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An Empirical Review of the Federal Reserve's Informational Advantage

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Abstract
Imperfect information in favour of the central bank or the private sector has strong theoretical implications. The empirical literature has then already tried to assess the direction of the information asymmetry in the case of the Federal Reserve. Evidence, however, is mixed. The objective of this paper is therefore to gain some unambiguous outcomes by avoiding biases of methods, data and samples. The results are twofold: *first*, Fed possesses an informational advantage on inflation but only on it. There is no evidence of any advantage for private forecasters or Fed on real GNP/GDP; *second*, the longer the horizon, the more pronounced the advantage of Fed on inflation. Last, this advantage appears to stem from the specific expertness of the Fed and its institutional access to special information.

Keywords: Monetary Policy, Information Asymmetry, Forecasts

JEL Classification: E52, D82, E37

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1. Introduction

Information is quite often the sinew of war. In monetary theory, the hypothesis of perfect information makes inefficient discretionary policies[1], while recently the introduction, generally through New-Keynesian models, of imperfections in the information process either on the central bank's or on the private sector's side has shown to produce different outcomes. Noisy information from policymakers reinforces the argument for commitment and policy carefulness. At the opposite, partial information from private agents gives rise to different recommendations, from successful discretionary policies to the need for more aggressive response to inflation. All in all, the hypothesis of flawed information seems more plausible than full information and the existence of imperfect information in favour of one actor or the other has strong theoretical implications.
The empirical literature has then already tried to assess the direction of the information asymmetry in the case of the Federal Reserve and US private sector with mainly **Peek, Rosengren and Tootell (1998, 2003), Joutz and Stekler (2000), Romer and Romer (2000), Atkeson and Ohanian (2001), Gavin and Mandal (2001), Sims (2002), Faust, Swanson and Wright (2004) and Amornthum (2006)**. Evidence, however, is mixed.

In contrast to the existing literature, the objective of this paper is to avoid biases of methods, data and samples, which may have led to these conflicting conclusions, to gain some clear-cut results. It therefore consists of use of various methodologies applied previously (Mean Square Errors, regressions, a pooling method of forecasts[2] and a factor model) on the same data and sample, extension of the latter, and use of real-time and final data. Alternative measure of inflation is also tested. Because the contribution is to compare methods to understand the differences in the existing results, I take into account criticisms made to them, attempting thus to close the gap in the literature.

The main findings shed some light on the debate: *First*, Fed possesses an informational advantage on inflation but only on it. There is no evidence of any advantage for private forecasters or Fed on real GNP/GDP. *Second*, the longer the horizon, the more pronounced the advantage of Fed on inflation. This tends to confirm the advantage is robust and not due to timing advantage and access to information on the short run. These results confirm the conclusions of **Sims (2002)** and some of those of **Romer and Romer (2000)**, while undermine the outcomes according to which Fed has no informational advantage. I suggest this advantage stems from institutional and inherent aspect of central banking. A parallel result arising from the array of methods is that Fed and private forecasters better forecast real-time value of real GDP while they both have more accurate predictions of final data of inflation.

The rest of the paper is organized as follows. Section 2 deals with the related literature, theoretical as well as empirical. Section 3 describes the data. Section 4 presents the methodologies tested and their results. Section 5 discusses the results and the sources of the informational advantage. Section 6 concludes this paper.

2. Related Literature

In theory, information has many different implications for monetary policy. In the case of the seminal work of **Lucas (1972)** and **Sargent and Wallace (1975, 1976)**, rational expectations suppose perfect information, discretionary policies provide relative price

[1] See **Lucas (1972)**, **Sargent and Wallace (1975), Barro (1976), Barro and Gordon (1983) and Canzoneri (1985).**
[2] Developed by **Davies and Lahiri (1995)** and **Clements, Joutz and Stekler (2007)**

distortions and then optimal monetary policy is reached by commitment. However, imperfect information seems more plausible than the standard assumption of full information. Because imperfectly observed policy is equivalent to unanticipated policy, some studies noted that monetary policy could have real effects such as **Taylor (1980)**, **Meyer and Webster (1982)**, and **Cukierman and Meltzer (1986)**. Empirical evidence has moreover established that monetary policy, unanticipated and anticipated (**Mishkin, 1982**), has real effects and virtually all countries established economic stabilization as one of the main goal of central banking.

Recently, there has been a growing literature on the implications of imperfect information for optimal monetary policy based on the New-Keynesian model. On one hand, information gap may be in favour of private agents. **Orphanides (2003)** find that with noisy information of policymakers, excessively activist policy can increase rather than decrease economic instability, what leads **Aoki (2003**) to infer the noise undergone by the central bank justifies a degree of policy cautiousness and optimal policy should display interest rate smoothing. **Svensson and Woodford (2002, 2003)** and **Swanson (2004)** confirm that policymakers should exhibit carefulness when observable variables are subject to measurement errors. Moreover, **Svensson and Woodford (2004)** show, assuming the private sector has more information than the policymaker, "all representations of optimal policy that would be correct in the case of full information continue to be correct under asymmetric partial information". **Aoki (2006)** makes a similar assumption (precisely the central bank has noisy information and the private agents have perfect information) and shows the central bank can improve the trade-off with a commitment regime that offset policies errors. They conclude that the information problem is a reason for the desirability of commitment. However, **Aoki (2006)** notes the quantitative benefit of commitment is shown to be very small, when these models are calibrated for the US economy.

On the other hand, the asymmetry of information might be in favour of the central bank, when individual agents have limited capacity for processing information. For instance, "allowing individual suppliers' subjective perceptions of current conditions to be contaminated by the noise that inevitably results from finite information-processing capacity" leads **Woodford (2003)** to find it "possible to explain not only real effects of purely nominal disturbances, but real effects that may persist for a substantial period of time". There is then an important cost to abstracting from the information limitations of price-setters. In the **Sargent and Wallace (1975)** model, successful discretionary policy would be only possible if central bank's information were not available to the public, but the interpretation could be inversed, that is "if suppliers have an inaccurate estimate of current aggregate conditions (…) because of paying insufficient attention to the available public domain data". In the same vein, **Sims (2003)** notes that the hypothesis of rational inattention fits macroeconomic time series relationships better than rational expectations. **Adam (2007)** shows identically that when firms' inattentiveness gives rise to idiosyncratic information errors and imperfect common knowledge about the shocks hitting the economy, monetary policy has strong real effects, making it optimal to stabilize the output gap. Even further, **Garfinkel and Oh (1995)** find, based on a model where the monetary authority's private information gives rise to an unavoidable trade-off between flexibility and credibility, noisy announcements can serve as a meaningful form of communication to make that trade-off more favourable.

At last, the 'learning' literature is based on the same hypothesis of limited information processing capacity of individuals. In this framework, **Evans and Honkapohja (2003)** make a case for incorporating private forecasts of inflation and output gap into the interest rate rule to reach optimal central bank behaviour under discretion; while **Waters (2006)** shows that the commitment optimum under rational expectations is not optimal under adaptive learning. Next, **Honkaphoja and Mitra (2005)** show in the case of central bank having less information about the shocks than the private sector, there is a further *learnability* constraint that must be met by the policymaker that can lead to problems of instability. In contrast, if the private sector has less information than the central bank, then no further *learnability* constraint arises as a result of the asymmetric information. They then support the general notion that the central bank should spend enough resources in acquiring good information about the shocks hitting the economy. In the continuity, **Orphanides and Williams (2007)** examine economy in which private agents and the central bank possess imperfect knowledge about the true structure of the economy. Private agents rely on an adaptive learning technology and policymakers are uncertain about the economy's natural rates of interest and unemployment. They show that the scope for economic stabilization is significantly reduced relative to an economy under rational expectations with perfect knowledge. And call for more aggressive responses to inflation that would be optimal under perfect knowledge.

There is very little doubt that both private agents and central banks have, in our real world, flawed information; the central question is to identify which one has the less imperfect information. Thus, many authors have already tried to assess the informational advantage between the central bank and the private agents. This issue is commonly assessed in the literature through forecasts[3].

On one hand, some authors have found evidence of an informational advantage for the central banks. **Romer and Romer (2000)** show the Federal Reserve has private information, by comparing the Greenbook[4] forecasts to private sector ones on a sample from 1969 to 1991 and over several horizons. They present evidence that Greenbook inflation forecasts have been more accurate than private forecasts, in the sense that the optimal linear combination of the private and Greenbook's forecasts places a weight near to one on the Fed's forecasts and essentially zero weight on the private sector's. The picture for the output growth forecasts is slightly different: Greenbook's forecasts were better than private sector's ones, but the evidence is weaker though the informational advantage is more pronounced at short horizons than for inflation. **Gavin and Mandal (2001)** compare Federal Open Meeting Committee, Blue Chip and Greenbook forecasts. Based on the root mean squared errors, the Greenbook forecasts of inflation are more accurate than any other forecasts, while the results are more contrasted for output on the 1983-1994 period. They show too that the Blue Chip consensus appears to match pretty well the FOMC's central tendency forecasts. **Sims (2002)** is led up to analyze the performance of the Federal Reserve forecasts and finds first on the 1979-1995 period, according to their RMSE that the best inflation forecasts are those of the Greenbook, and that the difference does not seem large with the MPS model of the Federal Reserve (the ancestor of the FRB/US model). He then carries on his study with a factor analysis of the forecasts and finds for inflation that the evidence for the superiority of the Greenbook over private forecasters is strong. The advantage on output growth is statistically negligible. Based on original data, **Peek, Rosengren and Tootell (1998, 2003)** find that

[3] One must recognize central bank forecasts may not be destitute of policy aspects (as they may be conditional to a monetary policy scenario), while private forecasts could respond to incitation for institutions to distance themselves from competition. However, the main hypothesis of this work, widespread in the literature, is to suppose forecasts made by both the central bank and the private sector map basically all information available to them. The fact that the former are released with a 5 years lag and the latter are lucrative goes in this direction.

[4] The Federal Reserve forecasts come from the Greenbook prepared by the staff of the Board of Governors before each meeting of the Federal Open Market Committee. These forecasts are made available to the public five years after the FOMC meeting they correspond.

confidential supervisory information on bank ratings (CAMEL ratings[5]) significantly improves private forecasts of inflation and unemployment rates, thus providing an informational advantage to the Federal Reserve. The results are consistent across the individual forecasters and for Blue Chip forecasts globally. The contribution of this rating is independent too of publicly available leading indicators. Moreover, they show supervisory information add significantly to private forecasts made even a full year after the information is gathered and released, and then supervisory data provide a persistent informational advantage, sufficiently large and persistent according to them to be exploited.

Finally, **Amornthum (2006)** claims too that the Federal Reserve has a better forecast accuracy over the private sector by comparing forecasts at the individual level in opposition to consensus forecasts. Its results suggest that the Fed dominates SPF, but not all private forecasters and that this advantage decreases with longer horizon.
One question that arises from this study is whether private forecasts do represent all private sector's information. Private forecasts are generally surveys and are thus made on the base of responses of many institutions, banks or firms from various horizons. They then gather information from diverse places and are too a source of information for some others agents. This point of view seems to be supported by the fact that surveys are good predictors[6]. I here decided to focus on the surveys. Forecasts of one individual institution could be more accurate than Fed's or surveys' ones at one date, but first, they do certainly not represent information of <u>all</u> private agents[7] and second, a forecaster that would succeed to consistently provide the best forecasts on the market would become known as the reference. Reality shows that it does not exist.

On the other hand, **Joutz and Stekler (2000)** examine the characteristics of Fed's forecasts and compare them to ARIMA models and ASA/NBER surveys. They focus on usual errors measures, tests for rationality and features of accuracy of these forecasts. According to their analysis, overall the Fed predictions tended to yield the same type of errors that private forecasters have displayed. **Atkeson and Ohanian (2001)** compare inflation forecasts from the Greenbook with a naïve model of forecast and find that the RMSE for both "are basically the same" and argue then that Greenbook's forecasts have on average been no better than the naive model. However, compared to previous ones, their study covers the years 1984-1996: a period of very stable evolution of inflation, what favors a naïve or AR model. **Faust, Swanson and Wright (2004)** concern themselves with the Federal Reserve policy surprises and whether they convey some private information. They then conduct two tests of hypothesis and find that the Federal Reserve policy surprises could not systematically be used to improve forecasts of statistical releases and that forecasts are not systematically revised in response to policy surprises. There is thus according to them little evidence that Fed's surprises pass on superior information.

Given the mixed results of the empirical literature, the contribution of this work is thereby to eliminate the samples or methods biases to gain some clear-cut conclusions on this asymmetry of information.

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[5] For "Capital, Assets, Management, Earnings and Liquidity". This composite rating evaluates the health of banks on these five categories and delivers a score between 1 (sound in every respect) and 5 (high probability of failure, severely deficient performance).

[6] **Ang, Bekaert and Wei (2005)** find that between time-series ARIMA models, regressions using real activity measures deducted from the Phillips curve, term structure models and survey based measures, the best method of forecasting US inflation out-of-sample is surveys.

[7] See above the literature on information processing limits.

3 Data Description

Greenbook forecasts impose themselves spontaneously as the Federal Reserve forecasts. The commercial forecasts surveys are used to represent the information hold by the private sector or at least markets participants that take place in the monetary game.

3.1 Forecast Data

Data used are those of the Federal Reserve and the Survey of Professional Forecasters (SPF hereafter) and both are made available on the web site of the Federal Reserve Bank of Philadelphia[8]. As a measure of inflation, I use the GDP price deflator (because it has been consistently forecasted throughout the entire period by both forecasters, compared to the Consumer Price Index for which the definition has changed across time and has started to be forecasted later. Robustness tests with CPI are nevertheless performed). As commonly used in literature, the real GDP/GNP is the variable considered for the 'growth' forecasts.

The Federal Reserve forecasts come from the Greenbook prepared by the staff of the Board of Governors before each meeting of the FOMC and are available from 1965:4 to 2001:4 for both inflation and real GDP/GNP growth at different horizons. They depend on the FOMC schedule and are then not available at a quarterly frequency. For instance, there were almost a meeting every month between 1960 and 1970 while eight forecasts in the 1980's. For this work, the Federal Reserve forecasts of a quarter are the forecasts made in the second month of the quarter, which the date is the closest to the 15th day. Indeed, because the objective is to compare accuracy of the forecasts, Greenbook and SPF ones should correspond to the same level of information. Inflation and real GNP/GDP forecasts are the annualized quarterly growth rate.

The commercial forecasts are those of SPF and are now conducted by the Federal Reserve Bank of Philadelphia itself. It extends the American Statistical Association/National Bureau of Economic Research Economic Outlook Survey. It is based on several commercial forecasts made by financial firms, banks, university research centers and private firms and is made in the second month of each quarter. Data are available without missing values from 1974:4 for inflation and from 1981:3 for real GDP. Here again forecasts are the annualized quarterly growth rates of the GNP/GDP price deflator and the real GNP/GDP.

3.2 Real-Time versus Final Data

The last series to present to make appropriate comparison of forecasts are the actual ones and these raise a particular issue. These kinds of data are frequently revised between the different releases and the question is then to know whether comparisons have to be made with the preliminary estimate, second estimate or final estimate. Because some information is not known directly or accounting standards change, the initial estimates are often revised.

The issue here is to know whether we should consider the producing of forecasts as a beauty contest[9] where forecasters try to obtain the most publicly-interesting results (the nearest forecasts to the first initial estimate) or whether we should compare to the definitive value (the one that economy experienced). Taking the real-time series could be defended on the basis that the influence of the forecast on the decisions is highest in the months following their release. At the opposite, choosing them on the purpose that forecasters cannot be

[8] For more details on the data sets, see www.philadelphiafed.org/econ/forecast/index.cfm.

[9] I here use the 'beauty contest' term in the extent that it could be argued that forecasters attempt to forecast future earlier announcements of data rather than later revisions (see for instance **Keane and Runkle (1990)**).

expected to predict further revisions might lead to economic distortion in the sense that the final objective of a forecast is to consider the evolution of a variable really experienced by the economy and not its first and maybe incorrect estimate.

Figure 1 - Inflation

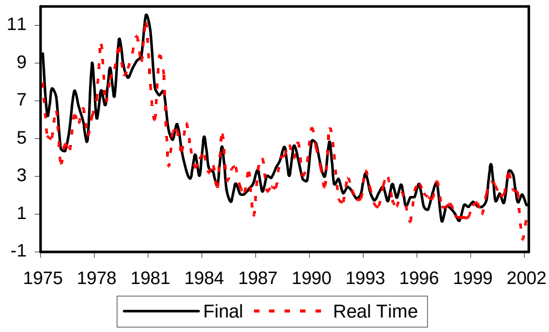
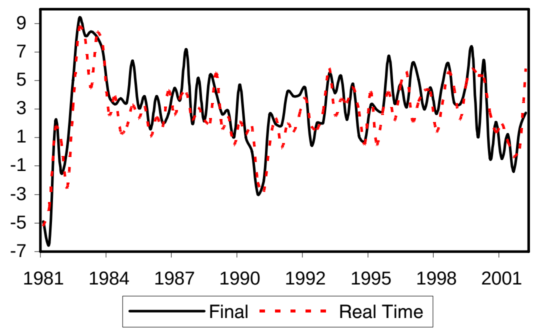


Figure 2 - Real GDP



However and in order to check robustness of the analysis and assess what could be the impact of real-time data, calculus will be performed with both actual data. The corrected and final series is provided by the Bureau of Economic Analysis whereas initial estimates come from the Real-Time Data Set for Macroeconomists compiled by Croushore[10] at the Federal Reserve Bank of Philadelphia. Both actual series are calculated as the forecasts, that is annualized quarterly growth rates. Figures 1 and 2 show the differences between the real-time estimates and the final value respectively of inflation and real GDP and fuel arguments for the use of both types of data[11] in regression.

4. Some Different Methodologies

In this section, the potential informational advantage is assessed through different methods applied on the same and longer sample, with actual and real-time data in order to avoid biases.

4.1 MSE

The simplest method to compare the forecast accuracy of both institutions is to measure their Mean Square Errors. In order to calculate the *p-value* for the test of the null hypothesis that Federal Reserve's and SPF's MSE are equal, I estimate according to **Romer and Romer (2000)** the following regression:

$$(\pi_{t+h} - \pi_{t,h}^{GB})^2 - (\pi_{t+h} - \pi_{t,h}^{SPF})^2 = \alpha + \varepsilon_t$$

where α is the difference between the squared errors of forecasts of both institutions and then allows to calculate the standard errors of α corrected for serial correlation with the Newey-West HAC method[12]. I can thus obtain a robust *p-value* for the test of the null

[10] For more details on the Real-Time Data Set, see **Croushore and Stark (2001)**. Data are available on the website of the Federal Reserve Bank of Philadelphia.

[11] The series which are already transformed into growth rates are stationary: the null hypothesis that each variable has a unit root is always rejected at the 10% level and most of the time at the 5% level. The investigation is carried out with the Phillips and Perron's Test that proposes an alternative (nonparametric) method of controlling for serial correlation when testing for a unit root. These results are available upon request.

[12] In regressions as the ones used hereafter, the problem due to the correlation between forecast errors leads to calculate robust standard errors to serial correlation. Indeed, when forecasts for four quarters ahead miss an unexpected change in the variable, this would definitely cause forecasts errors all in the same direction. Forecasts are then declared serially correlated. In order to deal with this problem, when considering forecasts for inflation h quarters ahead, the standard errors are computed correcting for heteroskedasticity and serial correlation according to the Newey and West's *HAC Consistent Covariances* method.

hypothesis that $\alpha = 0$, in order to determine whether the forecast errors are significantly different.

Table 1 shows the results. They are univocal concerning inflation forecasts: when both institutions are compared on the Final Data basis, Greenbook's MSE are 0.93 and 1.51 respectively at horizons h=1 and 4 while SPF's MSE are 1.25 and 2.46. The *p*-values clearly prove that these values are significantly different. The pattern is identical and as straightforward when the comparison is made with Real-Time Data.
About real GNP/GDP, results are much more mixed: the MSEs of Greenbook are comparable or a very little lower than those of SPF but the difference is not significant at all in the four cases (h=1 or 4 and with Final or Real-Time Data).

These results confirm those of **Gavin and Mandall (2000)**, where Greenbook's inflation RMSEs outperform FOMC and Blue Chip's ones, while for output, the RMSEs are very similar between all three forecasters. The pattern is the same in the **Joutz and Stekler (2000)** and **Sims' (2002)** findings. **Clements, Joutz, Stekler (2004)** only focus on Greenbook forecasts, but results for inflation and real GDP are equivalent.
Moreover, these findings could be compared with those of **Amornthurm (2006)** that uses a near method to compare accuracy between two forecasts by evaluating the loss associated with forecasts errors. **Diebold and Mariano (1995)** propose a method to test the difference in the accuracy of two forecasts, that is applied by Amornthurm to the same data than here but at the individual level (Greenbook's forecasts are compared to individual forecasts made for SPF but not to SPF's consensus). The Diebold-Mariano test gives results that confirm the results here: the Fed has statistically lower MSE than 60-75% of the commercial forecasters and this proportion is even higher at 73% for forecasts at horizon four quarters ahead. The author adds than "clearly, no SPF forecaster can dominate the Fed at any horizon. A few may have lower MSE then the Fed's one, but none of them has statistically lower MSE". Finally, it can be said according to his work that the Fed dominates 60% of the commercial forecasters and is as accurate as 40% of them.

4.2 Regressions

In this section, the purpose is to compare the forecasts of the Federal Reserve with those of SPF with the regression methodology of **Fair and Shiller (1989, 1990)** and **Romer and Romer (2000)**. It consists of regressing the actual inflation on forecasts made by both institutions in order to know whether the Greenbook's forecasts contain information that could be useful to private agents to form their forecasts. The point as described by the authors is to see if "individuals who know the commercial forecasts could make better forecasts if they also knew the Federal Reserve's".
The regression then follows this form:

$$\pi_{t+h} = \alpha + \beta_{GB}\pi_{t,h}^{GB} + \beta_{SPF}\pi_{t,h}^{SPF} + \varepsilon_t$$

where π_{t+h} is the actual inflation, either the real-time or the final data, $\pi_{t,h}^{GB}$ is the forecast made by the Federal Reserve and $\pi_{t,h}^{SPF}$ by SPF in date *t* for *h* horizons later. The main idea behind this regression is then to see if Federal Reserve forecast contains useful information to forecast inflation and more useful information than the one given by SPF forecasts by testing whether β_{GB} is different from zero, whether β_{GB} is near to 1 and β_{GB} is different and higher than β_{SPF}. Standard errors are here again computed using the Newey-West's HAC methodology to correct serial correlation.

Robustness

I then test the robustness of the main regression with a different specification concerning the timing of the Federal Reserve and SPF forecasts. In the first one, forecasts used come from the same quarter. Because the date when the forecasts are made in the quarter varies, the Federal Reserve may benefit of a possible timing advantage, because it has had more time to collect more data. Thus, this second specification put clearly the Federal Reserve in a deliberate situation of a timing disadvantage. The equation regressed becomes:

$$\pi_{t+h} = \alpha + \beta_{GB}\pi^{GB}_{t-1,h+1} + \beta_{SPF}\pi^{SPF}_{t,h} + \varepsilon_t$$

where $\pi^{GB}_{t-1,h+1}$ is the forecast made by the Federal Reserve at the previous quarter compared to SPF, for a horizon one quarter later.

Second, I re-run the main regression on a reduced sample to take into account the choice of **Atkeson and Ohanian (2001)** to rule out the period of strong disinflation of the beginning of the eighties. Due to the private agents' idea that central bank won't succeed to reduce inflation, central banks forecasts could have been better than private forecasts. In order not to debate on the date of the end of the disinflation, I exclude the Vockler mandate and start then the sample in 1987Q3 when Greenspan took his function. The end of the sample is still 2001Q4.

Third, in order to check that the estimates of previous regressions are not distorted by multicollinearity (Table 4 shows forecasts are highly correlated between themselves) as discussed by **Granger and Newbold (1977)**, the actual inflation is now regressed on only one forecast:

$$\pi_{t+h} = \alpha + \beta_{GB\ or\ SPF}\pi^{GB\ or\ SPF}_{t,h} + \varepsilon_t$$

The objective of this calculus is simply to compare the statistical tools of the global significant of the model (R^2 and Square Sum of Residuals) between the different forecasts, so as to ensure that the explanatory power found in the main regression is still valid when forecasts are compared one by one and not together and thus maybe polluted by the high correlation between them. It may be informative to have a look too on the coefficient $\beta_{GB\ or\ SPF}$, more particularly in what extent this one is near to 1, and its significance. This calculation allows thus to check the robustness of the previous results at the hands of some critics against the method of regressions of forecasts combination.

Results

Table 2a summarizes the results of the main regression. Regarding inflation, this first regression shows first that the coefficients on the Greenbook forecasts are significant, while those of SPF are not at any time, and second that β_{GB} is by and large near to one: 0.76 and 0.99 at horizon h=1 respectively for Final and Real-Time Data and 1.38 and 1.21 at horizon h=4, while β_{SPF} is next to zero. Concerning real GNP/GDP, the pattern is quite different: when analysing the base regression, at the short horizon h=1, both coefficients of Greenbook and SPF are very similar (grossly around 0.6) and significant only at the 10% level, for both actual data. At the longer horizon h=4, the coefficients of Greenbook β_{GB} are higher than 0.5, but are not significant at all as those of SPF. Once again, it is very difficult to conclude something from the real GNP/GDP forecasts as the results are mixed. Both institutions seem to be on an equal footing about real activity forecasts. In comparison, the inflation results let appear some evidence for a better accuracy of the Fed forecasts.

Table 2b exhibits the regression results with a timing disadvantage for the Federal Reserve and those about inflation present almost similar results: except when compared to final data at short horizon (h=1), where the estimate of β_{SPF} is superior to the one of β_{GB}, respectively 0.59 and 0.48 (but both are significant), the coefficients of the Greenbook are significant while those of SPF not, are always largely superior to those of the SPF, and are included between 0.71 and 0.97, so significantly near to one.
One can note that the informational advantage shown by these coefficients seems to be higher when the horizons are longer, this being robust to both types of actual data.
In the regression concerning real GNP/GDP, at horizon h=1, the results are straight: estimates of β_{GB} are near to zero and not significant at all while those of β_{SPF} are near to one and very significant. At the longer horizon h=4, neither estimates of coefficients of both forecasters give any indication and are not significant (even at the 10% level).

Table 2c reveals the coefficients of the regression made on a smaller sample in order to rule out the strong disinflation period and thus assess the previous results at the light of more economically stable period. The numerical results are in the line with the other specifications: significance of the Greenbook estimates at both horizons (while not for the SPF) and coefficients near to one, in the inflation case. Here again, the real GNP/GDP case do not give analyzable results, those being conflicting and not significant.

Table 2d compiles indicators that could help to verify that estimates of regressions are not polluted by strong correlation between forecasts, by confirming the difference in the explanatory power of each forecast. Thus, regarding to inflation, one can observe that the R^2 is consistently higher and the SSR consistently lower for the Greenbook forecasts compared to the SPF ones, the gap rising when the horizon is longer, whatever actual data are. These corroborate previous results showing that the Federal Reserve make better inflation forecasts than SPF. The results concerning the real GNP/GDP do not give further indications about a potential informational advantage. The very similar R^2 and SSR confirm that both institutions are on an equal footing and have a very proximate forecast accuracy (or inaccuracy) and seem then to benefit from the same information.

The results of the base regression (confirmed by the robustness regressions) are similar to those of **Sims (2002)** where the coefficient on Greenbook inflation forecasts is consistently higher than those of SPF or MPS, while Greenbook output forecasts has not this advantage over the private forecasts. They extend too the results of **Romer and Romer (2000)** for inflation but are slightly different concerning real GNP/GDP for which they conclude that Fed has an informational advantage and that this one is even more pronounced than inflation at short horizon.
Here again these inflation results can be compared with those of **Amornthum (2006)** at the individual level based on the forecast encompassing test of **Harvey, Leybourne and Newbold (1998)**. It consists of regressing the forecast errors of one forecaster on the difference between Fed and commercial forecasts and inversely with Fed and assess then who can explain the errors of the other. He finds that proportions of SPF forecasters who are encompassed by the Fed are approximately between 50% and 90%. They do not find evidence that the SPF forecasters can encompass the Fed.

4.3 A Pooled Approach

The fourth method used to discriminate forecasts of inflation and output made by the Federal Reserve and the private forecasters is based on a **Davies and Lahiri (1995)** and **Clements, Joutz and Stekler (2007)** methodology that consists of pooling the forecasts across all horizons. Many of the others studies on the subject compared the forecasts separately for each horizon and using this methodology permits to diversify ways to obtain results and thus affirm the robustness of conclusions.

The advantage of this approach concerns the interpretation of findings, not subject to each individual horizon as when for instance results are opposed for different horizons of forecasts.

Some issues arise with this method: is it adequate to pool the forecast obtained by different models, supposing that maybe forecasts at short and long horizons are not derived from the same models, and in the same manner to pool survey's consensus that represents many individual forecasters? The decomposition of forecast errors developed by **Davies and Lahiri (1995)**, used by **Clements, Joutz and Stekler (2007)** and repeated here responds specifically to these concerns.

The method needs because of aggregating the horizons to deduct the correlation structure across errors of targets and lengths that is consistent with rationality. The forecast error can be presented as follows:

$$A_t - F_{th} = \alpha + \lambda_{th} + \varepsilon_{th}$$

where A_t is the effective value at *t*, F_{th} is the forecast made for the period *t* at time *t-h*, that is with a horizon of *h* periods, λ_{th} are the aggregate or common macroeconomic shocks and correspond to the sum of all shocks that occurred between *t-h* and *t*, and ε_{th} are the idiosyncratic shocks.

This equation can be rewritten: $e_{th} = \alpha + v_{th}$

And then for all observations: $\mathbf{e} = \alpha \mathbf{i}_{TH} + \mathbf{v}$ (1)

where **v** is the TH vector that aggregate v_{th} according to **A** and **F**. One may assume that E (**v**) = 0, but $\mathbf{\Sigma} = E(\mathbf{vv'})$ will not be proportional to the identity matrix. Assuming that the ε_{th} are not correlated, $E(\varepsilon_{th}\varepsilon_{sj}) = \sigma_\varepsilon^2$ when *s*=*t* and *j*=*h*, and zero otherwise, we obtain:

$$\mathbf{\Sigma} = \sigma_\varepsilon^2 \mathbf{I}_{TH} + \mathbf{\Psi}$$

$\mathbf{\Psi}$ captures the fact that forecasts which have common macroeconomic shocks, whatever the targets are, will be correlated. The precise form[13] of $\mathbf{\Psi}$ depends on the maximum and minimum forecast lengths, but principally on the single unknown variance parameter $\sigma_u^2 = E(u_t^2)$ supposing homoscedastic aggregate shocks. One may also assume the idiosyncratic shocks have common variance, $\sigma_\varepsilon^2 = E(\varepsilon_{th}^2)$, for all *t* and *h*.

The test of bias can be based on the OLS estimator of α in (1),

$$\hat{\alpha} = (TH)^{-1} \sum_{t=1}^{T} \sum_{h=1}^{H} e_{th} \quad (2)$$

To obtain a consistent standard error for OLS, $\mathbf{\Sigma}$ needs to be replaced by an estimate $\hat{\mathbf{\Sigma}}$. To calculate it, one have to required estimates of σ_u^2 and σ_ε^2. These can be obtained as follows. $\hat{\alpha}$ is estimated from (2). Then $\hat{v}_{th} = e_{th} - \hat{\alpha}$. Using $E(v_{th}^2) = \sigma_\varepsilon^2 + h\sigma_u^2$, one may obtain estimates $\hat{\sigma}_u^2$ and $\hat{\sigma}_\varepsilon^2$ as the estimated coefficients $\hat{\varphi}_0$ and $\hat{\varphi}_1$ in the regression:

$$\hat{\mathbf{v}} \circ \hat{\mathbf{v}} = \varphi_0 \mathbf{i}_{TH} + \varphi_1 \boldsymbol{\tau} + \omega$$

where $\circ$ is the Hadamard product, denoting element-by-element multiplication, $\boldsymbol{\tau} = \mathbf{i}_T \otimes \boldsymbol{\tau}_H$ ($\otimes$ is the Kronecker product, defining block multiplication) and $\boldsymbol{\tau}'_H = (H, H-1, \ldots, 1)$. Thus,

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[13] See Clements, Joutz and Stekler (2007) for more details.

$\hat{\varphi}_0$ is an estimate of σ_ε^2, the variance of idiosyncratic shocks and $\hat{\varphi}_1$ estimates σ_u^2, the variance of the homoscedastic macro shocks.
The possibility of private information is noted by **Davies and Lahiri (1995)**, their original formulation becoming:

$$A_t - F_{th} = \alpha + \lambda_{th} + \eta_{th}$$

with $\lambda_{th} = \sum_{j=1}^{h} u_{tj}$ and $\eta_{th} = \sum_{j=1}^{h} \varepsilon_{tj}$. Thus, as h gets smaller the variance of the private component, $Var(\eta_{th})$ declines. Without private information, the variance of the private component is constant for all h.
In this analysis, we can think of the Federal Reserve or SPF as possessing confidential private information. Whether the Federal Reserve or SPF has private information, so that the idiosyncratic component is absent $\sigma_\varepsilon^2 = 0$ and σ_u^2 the macro shock becomes the global variance of u_{tj}^*, or whether there is an idiosyncratic component, will influence the correlation structures of the forecast errors and the validity of some tests of the efficiency forecasts. These alternative assumptions about private information could provide some robustness to the results.

The added value of this methodology is to bring strength to previous results and check if they are not sensitive to the fact that analysis is made horizon by horizon. The method of pooling forecasts leads to more global and *in-one-way* results about the performance of both institutions by and large.

For the estimation presented here, forecasts of current and next four quarters of both institutions are pooled. **Table 3** indeed confirms the previous results for both inflation and real GNP/GDP. For the former, the SPF bias is larger than the Greenbook one and more significant, whether the data are final or real-time and the assumption on private information stated or not. Similarly, the pooled Greenbook RMSE are again lower than those of SPF. For the latter, values of bias are very close between themselves and the RMSE are almost equal, what tends to confirm too that concerning the real GNP/GDP the Federal Reserve is not a better forecaster than private sector and do not dispose of private information on this variable.

4.4 One Factor Model

The choice of this last method comes from the observation that forecasts are highly correlated and even more strongly correlated between themselves[14] than with the actual data, as one can see from **Table 4.**
The choice of factor analysis as an other method to assess informational advantage uprises from the work of **Romer and Romer (2000)** when they regress actual inflation on the forecasts, who refer to this method as measuring the 'information content' of forecasts, in the sense that they provide information to people who would like to approach the actual value of inflation. But as **Sims (2002)** objects, "while this regression is useful information, if interpreted carefully, it is probably misleading to think of it as characterizing 'information content'. These forecasts in some sense have nearly the same 'content', since they are so highly correlated".
In order to provide a more complete study on information asymmetry, this part will now replicate the method thought by Sims to attempt to rule out the high correlation between forecasts thanks to factor analysis. This method is near to the Principal Components Analysis insofar as it searches to replace a large set of variables with a smaller set of new variables,

[14] This could mainly be explained by the herding phenomena that characterizes the financial markets and their actors (**Shiller (1995)** and **Devenow and Welch (1996)**).

but takes it away to find a solution to the covariance between observed variable. It is used as an explanatory model for the correlations among data and attempts to explain the variance which is common to at least two variables and presume that each variable have also an own variance which represents its own contribution.

The main assumption is that all forecasters have imperfect observations on a single 'forecastable component' (the common factor that gathers the strong covariance between forecasts) of actual value, which they may or may not use optimally. If *f** is the forecastable component of π_{th}, we then have the following model:

$$\pi_{th}^{F} = \lambda + \theta f_{th}^{*} + \varepsilon_{th}$$

$$\pi_{th} = \alpha + \beta f_{th}^{*} + \nu_{th}$$

$$Var\left(\begin{bmatrix} \varepsilon_{th} \\ \nu_{th} \end{bmatrix}\right) = \Omega$$

with Ω diagonal and f_{th}^{*} orthogonal to ε and ν.

In this model, the quality of a forecast is related inversely to the variance of its ε_{th} and to the deviation of its θ coefficients from β. It could be noted that the coefficients are not proportional to the forecast error variances, because they maybe include a dominant contribution from the variance of ν; the coefficients are inversely proportional to the relative idiosyncratic variances, even if these are an unimportant component of overall forecast error.

Sims proposes and presents the possibility of a second component of common variation: a 'common error', but argues that analysis of forecast quality would then be limited and that despite its simplicity the model above provides "a good approximation to the actual properties of the forecasts". This method could indeed allow discriminating between the part of forecast errors which arise from *unforecastable* macroeconomic shocks and the part which comes from idiosyncratic errors.

Thus, the objective is to gather the correlation between forecasts in a 'forecastable component' in order to extract specific variances proper to each forecast. Thus the variance σ^2 of ε_{th} is our point of interest. However, considering the factor analysis methodology, the interpretation of the estimates could be difficult in general, but even more in this fit because a simple model with only one factor (as decided here to deal with the correlation issue) is obviously not sufficient to explain the pattern in these data. An analysis with multiple factors as widely used in sociology would give better statistical results. Thereby, the likelihood ratio and the *p*-value of acceptable fit are likely to be low because of the deliberate choice of only one factor as an base hypothesis and due to the fact that this method provides results that are sensitive to serial correlation and non-normality, two characteristics of forecasts.

Table 5 presents the results. The model based on the hypothesis of a common and unique forecastable component ascribes a very low idiosyncratic error to Greenbook forecasts compared to naïve[15] and SPF forecasts. While at a short horizon h=1, the difference is not so marked (as in the Sims' paper), the difference at horizon h=4 is clear, this being right for both inflation and real GNP/GDP and both actual data. These results suggest that the forecast accuracy of Greenbook forecasts arises from their low idiosyncratic error.

One could nevertheless be surprised that the specific error is so low for real GNP/GDP, as the Greenbook do not seem to better perform than SPF in previous results. One possible explanation might be that the Fed makes good forecasts of the 'forecastable component' (the

[15] The naïve forecast series is added in order to get a benchmark in the one factor model. This series corresponds to no-change forecasts, i.e. the value at the date t is the forecast at the date t+1.

Greenbook estimates of f^* are close to 1…), while SPF makes less precise forecast of this component (…and much lower for the SPF). But the better forecast accuracy of a component that will surely be subject to macro shocks and whose determinants are more difficult to evaluate might not give a clear advantage and SPF with a higher idiosyncratic error arrives thus at a similar forecast performance.

These results are similar to those of **Sims (2002)** with in particularly a low idiosyncratic error for the Greenbook forecasts. He concludes as here that Greenbook has superior information concerning inflation, but that there is no advantage in favor of the one or the other institution about output which is line with the results of the previous methodologies of this paper.

4.5 Robustness Test: Alternative Inflation Variable

Private agents may be more prone to forecast the Consumer Price Index (CPI) than the GDP price deflator, and this might be a reason for their less accurate performance in forecasting inflation. In order to check the robustness of the previous results for inflation, I then provide additional tests with CPI. Data are available from the same sources, but only from 1982Q1 to 2001Q4. **Table 6** displays evidence that confirms the previous results and show that the variable chosen for inflation do not lead to reconsider the accuracy of Greenbook's forecasts.

5. Analysis of the Informational Advantage

5.1 Two Main Results

Two robust conclusions emerge from the comprehensive set of methodologies used to assess the forecasts accuracy and then the information asymmetry. Indeed, the switch to one actual data to the other and the similarity of the results independently of the specifications suggest:

First, Fed possesses an informational advantage on inflation but only on it. There is no evidence of any advantage for private forecasters or Fed on real GNP/GDP.

Second, the longer the horizon, the more pronounced the advantage of Fed on inflation. This tends to confirm the advantage is robust and not due to timing advantage and access to information on the short run.

The possible explanations for an advantage of the Fed on inflation and not output are not obvious. It might be advanced that inflation variable is on what central banks are first (but not only) judged. All the more so inflation forecasts are often considered as the intermediate target of monetary policy. Moreover, the lost associated to inflation in the central bank loss function may have some impact too. If Fed greatly balances inflation, Fed will make everything possible to reach its inflation goal and then *endogenises* inflation by dint of focusing on it. Thus the second variable, the output growth, becomes an adjustment variable. This focus may be all the more so important that Fed attempt to reach its 'implicit' inflation target. Finally, the vision of central banking as management of expectations may strengthen the argument for an inflation focus.

Compared to the previous literature, the first result confirms the view of **Sims (2002)**, but are in partial contrast with those of **Romer and Romer (2000)**, since there is no evidence of a Fed's advantage on GDP and totally opposed to **Atkeson and Ohanian (2001)** and **Joutz and Stekler (2000)** that find no advantage. The second pattern highlighted here contributes to the literature as a new outcome.

The advantage of Fed on inflation is all the more so notable that **Stock and Watson (2007)** show inflation has both become easier to forecast, due to the decline of its volatility, but also harder to forecast insofar as "it has become much more difficult for an inflation forecaster to provide value added beyond a univariate model". On the other hand, the equivalence of forecasts accuracy of growth could bridge with **Tulip (2005)** which finds uncertainty is still as high as in 1970s at long horizons and has been less reduced than volatility. It may explain in part that errors are quite similar. Last, the finding that Fed and private forecasters makes similar errors on growth is confirmed by **Baghestani (2008)** that finds unemployment rate forecasts (as a proxy of real activity) are very similar between Fed and private forecasters.

5.2 A Parallel Result: the Actual Data Issue

Whatever inflation data are real-time or final, the results give similar indications on the Federal Reserve's informational advantage, what constitute a robustness check and tend to support the conclusion that patterns of forecast accuracy presented here are not subject to variation of data definitions.

Furthermore, an identical scheme emerges from all methodologies: Fed and SPF better forecast real-time value of real GDP while they both have more accurate predictions of final data of inflation.

One possible explanation of this pattern is that real GDP is certainly more difficult to forecast than inflation, its determinants more multiple and subjects to fewer vagaries, while inflation could suffer from more cyclical events, but is better anchored. Thus, when forecasting real GDP, forecasters are quite understandably targeting the nearest (the more current) actual data.

5.3 Sources of the Fed's Advantage

In the literature, the sources of an informational advantage of the central bank may arise from different arguments: *(i)* the institutional and inherent advantage possessed by the central bank about its own future policy path, *(ii)* the knowledge derived from the role of supervisor and regulator of banks (**Peek, Rosengren and Tootell (1998) and (2003)**), *(iii)* an expertise advantage leading **Sims (2002)** to argue that "the Fed is simply making better use than other forecasters of the same collection of aggregate time series available to all", *(iv)* the fact that as reported by **Romer and Romer (2000)** the Fed succeeds in collecting better and larger detailed information about determinants of future inflation, what is somehow linked to specific expertise. It stems from the huge amount of resources it devotes to this fastidious work, relative to individual private-sector firms or banks, and *(v)* secrecy, that provides to the Fed a relative enhanced information set compared to private forecasters.

When taken into account that developed networks allow information to circulate very quickly, that private sector as a whole employs highly qualified forecasters and dedicates significant amounts to forecasting, and hypothesis that the financial markets properly aggregate information, arguments *(iii)* and *(iv)* about specific expertise might seem questionable. However, two points temper this judgment: first, although huge progresses have been made in the information process recently, coordination, uncertainty and noisy signals are still rendering information imperfect as the thriving literature on those subjects attests; second, **Bernanke and Boivin (2003)**[16] develop a data-rich environment model that

[16] Their analysis besides compare the forecasting performance of the Greenbook to their data-rich model: FM-VAR and to combination of the Greenbook and their model. They find Greenbook does marginally worse than FM-VAR for next quarter's inflation (CPI here) forecast and better for longer horizons, while unemployment forecasts are comparable. These outcomes appear to be in line with those found here. The combination forecasts have broadly similar (verily better) forecasting performance than Greenbook forecasts.

confirms aggregation and exploitation of a very large amount of data has an added-value for monetary policy analysis.
Concerning the argument *(ii)*, **Peek, Rosengren and Tootell (1998, 2003)** suggest the Fed obtains its exploitable informational advantage from its supervisory role and more specifically from non market traded banks, for which the data are confidential and remain so for a significant period of time. These works could be put together with the ones of **Kashyap and Stein (1994a, 1994b, 2000)** that find small banks may be particularly important for the level of economic activity because they disproportionately lend to finance inventories and small business. Thus, all information that could be gathered from this side is 'unavailable' to private sector and seems useful and used by the Fed via its supervisory role.

Concerning the advance knowledge of Fed's future policy path, evidence is mixed. Some empirical investigation[17] on market expectations of the federal funds rate shows that US markets are rarely surprised by the Fed at very short horizons as a few weeks. For longer horizon, the performance of expectations is poorest, what corroborate argument *(i)*. However, **Hubert (2009)** assesses potential informational advantage of some communicating central banks and finds that if it may constitute private information, it is not a sufficient condition. Moreover, the Swedish central bank publishes explicit interest rate paths and yet experiences a significant informational advantage. Last, interest rate paths result from macroeconomic forecasts and are in fact endogenous to the specific expertise of the central bank.

Finally, argument *(v)* on secrecy is also countered by results of **Hubert (2009)** on communicating central banks. The Fed appears then to benefit from a specific expertise advantage and from its institutional access to special information. The effects of advance knowledge of future policy path, due to the structure of the monetary game where the central bank is the leader, are ambiguous.

6. Conclusion

This paper assesses information asymmetry between the central bank and the private sector by comparing forecasting performance of the Fed and the Survey of Professional Forecasters. In order to gain some unambiguous results, since empirical evidence is mixed so far, the objective of this work is to avoid biases of methods, data and samples when assessing this issue. The results are twofold: *first*, Fed possesses an informational advantage on inflation but only on it. There is no evidence of any advantage for private forecasters or Fed on real GNP/GDP. *Second*, the longer the horizon, the more pronounced the advantage of Fed on inflation. This tends to confirm the advantage is robust and not due to timing advantage and access to information on the short run.

When analyzing these results, one should nevertheless keep in mind that they are tributary to the fact that forecasts and surveys are respectively not perfect proxy for information and for private sector information. Even so, an open question arises from these results: practically, how the Fed could take benefit from this advantage on private agents' expectations to conduct its monetary policy.

[17] See for instance on this topic **Poole, Rasche, and Thornton (2002) and Swanson (2006).**

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Table 1 - Mean Squared Errors

Inflation - Final				Inflation - Real Time			
Horizon	GB	SPF	p-value	Horizon	GB	SPF	p-value
1	0.9301	1.2508	0.0208	1	1.1964	1.7160	0.0006
4	1.5172	2.4671	0.0001	4	1.7372	2.5755	0.00003
Real GNP/GDP - Final				**Real GNP/GDP - Real Time**			
Horizon	GB	SPF	p-value	Horizon	GB	SPF	p-value
1	6.0972	6.2341	0.7446	1	4.6124	4.6185	0.9855
4	6.2479	6.5188	0.5400	4	4.7267	4.8507	0.7401

The p-value is for the test of the null hypothesis that the central bank errors and private sector errors are equal.

Table 2a - Base Regression

Inflation - Final Data			Inflation - Real-Time Data		
	Coef	Std Error		Coef	Std Error
Cst	-0.5224**	(0.2593)	Cst	-0.2827	(0.2781)
GB+1	0.7650***	(0.1211)	GB+1	0.9931***	(0.1206)
SPF+1	0.2847*	(0.1514)	SPF+1	-0.0032	(0.1663)
Inflation - Final Data			**Inflation - Real-Time Data**		
	Coef	Std Error		Coef	Std Error
Cst	-0.1855	(0.4520)	Cst	-0.3846	(0.4437)
GB+4	1.3851***	(0.2228)	GB+4	1.2176***	(0.2360)
SPF+4	-0.3781	(0.2434)	SPF+4	-0.1783	(0.2247)
Real GNP/GDP - Final Data			**Real GNP/GDP - Real-Time Data**		
	Coef	Std Error		Coef	Std Error
Cst	-0.3840	(0.8778)	Cst	-0.2863	(0.8996)
GB+1	0.7277*	(0.3701)	GB+1	0.5313*	(0.2976)
SPF+1	0.6422**	(0.3017)	SPF+1	0.6250*	(0.3672)
Real GNP/GDP - Final Data			**Real GNP/GDP - Real-Time Data**		
	Coef	Std Error		Coef	Std Error
Cst	2.7710*	(1.6030)	Cst	1.8915	(1.4741)
GB+4	0.7407	(0.5537)	GB+4	0.5483	(0.4455)
SPF+4	-0.5286	(0.5794)	SPF+4	-0.1878	(0.4457)

Numbers in parentheses are robust standard errors. *,**,*** means respectively significant at 10%, 5% and 1%.

Table 2b - Timing Disadvantage

Inflation - Final Data			Inflation - Real-Time Data		
	Coef	Std Error		Coef	Std Error
Cst	-0.6614**	(0.2651)	Cst	-0.4570	(0.2956)
GB+2	0.4805***	(0.1714)	GB+2	0.7161***	(0.2072)
SPF+1	0.5975***	(0.1969)	SPF+1	0.3121	(0.2323)

Inflation - Final Data*			Inflation - Real-Time Data*		
	Coef	Std Error		Coef	Std Error
Cst	-0.5284	(0.4824)	Cst	-0.7914	(0.5117)
GB+5	0.9727***	(0.2859)	GB+5	0.9247***	(0.2417)
SPF+4	0.0655	(0.2833)	SPF+4	0.1802	(0.2876)

Real GNP/GDP - Final Data			Real GNP/GDP - Real-Time Data		
	Coef	Std Error		Coef	Std Error
Cst	-0.4633	(1.1861)	Cst	-0.0887	(1.0243)
GB+2	0.0719	(0.3882)	GB+2	-0.1880	(0.3083)
SPF+1	1.3057***	(0.3414)	SPF+1	1.2545***	(0.3773)

Real GNP/GDP - Final Data*			Real GNP/GDP - Real-Time Data*		
	Coef	Std Error		Coef	Std Error
Cst	3.2392*	(1.7349)	Cst	2.2244	(1.5707)
GB+5	0.8660	(0.6184)	GB+5	0.2689	(0.4746)
SPF+4	-0.8467	(0.7725)	SPF+4	-0.0685	(0.6585)

*only 90 obs, because GB don't always publish forecasts at horizon h=5

Numbers in parentheses are robust standard errors. *,**,*** means respectively significant at 10%, 5% and 1%.

Table 2c - Smaller Sample Period 1987Q3-2001Q4 - 58 obs

Inflation - Final Data			Inflation - Real-Time Data		
	Coef	Std Error		Coef	Std Error
Cst	-0.0486	(0.3781)	Cst	-0.5337	(0.4333)
GB+1	0.5331***	(0.1975)	GB+1	0.8314***	(0.2058)
SPF+1	0.3457	(0.2084)	SPF+1	0.2149	(0.1932)

Inflation - Final Data			Inflation - Real-Time Data		
	Coef	Std Error		Coef	Std Error
Cst	0.2288	(0.5540)	Cst	-0.4836	(0.6528)
GB+4	0.8041**	(0.3952)	GB+4	0.9451***	(0.3463)
SPF+4	-0.0152	(0.4505)	SPF+4	0.0858	(0.4307)

Real GNP/GDP - Final Data			Real GNP/GDP - Real-Time Data		
	Coef	Std Error		Coef	Std Error
Cst	0.8770	(1.0720)	Cst	0.4403	(1.1918)
GB+1	0.3724	(0.3440)	GB+1	0.1499	(0.2253)
SPF+1	0.5371	(0.3905)	SPF+1	0.7942*	(0.4628)

Real GNP/GDP - Final Data			Real GNP/GDP - Real-Time Data		
	Coef	Std Error		Coef	Std Error
Cst	5.5045***	(1.3727)	Cst	3.3406**	(1.3550)
GB+4	0.4235	(0.6567)	GB+4	0.1679	(0.5685)
SPF+4	-1.4397*	(0.7264)	SPF+4	-0.4479	(0.6789)

Numbers in parentheses are robust standard errors. *,**,*** means respectively significant at 10%, 5% and 1%.

Table 2d - Significant Model

Inflation - Final Data - 1974:4-2001:4			Inflation - Real Time Data - 1974:4-2001:4		
	Coef	Std Err		Coef	Std Err
GB+1	1.0193***	(0.0502)	**GB+1**	0.9902***	(0.0583)
	R^2	0.8711		R^2	0.8323
	Adjusted R^2	0.8699		Adjusted R^2	0.8307
	SSR	92.4313		SSR	118.7663
SPF+1	1.0711***	(0.0637)	**SPF+1**	1.0177***	(0.0809)
	R^2	0.8360		R^2	0.7642
	Adjusted R^2	0.8345		Adjusted R^2	0.7620
	SSR	117.5840		SSR	166.9585
GB+4	1.0605***	(0.1153)	**GB+4**	1.0646***	(0.1218)
	R^2	0.7712		R^2	0.7470
	Adjusted R^2	0.7691		Adjusted R^2	0.7447
	SSR	155.4973		SSR	178.9005
SPF+4	1.0953***	(0.1674)	**SPF+4**	1.1170***	(0.1581)
	R^2	0.6636		R^2	0.6634
	Adjusted R^2	0.6605		Adjusted R^2	0.6603
	SSR	228.6615		SSR	238.0248

Real GNP/GDP - Final Data - 1981:3-2001:4			Real GNP/GDP - Real Time Data - 1981:3-2001:4		
	Coef	Std Err		Coef	Std Err
GB+1	1.1469***	(0.3057)	**GB+1**	0.9393***	(0.2604)
	R^2	0.2548		R^2	0.2220
	Adjusted R^2	0.2455		Adjusted R^2	0.2123
	SSR	467.3179		SSR	375.6818
SPF+1	1.3490***	(0.3360)	**SPF+1**	1.1411***	(0.3194)
	R^2	0.2370		R^2	0.2202
	Adjusted R^2	0.2274		Adjusted R^2	0.2104
	SSR	478.5308		SSR	376.5563
GB+4	0.4887	(0.5113)	**GB+4**	0.4587	(0.4469)
	R^2	0.0294		R^2	0.0325
	Adjusted R^2	0.0172		Adjusted R^2	0.0204
	SSR	464.3463		SSR	368.0784
SPF+4	0.0796	(0.6513)	**SPF+4**	0.2624	(0.5686)
	R^2	0.0005		R^2	0.0062
	Adjusted R^2	-0.0120		Adjusted R^2	-0.0062
	SSR	478.1735		SSR	378.1018

Numbers in parentheses are robust standard errors. *,**,*** means respectively significant at 10%, 5% and 1%.

Table 3 - Forecasts Pooled over Horizon (current and next 4 quarters)

				Idiosyncratic component		No Idiosyncratic component				
			$\hat{\alpha}$	*se*	*p-val*	*se*	*p-val*	σ_{ε}^2	σ_u^2	RMSFE
Inflation	Final Data	GB	-0.279	0.128	0.029	0.166	0.093	0.527	0.181	1.071
		SPF	-0.476	0.170	0.005	0.196	0.016	0.456	0.330	1.293
	Real-Time Data	GB	-0.268	0.134	0.046	0.181	0.138	0.691	0.197	1.164
		SPF	-0.465	0.160	0.004	0.206	0.024	0.802	0.284	1.367
Real GNP/GDP	Final Data	GB	0.743	0.273	0.007	0.418	0.076	3.532	0.579	2.413
		SPF	0.695	0.292	0.018	0.423	0.101	3.304	0.676	2.411
	Real-Time Data	GB	0.214	0.280	0.446	0.376	0.571	2.227	0.642	2.049
		SPF	0.166	0.279	0.552	0.372	0.656	2.150	0.637	2.022

Table 4 - Correlation

Inflation +1 - Final Data

	Actual	GB	SPF
Actual	1		
GB	0.9333	1	
SPF	0.9143	0.9585	1

Inflation +1 - Real-Time Data

	Actual	GB	SPF
Actual	1		
GB	0.9123	1	
SPF	0.8742	0.9585	1

Inflation +4 - Final Data

	Actual	GB	SPF
Actual	1		
GB	0.8782	1	
SPF	0.8146	0.9555	1

Inflation +4 - Real-Time Data

	Actual	GB	SPF
Actual	1		
GB	0.8643	1	
SPF	0.8145	0.9555	1

Real GNP/GDP +1 - Final Data

	Actual	GB	SPF
Actual	1		
GB	0.5048	1	
SPF	0.4868	0.7964	1

Real GNP/GDP +1 - Real-Time Data

	Actual	GB	SPF
Actual	1		
GB	0.4712	1	
SPF	0.4692	0.7964	1

Real GNP/GDP +4 - Final Data

	Actual	GB	SPF
Actual	1		
GB	0.1713	1	
SPF	0.0213	0.6257	1

Real GNP/GDP +4 - Real-Time Data

	Actual	GB	SPF
Actual	1		
GB	0.1803	1	
SPF	0.0786	0.6257	1

Table 5 - One Factor Model

	Inflation - Final Data				**Inflation - Real-Time Data**			
	Horizon h=1		Horizon h=4		Horizon h=1		Horizon h=4	
	est	*var*	*est*	*var*	*est*	*var*	*est*	*var*
Actual	0.945	0.108	0.881	0.224	0.9179	0.1574	0.8682	0.246
GB	0.982	0.036	0.998	0.005	0.9859	0.028	0.9967	0.007
SPF	0.976	0.047	0.957	0.084	0.9717	0.0559	0.9579	0.082
Naïve	0.934	0.128	0.894	0.201	0.9037	0.1833	0.8828	0.221
	log LH	-0.048	*log LH*	-0.291	*log LH*	-0.116	*log LH*	-0.179
	p-value	0.079	*p-value*	0.000	*p-value*	0.002	*p-value*	0.000

	Real GNP/GDP - Final Data				**Real GNP/GDP - Real-Time Data**			
	Horizon h=1		Horizon h=4		Horizon h=1		Horizon h=4	
	est	*var*	*est*	*var*	*est*	*var*	*est*	*var*
Actual	0.5672	0.6783	0.1716	0.9705	0.5537	0.6934	0.1812	0.9672
GB	0.8816	0.2228	0.9975	0.005	0.8908	0.2065	0.9975	0.005
SPF	0.8988	0.1921	0.6271	0.6068	0.8849	0.217	0.6271	0.6068
Naïve	0.582	0.6613	0.1615	0.9739	0.6058	0.633	0.2925	0.9145
	log LH	-0.033	*log LH*	-0.197	*log LH*	-0.094	*log LH*	-0.174
	p-value	0.277	*p-value*	0.000	*p-value*	0.026	*p-value*	0.001

Table 6 - Robustness: CPI (1982:1 - 2001:4)

Mean Square Errors

Horizon	GB	SPF	p-value
1	4.510	4.770	0.1853
4	4.137	4.498	0.0053

Regressions

Base

	Coef	Std Error		Coef	Std Error
Cst	0.8551	(0.8194)	Cst	1.2706	(0.8189)
GB+1	1.0658*	0.6445	GB+4	1.1088**	0.4686
SPF+1	-0.3907	0.7745	SPF+4	-0.5528	0.5333

Timing Disadvantage

	Coef	Std Error		Coef	Std Error
Cst	1.4887	(1.0333)	Cst	1.2262	(0.9912)
GB+2	1.1308***	0.2607	GB+5	1.2748*	0.7468
SPF+1	-0.6720	0.5215	SPF+4	-0.7104	0.8274

Significant Model

	Coef	Std Error		Coef	Std Error
GB+1	0.7748***	(0.1929)	SPF+1	0.7391***	(0.2606)
	R^2	0.1511		R^2	0.0966
	Adj. R^2	0.1402		Adj. R^2	0.0850
	SSR	349.0		SSR	371.4
GB+4	0.6426***	(0.1914)	SPF+4	0.5958***	(0.2241)
	R^2	0.1138		R^2	0.0796
	Adj. R^2	0.1025		Adj. R^2	0.0678
	SSR	304.1		SSR	315.8

*,**,*** means respectively significant at 10%, 5% and 1%.