, 2001). Croushore (2006, chap. 17) and Stark and

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