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Abstract

Recent research has documented that the Federal Reserve produces systematic errors in forecasting inflation, real GDP growth, and the unemployment rate, even though these forecasts are unbiased. We show that these systematic errors reveal that the Fed is “surprised” by real and inflationary cycles. Using a modified Mincer-Zarnowitz regression, we show that the Fed knows the state of the economy for the current quarter, but cannot predict it one quarter ahead.

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Can the Fed Predict the State of the Economy?

Monetary policy decisions are based on forecasts of future economic activity. Consequently, the Greenbook forecasts made by the Federal Reserve (Fed) staff have been extensively evaluated. The forecasts are quarterly predictions made several times each quarter with horizons of zero to eight quarters. The staff predicts GDP, its components, various price indices, unemployment, etc. These forecasts should reveal what the Fed knows about the current and future states of the economy.

Recent research has shown that the Fed forecasts contain systematic errors (Joutz and Stekler, 2000). Forecasters overestimated the rate of growth during slowdowns and recessions and underestimated it during recoveries and booms. Similarly, inflation was under-predicted when it was rising and over-predicted when it was declining. Particularly large errors occurred during the periods when prices were rising rapidly during the 1970s and early 1980s.¹

This paper explores the systematic errors in the Greenbook forecasts of US real output growth, inflation, and the unemployment rate to determine if these errors reveal what the Federal Reserve knows about the state of the US economy. If the staff has information on real and inflationary cycles, it should be incorporated into the forecasts. In this analysis, we modify the Mincer-Zarnowitz (1969) regression to include dummy variables for the NBER-dated recessions and ECRI-dated inflationary cycles.

We first present the data and the modified Mincer-Zarnowitz regressions. Our results show that the Fed forecasts do not incorporate information on recessions or inflationary cycles

¹ Hanson and Whitehorn (2006) also observed these systematic errors but associated them with particular time periods rather than with stages of the business cycle.

into the one-quarter-ahead forecasts. This information is contained in the current quarter forecasts, indicating that the Fed knows the state of the economy for the current quarter, but cannot predict it one quarter ahead.

I. Data

We examine the Federal Reserve staffs Greenbook forecasts for the period 1965IV-2001IV. The forecasts are for the current quarter and one quarter-ahead for three variables: the real output growth rate (GNP from 1965IV to 1991III and GDP from 1991IV on), the GNP/GDP deflator inflation rate, and the unemployment rate. Whenever there are multiple forecasts in each quarter, we use the last one.² The actual data are the NIPA estimates that are released approximately 45 days after the quarter to which they refer.³ All data, with the exception of the unemployment rate, are converted into annualized growth rates.

Figures (1a-1d,..., 3a-3d) present data for each variable: the annualized growth rate of real GNP/GDP, the annualized inflation rate as measured by the GNP/GDP deflator, and the unemployment rate. The upper left hand graphs display the historical data used in the analysis. The other quadrants of these figures display, for each series: the current quarter and one quarter-ahead forecast errors and the forecast revisions between the current quarter and one-quarter-ahead forecasts.

The shaded areas of Figures 1 and 3 represent the dates of these recessions, as defined by the NBER. In Figure 2 the shaded areas represent periods when the inflation rate was increasing

² We use the last forecast for each quarter because those contain the maximum amount of information on which to base current and next quarter forecasts. Forecasts made within the first 10 days of the next quarter are considered made in the previous quarter because there would be no new information for the subsequent quarter. We also analyzed forecasts made in the middle of the quarter. The results were similar.

³ Use of the real time data avoids definitional and classification changes and is the most consistently available data set for our sample. The terminology for these data releases has varied over the sample. We obtained similar results using the 90 day releases.

(moving from trough to peak). The dates for the periods of the inflation cycle were obtained from Dr. Anirvan Banerji of the Economic Cycle Research Institute (ECRI).

II. The Modified Mincer-Zarnowitz Regression and Results

The basic Mincer-Zarnowitz regression is:⁴

$$A_t = \beta_0 + \beta_1 F_{t,t-i} + e_{t,t-i}; \quad i = 0,1 \quad (1)$$

where A_t and $F_{t,t-i}$ are the actual and predicted values for time t . The forecast is conditional on the information available at time $t-i$. When $i = 0$, it refers to a current quarter forecast. For a test of informational efficiency, the null hypothesis is: $\beta_0 = 0$ and $\beta_1 = 1$. A rejection of this hypothesis indicates that the forecasts are biased and/or inefficient. The Wald test and the F distribution are used to test this null.

In order to determine whether the forecasts incorporated information about the state of the economy, we modified (1). Our modified Mincer-Zarnowitz regression (2) is:

$$A_t = \beta_0 + \beta_1 F_{t,t-i} + \beta_2 D_t + e_{t,t-i}; \quad i = 0,1 \quad (2)$$

where D_t is a dummy that reflects the state of the economy. In the growth and unemployment equations, it takes on the value 1 if the economy was in a NBER-dated recession and is zero otherwise. In the inflation equation, the dummy takes on the value 1 from the trough to the peak of the inflation cycle as dated by ECRI, zero otherwise. The joint null hypothesis is: $\beta_0 = 0$, $\beta_1 = 1$, and $\beta_2 = 0$.⁵ If the coefficients associated with the dummies are non-zero, the

⁴ Similar results with respect to the role of the state of the economy can be obtained using the Holden and Peel (1990) bias test.

⁵ In applying (2) to the forecasts that have a one-quarter lead, the Newey-West procedure was used to estimate HAC consistent standard errors in (2).

dummies contain information that can explain the forecast errors. This indicates that the Fed did not include the information on the state of the economy in the forecasts.

The results are reported in Tables 1a and 1b. The coefficients of the dummy variables are not significant in any of the current quarter equations (Table 1a). The estimates for the one-quarter-ahead predictions (Table 1b) indicate that the dummy coefficient is significant in all three equations. These results suggest that the Fed does not know what the state of the economy will be in the next quarter. Furthermore, if the Fed did have information on the state of the economy, the modified Mincer-Zarnowitz Wald test suggests that all three forecasts reject the null of informational efficiency because these forecasts did not incorporate this information.

In the real GDP growth equation for the one-quarter-ahead forecasts (Table 1b), the NBER dummy coefficient is negative, suggesting that the Fed overestimated real GDP growth during recessions. In addition, the constant in that equation is positive and significant, showing that the Fed forecasts underestimated real GDP growth during expansions. In the inflation equation, the ECRI dummy coefficient is positive, indicating that the Fed underestimated inflation when it was increasing (moving from trough to peak in the inflation cycle). Although the constant in that equation is insignificant, it is negative. This suggests that the Fed overestimated inflation when it was decreasing (moving from peak to trough in the inflation cycle). We also obtain the expected results in the unemployment equation: the NBER dummy coefficient is positive, suggesting that the Fed did not realize the degree of slackness in the labor market when in a recession. All of these statistical results are in accord with the findings about systematic errors in the literature.

III. An Interpretation

While the dummy coefficients in the current quarter equations are not significant, they are significant in all of the one-quarter-ahead equations. In order to see how the current quarter forecasts ($F_{t,t}$) differ from the one-quarter-ahead forecasts from the previous quarter ($F_{t,t-1}$), we examine the revisions in the forecasts. We are thus comparing forecasts for the same quarter (t) made at two different times (t and $t-1$). The current quarter forecasts are the last ones that were made in each quarter. Consequently, at the end of the quarter there would be virtually complete knowledge about the state of the economy in the previous quarter and considerable information about the current quarter.

To determine how knowledge about the state of the economy affected the revisions of the forecasts, the revision in the forecast, $F_{t,t} - F_{t,t-1}$, is regressed on the state of the economy, (D_t)

$$F_{t,t} - F_{t,t-1} = \delta_0 + \delta_1 D_t + \nu_t \quad (3)$$

Table 2 shows that the coefficients associated with the state of the economy are all significant and have the expected signs. Knowing that the economy was in a recession, the GDP forecasts for the current quarter are revised downwards and the unemployment prediction is revised upwards. When inflation was increasing, the forecast for the current quarter is revised upwards. The evidence indicates that when the Fed forecasters had information about the state of the economy, they used the information correctly because these revisions are in the right direction.

VI. Implications and Conclusions

Based on the forecasts made by the Federal Reserve staff, the state of the economy is known by the Fed only in the current quarter and is not incorporated into their one-quarter-ahead forecasts. These results suggest that systematic errors can exist in the forecasts (as found by

Joutz and Stekler, 2000), but they may offset each other over the business cycle. Given that knowledge about the state of the economy is important for setting monetary policy, the Fed's inability to forecast it one quarter ahead is disconcerting.

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Figure 1.a 1-d

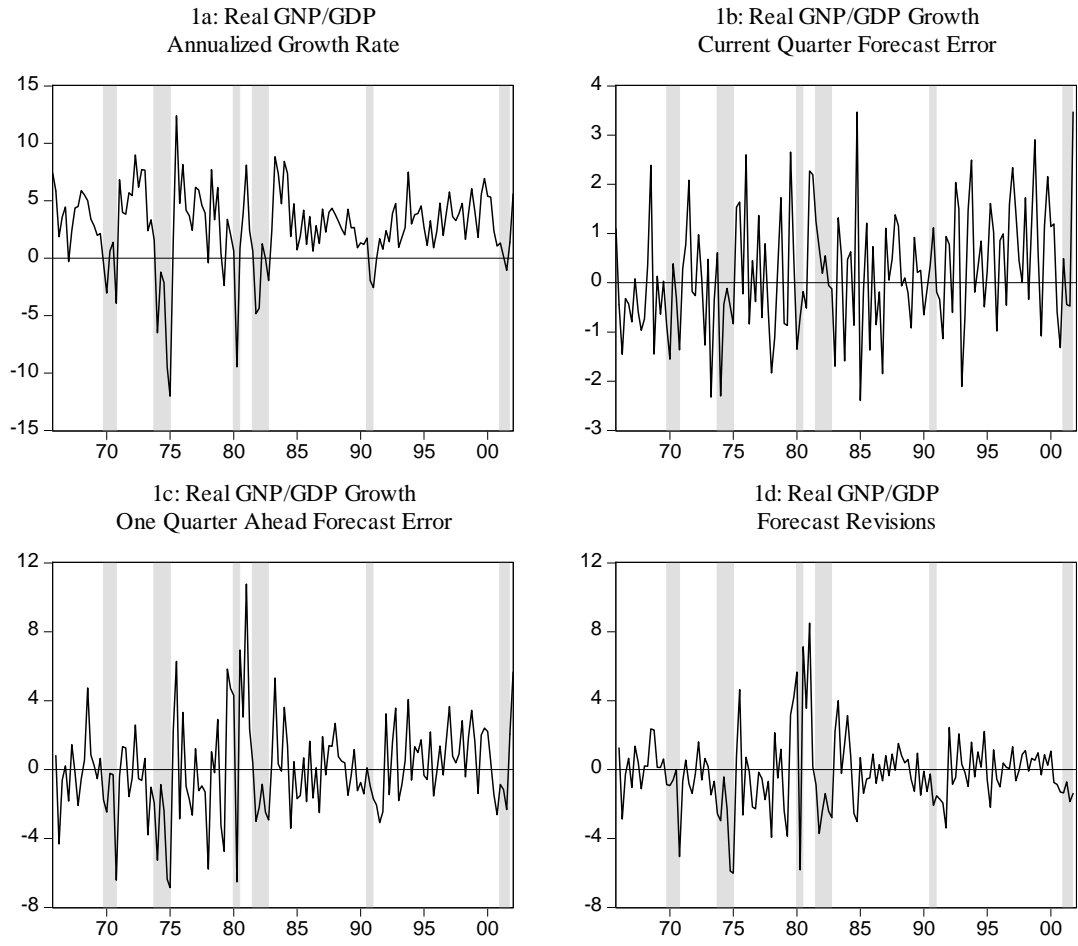


Figure 2.a-2.d

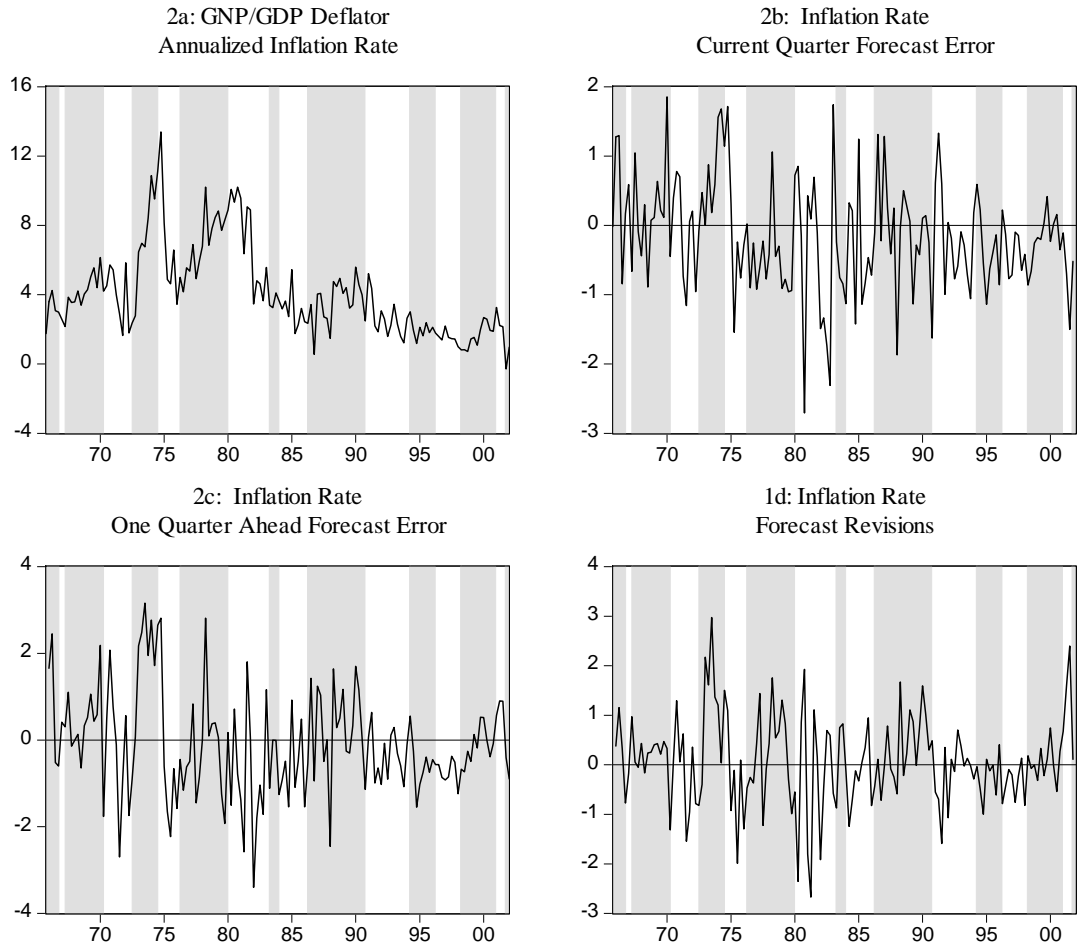
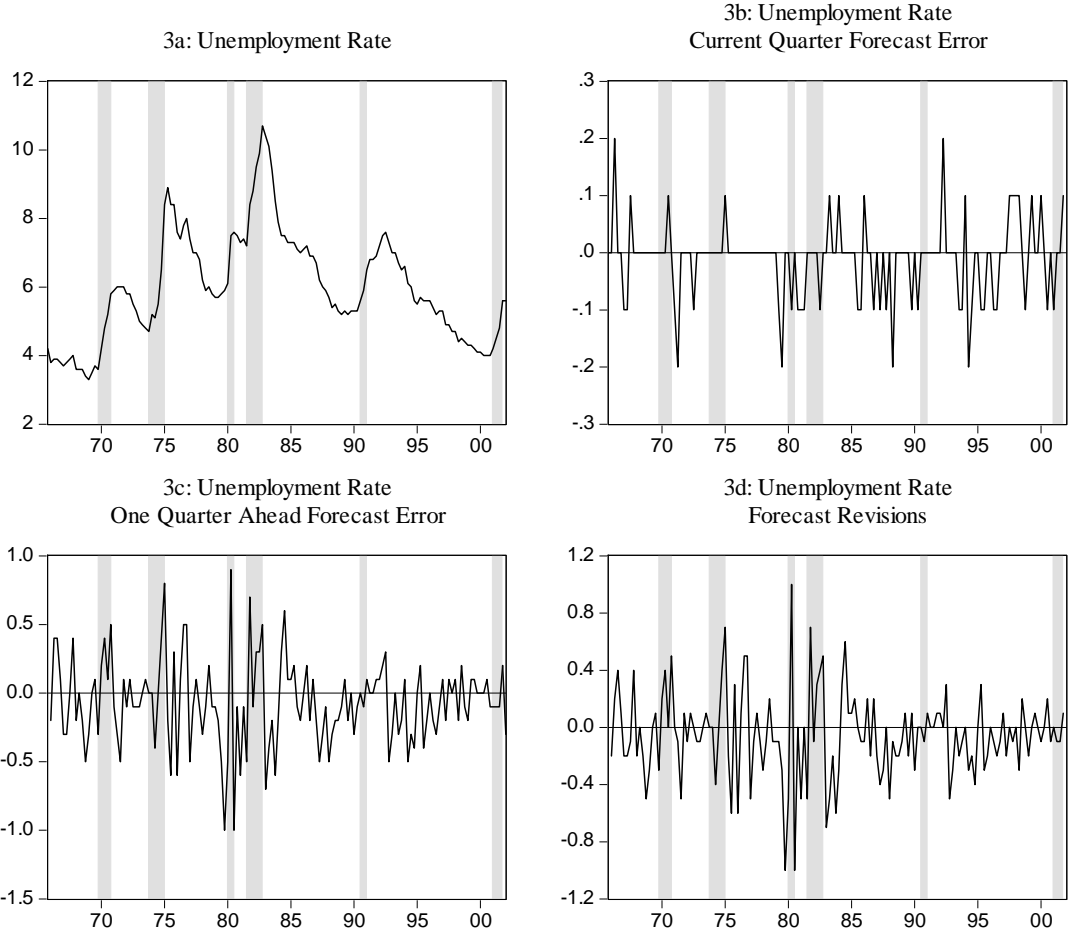


Figure 3.a-3.d



**Table 1a: Current Quarter Greenbook Forecasts
Modified Mincer-Zarnowitz Regressions,
1965IV - 2001IV (Standard Errors in Parentheses)**

	Constant	Slope	NBER Dummy	Inflation Dummy	Wald Test Probability
RealGrowth	0.295 (0.183)	0.990*** (0.042)	-0.411 (0.339)		0.13
INF	-0.326** (0.162)	1.007*** (0.027)		0.216 (0.138)	0.04
UN	0.001 (0.021)	0.997*** (0.003)	0.016 (0.014)		0.11

*, **, *** Significant at the 10%, 5%, and 1% level respectively.

**Table 1b: One Quarter-ahead Greenbook Forecasts
Modified Mincer-Zarnowitz Regressions,
1965IV - 2001IV (Standard Errors in Parentheses)**

	Constant	Slope	NBER Dummy	Inflation Dummy	Wald Test Probability
RealGrowth	1.952*** (0.597)	0.543*** (0.162)	-3.781*** (0.586)		<0.01
INF	-0.474 (0.311)	0.995*** (0.067)		0.655*** (0.224)	<0.01
UN	0.082 (0.096)	0.969*** (0.017)	0.192** (0.079)		<0.01

*, **, *** Significant at the 10%, 5%, and 1% level respectively.

**Table 2
Bias Tests for Forecast Revisions 1966I - 2001IV
(Standard Errors in Parentheses)**

	Constant	NBER Dummy	Inflation Dummy
RealGrowth	0.127 (0.185)	-1.735*** (0.428)	
INF	-0.205 (0.116)		0.457*** (0.149)
UN	-0.085*** (0.027)	0.167*** (0.063)	

*, **, *** Significant at the 10%, 5%, and 1% level respectively.