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The Superiority of Greenbook Forecasts and the Role of Recessions

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Abstract

In this paper, we investigate the role of recessions on the relative forecasting performance of the Fed and the private sector. Romer and Romer (2000) showed that the Fed's forecasts of inflation and output were superior to that of the private sector in the pre-1991 period. D'Agostino and Whelan (2008) found that the information superiority of the Fed deteriorated after 1991. Our results show that the information superiority of the Fed in forecasting real activity did arise from its forecasting dominance during recessions. If recessions are excluded from the pre-1992 period, the informational advantage of the Fed disappears, and in some cases, private sector forecasts perform better. We do not find any systematic effect of recessions on inflation forecasts.

Keywords: Greenbook Forecasts, Recessions, Business Cycle Turning Points.

JEL Code: E31, E32, E37

Non-Technical Summary

The Greenbook forecasts prepared by the Federal Reserve Staff play a major role in the formulation of the monetary policy in the U.S. These forecasts are presented to the Federal Open Market Committee (FOMC) members before each meeting. The private sector also spends substantial amount of resources to generate their own forecasts for major macroeconomic variables. These forecasts play a major role in shaping market and public's expectation about the future macroeconomic environment. Since Greenbook forecasts are released with a lag of five years, they are not available in public domain in real-time.

There has been a considerable interest in the macroeconomic literature over the relative superiority of the Greenbook (GB) forecasts over the private sector forecasts. Using data till 1991, Romer and Romer (2000) show that the Greenbook forecasts of inflation and real GDP are statistically unbiased and dominate private sector forecasts. Their findings suggest that the Federal Reserve has considerable information about inflation beyond what is known to the private sector. D'Agostino and Whelan (2008) have shown that the superior forecasting performance of the GB forecasts deteriorated after 1991. According to them, over the decade 1992-2001, the superior forecast accuracy of the Fed held only over a very short horizon and was limited to its forecasts of inflation. The evidence that asymmetric information has disappeared in the 1990s has been attributed to the great moderation by D'Agostino and Whelan (2008).

This paper investigates the role of recessions on the relative forecasting performance of the Fed and the private sector. In addition to real GDP growth, we also examine the differences in the forecasting performance of three other measures of real activity: industrial production, housing starts, and unemployment. The previous research in the literature has focused only on real GDP and inflation forecasts. We concentrate on the role of recessions because the degree of underperformance of forecasts increase significantly at the business cycle turning points. This is especially important for real variables, since the volatility of these variables is usually very high at business cycle turning points, thus making the job of forecasting them really difficult.

Our results show that the superior forecasting performance of real activity of the Fed arises from its superior performance during recessions and at business cycle turning points. In terms of overall forecast accuracy, we find that on average the forecast error committed by the Fed staff in predicting real activity and inflation was lower in the pre-1991 sample period. However, modified Diebold-Mariano test suggests that these differences in the forecasting performance of real activity were not statistically significant. Our findings suggest that the

differences in the forecast accuracy are statistically significant during recessions, implying that the Fed Board staff does a significantly better job in predicting real activity measures during recessionary periods and at business cycle turning points. This result gets reinforced if we perform information asymmetry tests. Consistent with what other researchers have found, we also find that GB forecasts encompass all the information about movements in real activity and inflation for the pre-1991 period. However, we find that once the recessionary periods are excluded, then the information asymmetry between the Fed and the private sector forecasts disappears for most of the forecast horizons for different measures of real activity. Therefore our results suggest that the disappearance of the information superiority that has been found by D'Agostino and Whelan (2008) and Gamber and Smith (2009) for the 2001-2003 sample period may have also been caused by the presence of a single but mild recession in 2001. We do not find any significant effect of recessions on forecasting performance of inflation. The exclusion of recessionary periods and turning points does not improve the forecasting performance of inflation of the private sector relative to the Federal Reserve. The erosion of the Fed's forecasting advantage in case of inflation seems to have been caused by the change in the inflation dynamics. If forecasting recessions and turning points matters much more than forecasting during normal times, then Fed may still possess informational advantage over private sector forecasters.

1 Introduction

The Greenbook forecasts prepared by the Federal Reserve Staff play a major role in the formulation of the monetary policy in the US. These forecasts are presented to the Federal Open Market Committee (FOMC) members before each meeting. The private sector also spends substantial amount of resources to generate their own forecasts for important macroeconomic variables. These forecasts play a major role in shaping market and public's expectation about the future macroeconomic environment. Since Greenbook forecasts are released with a lag of five years, they are not available in public domain in real-time.

There has been a considerable interest in the macroeconomic literature over the relative superiority of the Greenbook (GB hereafter) forecasts over the private sector forecasts[1]. Using data till 1991, Romer and Romer (2000) show that the Greenbook forecasts of inflation and real GDP are statistically unbiased and dominate private sector forecasts. Their findings suggest that the Federal Reserve has considerable information about inflation beyond what is known to the private sector. The period of "Great Moderation"[2] between 1982-2007 has affected the time-series properties of most of the macroeconomic variables. One of the implications of the great moderation has been a change in the forecasting performance of different models. The change in the forecasting performance has reignited the interest in the information asymmetry hypothesis between the Federal Reserve and the private sector. D'Agostino and Whelan (2008) have shown that the superior forecasting performance of the GB forecasts deteriorated after 1991. According to them, over the decade 1992-2001, the superior forecast accuracy of the Fed held only over a very short horizon and was limited to its forecasts of inflation. In a related paper, Gamber and Smith (2008) compare the forecasting performance of the private sector with the Federal Reserve and find that the Fed's relative forecasting superiority has declined with respect to the SPF forecasts for inflation and real GDP growth after 1994. The evidence that asymmetric information has disappeared in the 1990s has been attributed to the great moderation by D'Agostino and Whelan (2008).

In this paper, we examine the role of recessions and business cycle turning points[3] in the existence of this information asymmetry between the Fed and the private sector in the

[1] For example, D'Agostino and Whelan (2008), Faust, Swanson, and Wright (2004), Faust and Wright (2009), Gavin and Mandal (2001), Gamber and Smith (2009), Romer and Romer (2000), and Baghestani (2006). Romer and Romer (2000) use three measures of private sector forecasts: Blue Chip, DRI, and SPF. D'Agostino and Whelan (2008) use only SPF forecasts as a proxy for the private sector forecasts. Their choice is mainly based on the availability of the data. We follow D'Agostino and Whelan (2008) and use SPF forecasts as a measure of private sector forecasts.

[2] Kim and Nelson (1999), McConnell and Perez-Quiros (2000).

[3] Throughout this paper, we use NBER recession dates. We also include a quarter before the peak and a quarter after the trough to capture the business cycle turning points.

pre-1991 sample period. In addition to real GDP growth, we also investigate the differences in the forecasting performance of three other measures of real activity: industrial production, housing starts, and unemployment. The previous research in the literature has focused only on real GDP and inflation forecasts. The inclusion of these measures of real activity can provide useful insights in our study especially since industrial production and housing starts are leading indicators of business cycles. We concentrate on the role of recessions because the degree of underperformance of forecasts increase significantly at the business cycle turning points. This is especially relevant for real variables, since the volatility of these variables is usually very high at business cycle turning points, thus making the job of forecasting them really difficult.

Our results show that the superior forecasting performance of real activity of the Fed arises from its superior performance during recessions and at business cycle turning points. In terms of forecast accuracy, we find that on average the forecast error committed by the Fed staff in predicting real activity and inflation was lower in the pre-1991 sample period. This is consistent with the previous findings in the literature. However, we find that the GB's forecast superiority disappears if recessions are excluded from the sample. Our findings suggest that the Fed Board staff does a significantly better job in predicting real activity measures during recessionary periods and at business cycle turning points. This result gets reinforced if we perform information asymmetry tests. Consistent with what other researchers have found, we also find that GB forecasts encompass all the information about movements in real activity and inflation for the pre-1991 period. However, we find that once the recessionary periods are excluded, then the information asymmetry between the Fed and the private sector forecasts disappears for most of the forecast horizons for different measures of real activity. Therefore our results suggest that the disappearance of the information superiority that has been found by D'Agostino and Whelan (2008) and Gamber and Smith (2009) for the post-1991 sample period may have also been caused by the presence of a single but mild recession in 2001. We do not find any significant effect of recessions on forecasting performance of inflation. The exclusion of recessionary periods and turning points does not improve the forecasting performance of inflation of the private sector relative to the Federal Reserve.

The plan of the remainder of this paper is as follows. Section 2 describes the data used in this paper; section 3 tests the rationality of different forecasts; section 4 and 5 present the empirical results of this paper, and section 6 concludes.

2 Data Description

We use four measures of real activity: real output, index of industrial production, unemployment rate, and housing starts. These measures of real activity are selected on the basis of data availability as forecasts for these variables are available since 1968 for both the Federal Reserve and the SPF. The SPF forecasts of components of GDP: consumption, investment, government expenditure and net exports are only available since 1981. The presence of only two recessions between 1982 and 1991 constraints us in studying the impact of recessions on relative forecasting performance of different components of GDP. Inflation measure is based on GDP/GNP deflator. The Greenbook forecasts and the SPF forecasts are obtained from the Federal Reserve Bank of Philadelphia[4]. The Greenbook forecasts are prepared by the Fed Staff and presented before each meeting of the Federal Open Market Committee (FOMC)[5]. We use SPF's forecast as a proxy for the private sector's expectation about the future of the economy. This survey was originally conducted by the American Statistical Association/ National Bureau of Economic Research and has been taken over by Federal Reserve Bank of Philadelphia. We use SPF's median forecasts. The data spans the last quarter of 1968 to the last quarter of 2001.

We consider forecasts of these variables up to 4-quarter ahead horizons. The current quarter forecasts are made in the middle of the quarter. Therefore 0-quarter ahead forecast in our paper represents the forecast of current quarter that was made in the middle of the quarter. The FOMC meets every six weeks and hence there are roughly eight Greenbook forecasts available in a year. However, for the earlier part of the sample (i.e. in the 1960s and the 1970s), FOMC meetings took place almost every month. Therefore there are twelve forecasts available within a year for that time period. The SPF's forecasts are performed near the end of the second month of each quarter. For comparison with Greenbook forecasts that are made every six weeks, we use the forecasts closest to the middle of the quarter. For early part of the sample when twelve Greenbook forecasts are available, we also choose the quarterly forecasts that were made in the second month of the quarter. The Greenbook forecasts are made available to the public with a five-year delay, and hence our sample ends in the last quarter of 2001.

[4]For 2-,3-, and 4- quarter ahead forecasts, few data points are missing for Greenbook forecasts prior to the third quarter of 1974. For systematic comparison, we do not use the SPF forecasts for those quarters for which the Greenbook forecasts are missing.

[5]It can be argued that these forecasts are not isolated ex-ante, as the Fed has access to SPF forecasts in real-time, whereas the GB forecasts are released to the private sector only after a significant time lag. This may be an issue for comparison of short horizon forecasts, but the assumption we make in this paper, which is not unreasonable is that the marginal contribution of SPF forecasts in the preparation of GB forecasts at longer horizons is insignificant.

Since all these measures of real activity and GDP deflator are subject to heavy revisions, data vintage selection for true realized value becomes an issue. We follow Romer and Romer (2000), and use the data released at the end of the third month following the end of the quarter that is being measured[6].

[6]Real-time data of these variables have been obtained from Federal Reserve Bank of Philadelphia's Real-Time Dataset for Macroeconomists. See Croushore and Stark (2001).

3 Test of Rationality

Before comparing the accuracy of forecasts, we investigate the rationality of the Greenbook forecasts and the private sector forecasts. Romer and Romer (2000) performed rationality test for Greenbook and private sector's forecast of inflation and could not reject the null of rationality at all forecast horizons for the pre-1991 sample period. In our study, we are also including index of industrial production, housing starts, and unemployment, and their forecasting properties have not been studied by the existing literature. Therefore it would be interesting to examine whether the Greenbook and private sector forecast of these variables are rational or not. Since Greenbook forecasts are not available to the public in real-time, the private sector forecasts can play a significant role in forming expectations about the economy. To test for rationality, we run the following regression:

$$y_{t+h} = \delta + \beta \widehat{y}_{t+h,t} + v_{t+h} \tag{1}$$

where y_{t+h} denotes the actual value of the variable of interest (GDP growth, IIP, inflation etc.) at time t+h, h is the forecast horizon. For example, if h=1, y_{t+1} is the actual realization of the variable of interest, and $\widehat{y}_{t+1,t}$ represents the forecast of y_{t+1} at time t. If forecasts are rational, then the null hypothesis of $\delta = 0$, and $\beta = 1$ would not be rejected. Table 1 and 2 report rationality test results for the Greenbook and the SPF forecasts for the full sample. P-values in tables 1 and 2 are the estimated p-values for testing null hypotheses. The results indicate that for most of the variables the null of rationality is not rejected at all horizons. As expected, the explanatory power of different forecasts decreases as the forecast horizon increases. The degree of reduction in forecasting power as forecast horizon increases is striking for the GDP growth and the industrial production. Our results indicate that the current quarter Greenbook and SPF forecast of index of industrial production can explain around 70 percent of the movement in the actual variable, which gets reduced to less than 3 percent for 4-quarter ahead SPF forecasts and 12 percent for Greenbook forecasts. Our results show that the explanatory power of Greenbook forecast is better than the SPF forecasts in most of the cases, and particularly for inflation. We also find that the degree of superiority of Greenbook's forecast of industrial production over SPF gets magnified at longer horizons.

4 Forecast Comparison

4.1 Informal Evidence

Asymmetric information between the Fed and the private forecasters about the future economic conditions is based on the assumption that the forecasting performance is similar on average across different points of business cycles. However, there is compelling anecdotal evidence which shows that macroeconomic forecasts fail to predict turning points and performance is relatively poor during the recessionary periods. Figures 1-4 show rolling 1-year Mean Squared Errors (MSEs) for GDP growth, IIP, unemployment rate, housing starts, and inflation for 2-,3-, and 4-quarter ahead forecasts. The shaded region represents NBER recessions including a quarter before the peak and a quarter after the trough. A pattern is evident in these MSEs especially at 2-,3-, and 4-horizon forecasts. We find that the MSEs for these real activity measures peak during business cycle turning points and during recessions. It is also clear that the private sector's forecast errors are consistently higher than the Greenbook forecast errors for 2-, 3- and 4-quarter forecast horizons during recessions. The results are relatively mixed for short-horizon forecasts (0- and 1-quarter ahead forecasts).[7] This ambiguity in short-horizon forecasts is not very surprising since timing of the forecasts plays a very big role in short-horizon forecasts. Since there is no exact overlap in the timing of these two forecasts (i.e. forecasts are not performed at the same time) we cannot draw certain conclusions from the comparison of the short-horizon forecasts. We can, however, draw more certain conclusions on the basis of long-horizon forecasts as the non-overlap of forecast release dates should not cause a problem for the longer horizon forecast comparisons.

4.2 Formal Evidence

To further investigate the relative forecasting performance of forecasts, we look at the MSEs of different variables. Table 3 reports the ratio of MSEs for different sample periods. MSE-Ratio represents the ratio of GB forecasts to SPF forecasts. A ratio lower than one means that the MSEs of GB forecasts are lower on average. To examine the effect of recession and turning points, we compare the forecast errors for pre-2001 and the pre-1991 period with and without recessions. First column of table 3 reports the ratio of MSE for whole sample and the second column represents the ratio of MSE for pre-2001 that excludes each recessionary period as defined by the NBER. To capture the forecasting performance during turning points we also exclude one quarter prior to the peak and one quarter after the trough.

[7] The graphs for 0-, and 1-quarter ahead MSEs are not shown here.

Similarly columns 3 and 4 show the ratio of MSEs during pre-1991 period with and without recession.

We look at the relative forecasting performance of real GDP growth first. As reported in table 3, for both the sample periods (columns 1 and 3), GB forecasts perform better on average than the SPF forecasts except for the 1-quarter ahead forecasts. If periods of recession are excluded from both samples, then the ratio increases, and in fact becomes higher than one in all the cases except for the 2-quarter ahead forecasts. This implies that if the recessionary periods are excluded from the sample, then informational advantage of the Fed disappears in case of the real GDP forecasts. The forecast errors of index of industrial production show similar pattern. For 2-, 3-, and 4- quarter ahead MSE-ratio changes from less than one to higher than one in 5 out of 6 cases implying that the superiority of GB forecasts gets reversed when the sample period does not include recessions. We do not find the same pattern for current and 1-quarter ahead forecasts. GB forecasts are better on average in all cases even if we exclude the recessions. As pointed out earlier, direct comparison of short-horizon forecasts is relatively difficult because of the non-overlap of the forecast release dates. Unemployment rate is the third measure of real activity in our study. For current and 1-quarter ahead forecasts private forecasts are better on average for all sample periods and for short-horizon forecasts, superior performance of private forecasts decreased after excluding the recessionary period. For 2-, 3-, and 4-quarter forecasts, we again find that the dominance of the GB forecasts disappears after the exclusion of the recessionary periods as MSE-ratio increases from less than one to greater than one. The forecasts for housing starts also display similar properties. We find that SPF forecasts' performance is relatively better for only 1-quarter ahead forecasts. Therefore the graphical pattern shown in figures 1-4 is reinforced by looking at the numerical values of the ratio of the forecast errors for different sample periods.

Our results show that MSE of GB forecasts is lower than the SPF forecasts on average. Does it imply that the GB forecasts are significantly superior to that of forecasts from SPF?. To test the significance of forecast superiority, we perform forecast comparison test. Since GB and SPF forecasts are non-nested, we use Diebold and Mariano (1995) and West (1996) type of forecast evaluation test. We also use the finite sample correction suggested by Harvey et al. (1998). This modified test statistic is referred to as the modified Diebold-Mariano test statistic. The modified Diebold-Mariano test statistic is estimated with Newey-West corrected standard errors that allow for heteroskedastic autocorrelated errors. The null hypothesis of this test implies that the forecast accuracy of the private sector forecast and the GB forecasts are not significantly different from each other. P-values for this test are

reported in the parentheses of table 3. The results suggest that GB'S forecasting performance of real activity is not significantly superior to that of SPF for most of the variables for all sample periods. This implies that even though MSE for the whole sample period and the pre-1991 period is lower for GB forecasts for most of the variables at different forecasting horizons, these differences do not pass the statistical test of forecast superiority.

Since the results suggest that recessions and business cycle turning points play a significant role in the forecasting performance of GB and SPF forecasts, we also examine the relative forecasting performance of the Fed and the private sector for recessionary periods only. Table 4 reports the results. MSE ratios are defined as earlier. Modified Diebold-Mariano p-values are in parentheses. The results suggest that the performance of Greenbook forecast is significantly better than the SPF forecasts for 2-,3-, and 4-quarter ahead forecasts. The average of 0-4 quarter ahead forecasts also suggest that GB forecast of real activity measures are significantly better than their private sector counterparts. Our findings imply that MSEs of GB forecasts are on average 30 percent lower during the recessionary periods, which is much higher than the normal times. This implies that the Fed's information superiority may have been based on its ability to provide better forecasts during recessions and at business cycle turning points. Less frequent occurrence of recessions may have caused the disappearance of the Fed's dominance in forecasting performance of the real activity between 1992-2003.[8]

We also investigate the role of turning points and recessions in the Fed' superior forecasting performance of inflation. We find that the inclusion or the exclusion of recessions and turning points from the sample doesn't affect the superiority of GB forecasts of inflation. In fact, GB forecasts perform even better after exclusion of recessionary periods and turning points. Figure 5 shows that the superior forecasting performance of the Fed's inflation forecast is arising from the behavior of the private forecasts during 1980-1987 period. There were persistent and significantly higher errors committed by the private forecasters in forecasting inflation during that time period. This is consistent with the finding in the literature that inflationary expectations of private sector adjusted slowly after the "Great Inflation" of the 1970s (Stock and Watson, 2000).

[8]It can also be argued that monetary policy was partly responsible for the less frequent occurence of recessions.

5 Test of Information Asymmetry

To test the hypothesis whether individuals who know the SPF forecasts could make better forecasts if they also knew the Fed staff's forecasts, Romer and Romer (2000) used the following specification:

$$y_{t+h} = \delta + \beta_G \widehat{y}^G_{t+h,t} + \beta_P \widehat{y}^P_{t+h,t} + \upsilon_{t+h} \tag{2}$$

where y_{t+h} denotes the actual value of the variable of interest (GDP, IIP, inflation etc.), h is the forecast horizon, and $\widehat{y}^G_{t+h,t}$ and $\widehat{y}^P_{t+h,t}$ are the h-period ahead GB and SPF forecast of variables of interest y_t. In this case, GB forecasts are useful in predicting y_t if and only if β_G is significant.

We also perform this test for information asymmetry for different measures of real activity and inflation. The above baseline model is estimated with forecasts of each quarter separately. One concern that is associated with these quarterly regressions is that the results may represent quarter-to-quarter noise. To take care of this problem, we follow Romer and Romer (2000), and also estimate the following model

$$\overline{y_{t+h}} = \delta + \beta_G \widehat{\overline{y}}^G_{t+h,t} + \beta_P \widehat{\overline{y}}^P_{t+h,t} + \overline{\upsilon_{t+h}} \tag{3}$$

where $\overline{y_{t+h}}$ is average of variable y up to horizon h, and $\widehat{\overline{y}}^G_{t+h,t}$ and$\widehat{\overline{y}}^P_{t+h,t}$ are the average Greenbook forecasts and average private sector forecasts up to horizon h. The above equation provides useful summaries of the overall relationship between the actual value and different forecasts. This also provides a check whether the relationship is systematic or just quarter-to-quarter noise.

The estimation results for above equations are presented in tables 5 and 6. We first estimate the above equation by dividing the sample in 1992 (table 5). The estimation results for real GDP and inflation forecasts are consistent with D'Agostino and Whelan (2008). Our results indicate that the GB forecasts contain valuable information not contained in the SPF forecasts for 1968-2001 and 1968-1991 sample periods for most of the variables at almost every forecast horizons. The point coefficient of β_G is bigger at higher forecast horizons. In most of the cases, point estimate of β_P is insignificant implying that little weight should be assigned to SPF forecasts, and all the weights should be assigned to GB forecasts. But this information asymmetry disappears for medium to long-horizon forecasts after 1991. In fact, the results for the post-1991 sample period indicate that at 2-,3-, and 4-quarter horizons, some coefficients on GB forecasts are negative but insignificant. The estimation result of equation 4 also confirms these broad patterns, and reinforce the evidence that the results obtained are not just quarter-to-quarter noise.

The empirical evidence presented above for real activity indicates that not only the Fed's informational superiority over the private sector has disappeared, its overall predictive power has also declined significantly. This decline in predictability in the post-1992 period is consistent across different forecast horizons and different variables. This is also true for private sector forecasts. Therefore it seems that the disappearance of the information asymmetry is due to a reduction in the predictive power of different forecasts. However, it should also be noted that the overall forecast error has declined significantly in the second period. The reduction in predictive power of different forecast is the result of an increase in stability of different macroeconomic variables. To illustrate this point, consider an extreme example. If economy becomes perfectly stable, there would not be any variability in the main macroeconomic indicators. By construction, a constant is uncorrelated with any predictor. Therefore the overall stability or the absence of recessions in the post-1992 period might have caused the disappearance of the information asymmetry between the Fed and the private sector.

The comparison of forecast errors in our earlier analysis showed that GB's forecasting dominance did arise mainly from its superiority in forecasting performance at business cycles turning points and recessions. This result is consistent for the full sample period as well as for the 1968-1991 period. In this section, we examine the role of recessions and turning points in information asymmetry between the GB forecasts and the private forecasts using equation 1. Table 6 shows the results for the case when recessions are excluded from the sample period 1968-2001 and pre-1992 sample period. If recessions don't affect the information contained in these two forecasts then the results obtained in table 6 will hold. Our results show that for 2-,3-,and 4-quarter horizon forecasts for real activity, the informational advantage of the Fed arises due to its performance during recessions. Once recessionary periods are excluded, the informational advantage of the Fed during pre-2001 and pre-1992 period disappears.

The point estimate of GDP growth, IIP, unemployment rate, and housing starts are significant and close to one for 2-,3-, and 4-quarter ahead GB forecasts for both the sample periods. Once recessionary periods are excluded from the regression, the point estimate of GB forecasts decreases significantly, and in some cases become negative. All the coefficients on GB forecasts become insignificant once recessionary periods are excluded. For 3-quarter ahead housing starts forecasts, the informational advantage of the Fed does not disappear but diminishes after the exclusion of recessions. If we concentrate on 0-4 quarter average forecasts, then our results are even more conclusive as the information asymmetry disappears for all four measures of real activity after exclusion of recessions and business cycle turning points.

The results are slightly mixed for short-horizon forecasts. The first interesting result is that the inclusion or the exclusion of recessions does not play a significant role in the determination of information asymmetry. We also find that the Fed has informational advantage over private forecasters in predicting industrial production at current and 1-quarter ahead forecasts and current output growth forecast. This informational advantage does not disappear after the exclusion of recessionary periods. Surprisingly, private forecasts dominate GB forecasts for unemployment and housing starts at short-horizons. D'Agostino and Whelan (2008) point out that the Fed's advantage in projecting current quarter real GDP forecasts is not surprising. According to them, the Federal Reserve Board involves a large number of staff economists in the Greenbook forecast exercises, with many working as sector analysts specializing in forecasting narrow areas. The Fed staff usually have access to some of the various monthly statistical releases that are used by the commerce department to construct their estimate of GDP. However, it may also be pointed out that the Fed has access to SPF forecasts in real-time, whereas the private sector does not have access to GB forecasts. For short-horizon forecasts, this may also play a role.

As pointed out earlier in our analysis, informational superiority of the Fed does not change for inflation if recessionary periods are excluded from the sample. Our estimation results for equations 2 and 3 support this hypothesis. Our regression results show that the exclusion of recessionary periods from the sample has no significant effect on the point estimates of inflation forecasts. Our finding that the relative forecasting performance does not depend upon the recessionary periods for inflation is not very surprising. We usually expect the real activity to be more volatile and harder to forecast at business cycle turning points. One of the reasons for the disappearance of the information asymmetry in the case of inflation for post-1991 period can be attributed to a break in the dynamics of inflation. As pointed out by Stock and Watson (2007), inflation has become both easier and harder to forecast in the 1990s. It has become easier to forecast because forecast errors for the private sector as well as the Fed's forecasts have become smaller. At the same time, it has become harder to forecast because the forecasting performance of the GB forecasts and the private sector forecasts have declined relative to a naive autoregressive forecasting model.

6 Conclusions

We re-examine the evidence of information asymmetry between the Fed forecasts and the private sector forecasts in the pre-1992 period, and the disappearance of this asymmetric information after 1991. Our results show that Fed's informational advantage in forecasting real activity in the pre-1991 period arises due to its superior forecasting performance during the recessions. We find that the disappearance of informational advantage coincides with less frequent occurrence of recessions in the US economy. If forecasting recessions and turning points matters much more than forecasting during normal times, then Fed may still possess informational advantage over private sector forecasters. We do not find any systematic effect of recessions on inflation forecasts of the Federal Reserve and the private sector forecasts. The erosion of the Fed's forecasting advantage in case of inflation seems to have been caused by the change in the inflation dynamics.

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Figure 1: 1-Year Rolling MSE (GDP Growth)

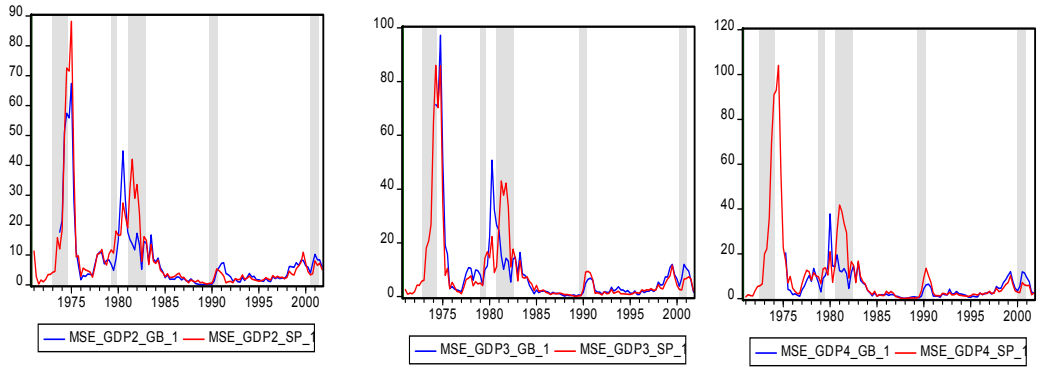

Figure 2: 1-Year Rolling MSE (Industrial Production)

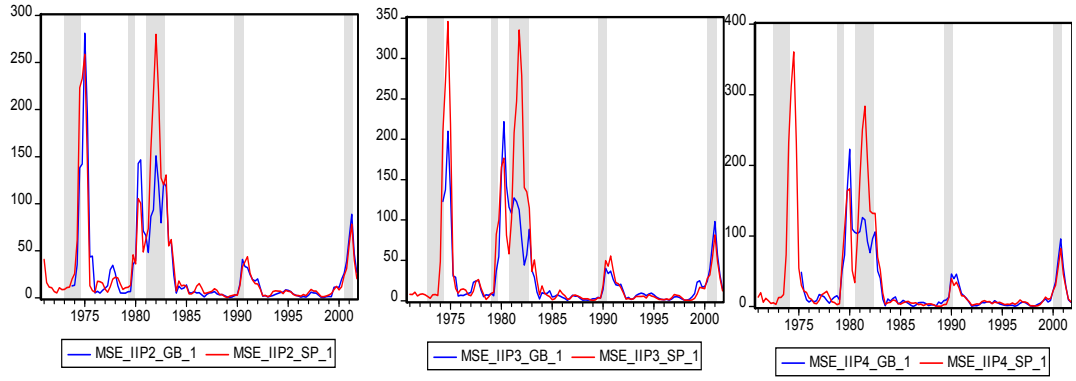

Figure 3: 1-Year Rolling MSE (Housing Starts)

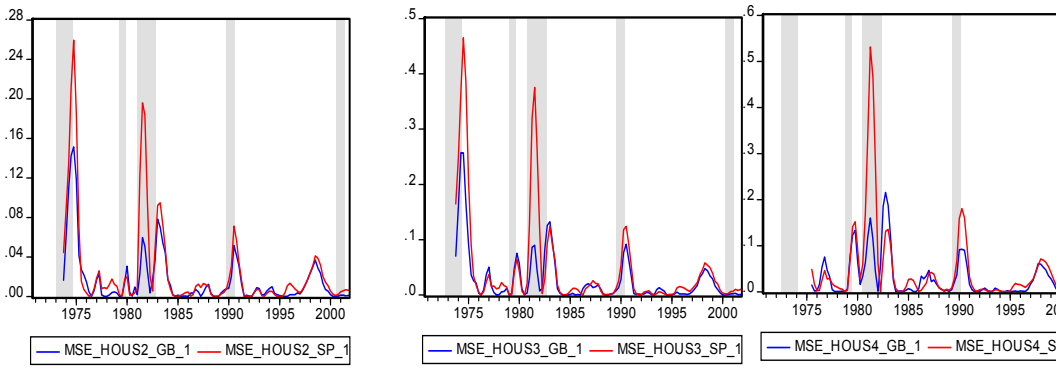

Figure 4: 1-Year Rolling MSE (Unemployment)

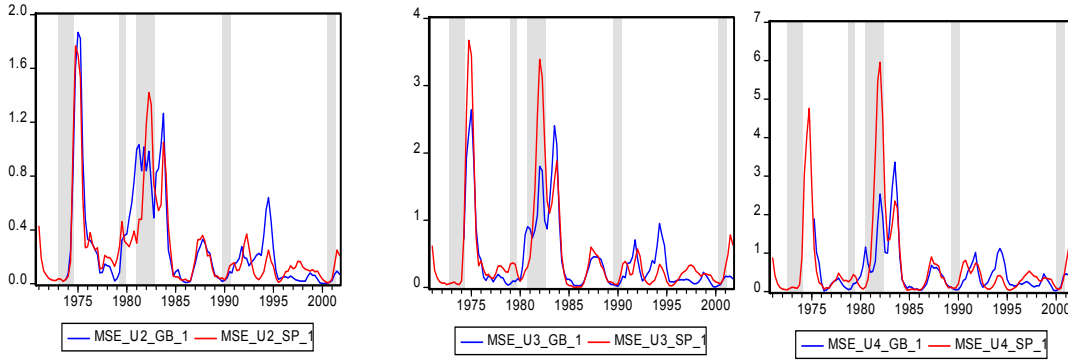

Figure 5: 1-Year Rolling MSE (Inflation)

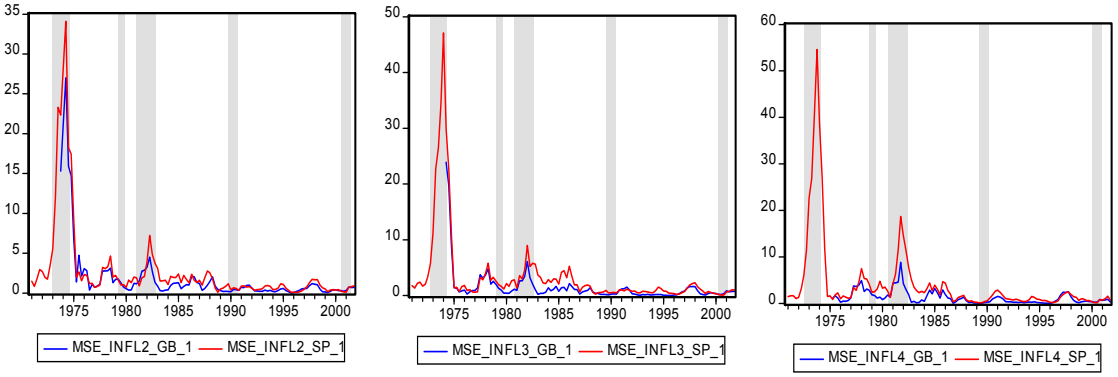

Table 1: Rationality Tests for Greenbook Forecasts

	Full Sample	(1968:04-2001:04)		
Variable	α	β	R^2	P-value
GDP0	0.23(0.34)	0.99(0.08)	0.62	0.49
GDP1	0.38(0.64)	0.84(0.16)	0.27	0.50
GDP2	0.01(0.73)	0.92(0.17)	0.22	0.64
GDP3	0.72(0.74)	0.64(0.20)	0.08	0.13
GDP4	0.85(0.87)	0.66(0.25)	0.07	0.34
GDP(0-4)	-0.37(0.56)	1.01(0.12)	0.40	0.51
IIP0	0.01(0.35)	0.94(0.04)	0.73	0.27
IIP1	-1.52(0.93)	1.08(0.14)	0.33	0.12
IIP2	-0.40(0.96)	0.78(0.17)	0.15	0.07
IIP3	-1.65(1.59)	1.07(0.35)	0.19	0.12
IIP4	-0.81(1.37)	0.95(0.27)	0.12	0.30
IIP(0-4)	-0.37(0.63)	0.87(0.12)	0.50	0.03
Start0	0(0.06)	1.01(0.03)	0.88	0.12
Start1	0.01(0.12)	1.02(0.07)	0.76	0.43
Start2	0.01(0.13)	0.99(0.08)	0.65	0.94
Start3	0.11(0.18)	0.92(0.12)	0.49	0.83
Start4	0.24(0.24)	0.83(0.15)	0.37	0.49
Start(0-4)	0.04(0.10)	0.97(0.06)	0.74	0.93
U0	0(0.05)	0.99(0.01)	0.98	0.02
U1	0.08(0.15)	0.97(0.03)	0.93	0.15
U2	0.29(0.31)	0.93(0.05)	0.87	0.32
U3	0.44(0.48)	0.91(0.08)	0.78	0.43
U4	0.62(0.70)	0.88(0.10)	0.70	0.33
U(0-4)	0.37(0.31)	0.92(0.05)	0.88	0.26
Infl0	-0.05(0.21)	0.98(0.06)	0.84	0.36
Infl1	-0.16(0.28)	1.03(0.08)	0.73	0.82
Infl2	-0.08(0.31)	1.03(0.09)	0.64	0.93
Infl3	-0.13(0.31)	1.04(0.09)	0.64	0.89
Infl4	-0.23(0.38)	1.04(0.11)	0.59	0.78
Infl(0-4)	-0.22(0.22)	1.02(0.06)	0.84	0.39

[a] The estimated equation is $y_{t+h} = \delta + \beta \widehat{y}^{G}_{t+h,t} + v_{y+h}$. $\widehat{y}^{G}_{t+h,t}$ is the h-period ahead GB forecast of variable y.

Table 2: Rationality Tests for SPF Forecasts

	Full Sample	(1968:04-2001:04)		
Variable	α	β	R^2	P-value
GDP0	0.04(0.42)	1.05(0.12)	0.59	0.51
GDP1	-0.20(0.83)	1.00(0.22)	0.32	0.79
GDP2	0.32(0.56)	0.74(0.16)	0.10	0.22
GDP3	0.03(0.83)	0.76(0.25)	0.07	0.19
GDP4	0.92(0.87)	0.52(0.24)	0.03	0.07
GDP(0-4)	-0.37(0.56)	1.01(0.12)	0.39	0.51
IIP0	-0.52(0.54)	1.18(0.12)	0.70	0.35
IIP1	-0.68(1.09)	0.89(0.21)	0.22	0.24
IIP2	-0.43(1.00)	0.74(0.21)	0.10	0.13
IIP3	0.37(1.12)	0.46(0.31)	0.02	0.06
IIP4	-0.11(1.31)	0.61(0.36)	0.02	0.14
IIP(0-4)	-1.27(0.78)	1.04(0.14)	0.30	0.07
Start0	-0.03(0.04)	1.03(0.03)	0.90	0.02
Start1	-0.10(0.10)	1.08(0.07)	0.76	0.25
Start2	-0.12(0.17)	1.08(0.11)	0.60	0.76
Start3	0.02(0.28)	0.97(0.18)	0.39	0.95
Start4	0.33(0.39)	0.77(0.26)	0.22	0.69
Start(0-4)	-0.07(0.16)	1.05(0.10)	0.69	0.84
U0	-0.04(0.06)	1.00(0.01)	0.98	0.04
U1	-0.04(0.21)	0.99(0.03)	0.93	0.42
U2	0.04(0.40)	0.98(0.06)	0.84	0.87
U3	0.32(0.60)	0.95(0.10)	0.72	0.85
U4	0.41(0.76)	0.93(0.12)	0.62	0.82
U(0-4)	0.15(0.39)	0.97(0.06)	0.87	0.91
Infl0	-0.25(0.25)	1.03(0.06)	0.79	0.36
Infl1	-0.12(0.34)	1.02(0.09)	0.64	0.93
Infl2	-0.20(0.45)	1.03(0.10)	0.53	0.90
Infl3	0.14(0.64)	0.95(0.13)	0.42	0.92
Infl4	0.47(0.73)	0.86(0.17)	0.35	0.73
Infl(0-4)	-0.32(0.36)	1.04(0.09)	0.69	0.59

[a] The estimated equation is $y_{t+h} = \delta + \beta \widehat{y}^{p}_{t+h,t} + v_{y+h}$. $\widehat{y}^{p}_{t+h,t}$ is the h-period ahead SPF forecast of variable y.

Table 3: MSE-Ratio Comparison

	Full Sample	(1968:04-2001:04)	(1968:04-1991:04)	
Variable	MSE-Ratio	MSE-Ratio$_{WR}$	MSE-Ratio	MSE-Ratio$_{WR}$
GDP0	0.94 (0.14)	0.94 (0.22)	0.93 (0.12)	0.96 (0.31)
GDP1	1.09 (0.23)	1.12 (0.14)	1.10 (0.31)	1.13 (0.24)
GDP2	0.86 (0.19)	0.98 (0.71)	0.82 (0.14)	0.94 (0.98)
GDP3	0.99 (0.63)	1.38 (0.04)	0.96 (0.46)	1.46 (0.08)
GDP4	0.98 (0.58)	1.06 (0.14)	0.92 (0.37)	1.01 (0.24)
GDP(0-4)	0.96 (0.78)	1.32 (0.01)	0.83 (0.53)	1.42 (0.05)
IIP0	0.83 (0.49)	0.70 (0.32)	0.85 (0.61)	0.75 (0.40)
IIP1	0.87 (0.10)	0.80 (0.13)	0.86 (0.12)	0.71 (0.11)
IIP2	0.93 (0.51)	0.99 (0.36)	0.91 (0.43)	1.04 (0.37)
IIP3	0.74 (0.10)	1.16 (0.28)	0.69 (0.07)	1.11 (0.37)
IIP4	0.90 (0.31)	1.14 (0.14)	0.88 (0.32)	1.33 (0.10)
IIP(0-4)	0.79 (0.34)	1.24 (0.25)	0.73 (0.31)	1.34 (0.19)
Start0	1.27 (0.23)	1.18 (0.42)	1.20 (0.34)	1.10 (0.62)
Start1	0.96 (0.73)	1.07 (0.43)	0.94 (0.65)	1.06 (0.49)
Start2	0.73 (0.06)	0.84 (0.64)	0.73 (0.05)	0.82 (0.71)
Start3	0.67 (0.06)	0.95 (0.36)	0.67 (0.06)	1.05 (0.81)
Start4	0.74 (0.13)	1.08 (0.57)	0.72 (0.12)	1.18 (0.40)
Start(0-4)	0.71 (0.12)	1.05 (0.95)	0.72 (0.14)	1.17 (0.67)
U0	1.63 (0.10)	1.04 (0.39)	1.42 (0.27)	0.84 (0.89)
U1	1.25 (0.11)	1.08 (0.20)	1.18 (0.18)	1.00 (0.46)
U2	0.97 (0.66)	1.08 (0.16)	0.98 (0.58)	1.11 (0.17)
U3	0.85 (0.20)	1.07 (0.35)	0.84 (0.15)	1.06 (0.36)
U4	0.89 (0.51)	1.09 (0.15)	0.85 (0.36)	1.22 (0.13)
U(0-4)	1.00 (0.95)	1.20 (0.19)	0.97 (0.78)	1.15 (0.22)
Infl0	0.82 (0.06)	0.80 (0.10)	0.83 (0.08)	0.80 (0.19)
Infl1	0.76 (0.00)	0.70 (0.00)	0.75 (0.00)	0.65 (0.00)
Infl2	0.76 (0.01)	0.65 (0.08)	0.77 (0.02)	0.68 (0.23)
Infl3	0.68 (0.00)	0.51 (0.00)	0.69 (0.00)	0.54 (0.00)
Infl4	0.59 (0.00)	0.50 (0.00)	0.58 (0.00)	0.51 (0.00)
Infl(0-4)	0.56 (0.00)	0.59 (0.00)	0.56 (0.00)	0.58 (0.00)

[a] MSE-Ratio$_{WR}$ refers to the MSE-ratio without recession. MSE-Ratio is the ratio of MSE of Greenbook Forecasts to SPF Forecasts. First column refers to the MSE-ratio for 1968-2001. Second Column refers to the MSE-ratio for 1968-2001 without recessionary periods. Similarly, third and fourth column represent MSE-ratio for 1968-1991 period with and without recessions. Modified Diebold-Mariano P-values are in parentheses. Diebold-Mariano method tests whether Greenbook forecast is significantly better than the SPF forecasts.

Table 4: MSE-Ratio For Recessions

Variable	MSE-Ratio
GDP0	0.77 (0.29)
GDP1	1.06 (0.68)
GDP2	0.73 (0.07)
GDP3	0.70 (0.01)
GDP4	0.71 (0.06)
GDP(0-4)	0.65 (0.00)
IIP0	0.91 (0.86)
IIP1	0.95 (0.46)
IIP2	0.82 (0.06)
IIP3	0.61 (0.02)
IIP4	0.68 (0.05)
IIP(0-4)	0.77 (0.00)
Start0	1.01 (0.22)
Start1	0.79 (0.06)
Start2	0.67 (0.03)
Start3	0.60 (0.02)
Start4	0.51 (0.02)
Start(0-4)	0.70 (0.00)
U0	2.30 (0.16)
U1	0.96 (0.78)
U2	0.65 (0.00)
U3	0.59 (0.00)
U4	0.52 (0.00)
U(0-4)	0.61 (0.10)
Infl0	0.89 (0.41)
Infl1	0.72 (0.00)
Infl2	0.71 (0.03)
Infl3	0.71 (0.01)
Infl4	0.72 (0.02)
Infl(0-4)	0.53 (0.01)

[a] MSE-Ratio is the ratio of MSE of Greenbook Forecasts to SPF Forecasts. Modified Diebold-Mariano P-values are in parentheses. Modified Diebold-Mariano method tests whether Greenbook forecast is significantly better than the SPF forecasts. MSE-ratios are calculated for recession periods characterized by the NBER and it also includes one quarter prior to the peak and one quarter after the trough.

Table 5: Test of Information Asymmetry

	(1968:04-1991:04)		(1992:01-2001:04)	
Variable	β_G	β_P	β_G	β_P
GDP0	**0.74**	**0.32**	**1.09**	-0.61
GDP1	0.11	**0.90**	**0.83**	-0.44
GDP2	**1.19**	-0.21	0.25	-1.45
GDP3	0.59	0.44	-0.56	0.05
GDP4	**0.71**	0.34	-0.93	0.11
GDP(0-4)	**0.62**	0.39	-0.18	-0.54
IIP0	**0.58**	**0.6**	**0.81**	0.22
IIP1	**1.04**	0.16	**0.96**	-0.32
IIP2	**0.65**	0.34	-0.09	0.07
IIP3	**1.37**	-0.26	-0.85	**0.97**
IIP4	**1.01**	0.16	0.06	-0.14
IIP(0-4)	**0.74**	0.28	**0.67**	-0.12
Start0	0.28	**0.76**	0.14	**0.87**
Start1	**0.6**	**0.48**	-0.01	**1.05**
Start2	**1.06**	-0.02	0.15	**0.95**
Start3	**1.17**	-0.24	**0.63**	0.46
Start4	**1.14**	-0.38	0.26	**1.00**
Start(0-4)	**1.11**	-0.13	0.15	**1.07**
U0	0.23	**0.76**	-0.03	**1.05**
U1	0.2	**0.79**	0.19	**0.82**
U2	**0.70**	0.21	**0.62**	0.37
U3	**1.09**	-0.26	0.46	0.56
U4	**1.20**	-0.50	-0.1	1.24
U(0-4)	**0.74**	0.14	**0.84**	0.01
Infl0	**0.78**	0.18	**0.45**	0.02
Infl1	**1.28**	-0.35	**0.47**	-0.19
Infl2	**1.36**	-0.51	0.12	0.33
Infl3	**1.47**	-0.63	0.06	0.18
Infl4	**1.74**	-0.87	0.09	0.04
Infl(0-4)	**1.85**	**-1.00**	0.38	0.20

[a] Bold numbers are significant at 10 percent significance level. The estimated equation is $y_{t+h} = \delta + \beta_G \widehat{y}^G_{t+h,t} + \beta_P \widehat{y}^P_{t+h,t} + v_{y+h}$. $\widehat{y}^G_{t+h,t}$ and $\widehat{y}^P_{y+h,t}$ are the h-period ahead GB and SPF forecasts of variable y. 0-4 refers to the average of 0 to 4 quarters ahead

Table 6: Test of Information Asymmetry

				(1968:04-2001:04)				(1968:04-1991:04)
Variable	β_G	β_P	β_G^{WR}	β_P^{WR}	β_G	β_P	β_G^{WR}	β_P^{WR}
GDP0	**0.71**	0.32	**0.66**	**0.33**	**0.74**	0.32	**0.68**	**0.32**
GDP1	0.12	**0.88**	0.04	**1.07**	0.11	**0.90**	0.10	**1.01**
GDP2	**1.08**	-0.22	0.39	**0.55**	**1.19**	-0.21	0.52	0.50
GDP3	0.51	0.25	-0.56	**1.57**	0.59	0.44	-0.60	**1.74**
GDP4	**0.52**	0.24	-0.33	**1.26**	**0.71**	0.34	-0.32	**1.36**
GDP(0-4)	**0.59**	0.33	-0.36	**1.27**	**0.62**	0.39	-0.33	**1.21**
IIP0	**0.58**	**0.60**	**0.67**	**0.39**	**0.58**	**0.60**	**0.66**	**0.40**
IIP1	**0.98**	0.18	**1.12**	0.29	**1.04**	0.16	**1.24**	0.18
IIP2	**0.60**	0.30	0.20	**0.95**	**0.65**	0.34	0.23	**0.96**
IIP3	**1.2**	-0.28	0.03	**1.03**	**1.37**	-0.26	0.13	**0.99**
IIP4	**0.95**	0.06	0.04	**1.18**	**1.01**	0.16	-0.03	**1.27**
IIP(0-4)	**0.73**	0.22	0.14	**0.74**	**0.74**	0.28	0.09	**0.78**
Start0	0.25	**0.78**	0.28	**0.76**	0.28	**0.76**	0.32	**0.72**
Start1	**0.56**	**0.50**	0.15	**0.87**	**0.60**	**0.48**	0.19	**0.83**
Start2	**1.04**	-0.04	**0.40**	**0.60**	**1.06**	-0.02	0.46	0.52
Start3	**1.21**	-0.36	**0.64**	0.27	**1.17**	-0.24	0.54	0.37
Start4	**1.12**	-0.41	0.26	0.58	**1.14**	-0.38	0.24	0.58
Start(0-4)	**1.12**	-0.18	0.32	**0.70**	**1.11**	-0.13	0.30	**0.70**
U0	0.14	**0.86**	**0.49**	**0.5**	0.23	**0.76**	**0.49**	**0.50**
U1	0.19	**0.8**	0.17	**0.80**	0.20	**0.79**	0.23	**0.76**
U2	**0.70**	0.25	0.35	**0.60**	**0.70**	0.21	0.32	**0.60**
U3	**1.03**	-0.15	**0.48**	**0.44**	**1.09**	-0.26	**0.53**	**0.34**
U4	**1.06**	-0.20	**0.37**	**0.51**	**1.20**	-0.50	**0.49**	0.27
U(0-4)	**0.68**	0.26	0.20	**0.74**	**0.74**	0.14	0.12	**0.82**
Infl0	**0.77**	0.23	**0.78**	0.17	**0.78**	0.18	**0.82**	0.05
Infl1	**1.26**	-0.24	**0.98**	-0.02	**1.28**	-0.35	**1.04**	-0.17
Infl2	**1.38**	-0.40	**0.87**	0.05	**1.36**	-0.51	**0.85**	-0.02
Infl3	**1.47**	-0.49	**1.04**	-0.09	**1.47**	-0.63	**1.07**	-0.20
Infl4	**1.67**	**-0.69**	**1.32**	**-0.39**	**1.74**	-0.87	**1.47**	-0.67
Infl(0-4)	**1.67**	**-0.71**	**1.11**	-0.10	**1.85**	**-1.00**	**1.15**	-0.14

[a] Bold numbers are significant at 10 percent sigificance level. The estimated equation is $y_{t+h} = \delta + \beta_G \widehat{y}^G_{t+h,t} + \beta_P \widehat{y}^P_{t+h,t} + v_{t+h}$. $\widehat{y}^G_{t+h,t}$ and $\widehat{y}^P_{t+h,t}$ are the h-period ahead GB and SPF forecasts of variable y. 0-4 refers to the average of 0 to 4 quarters ahead. β_G^{WR} and and β_P^{WR} are coefficients on GB and SPF forecasts when recessions are excluded.