Inflation, Inflation Expectations and Core Inflation

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ABSTRACT: This paper combines the literature on consumer price inflation forecasts such as the Greenbook and the Survey of Professional Forecasters and on core inflation measures such as weighted median inflation and inflation minus food and energy by examining the relative informational content of these measures for predicting future inflation. I find that the Greenbook and Survey of Professional Forecasters consumer price inflation forecasts do contain more information than core inflation measures. Given these results, I test to find a simple proxy of the Greenbook consumer price inflation forecast, which may be more informative than the Survey of Professional Forecasters forecast. The best proxy of the Greenbook consumer price forecast is the Survey Professional Forecasters consumer price forecast not a core inflation measure.

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1. Introduction

This paper examines the relative information content of forecasts of inflation and measures of core inflation; it tests what is the best measure to forecast inflation. Forecasters use a variety of methods: large scale econometric models, Phillips curve models, core inflation measures and lagged inflation measures (ARIMA models). When searching for the best forecast, economists often compare forecasts by examining the root mean squared error (RMSE); however, RMSE is not the only criterion that is considered. Forecasts from large scale econometric models may be more costly to produce and that cost may not be worth the possible reduction in the RMSE. It may be, given the costs and a small difference in RMSE, that using lagged inflation as the forecaster is a better use of resources. This paper draws on the forecasting inflation literature to test if core inflation measures such as the weighted median contain more information about future inflation than professional forecasts of inflation.

Previous work by Smith (2004) shows that the weighted median Consumer Price Index (CPI) inflation rate is a better forecaster of future inflation than lagged inflation and the traditional core inflation measure, inflation minus food and energy. Smith (2004) uses both in-sample prediction and simulated forecasting to test whether the weighted median inflation rate can forecast next year's CPI inflation better than lagged inflation or lagged inflation minus food and energy.

Romer and Romer's (2000) paper examines if there is additional information in the Greenbook inflation (GNP deflator) forecasts over commercial forecasts. They compare the Greenbook inflation forecast to the Blue Chip forecast, DRI (Global Insight) forecast, and the Survey of Professional Forecasters (SPF) forecast. They find that the Greenbook does contain additional information over that contained in commercial forecasts and that the weight that

should be placed on the Greenbook forecast is generally close to one. Romer and Romer (2000) also examine the information in the CPI forecasts and find that there is additional information in the Greenbook forecast over what is contained in commercial forecasts but they do not examine the forecasting ability of core inflation measures.

Gavin and Mandal (2001) examine the relationship between the Greenbook and Blue Chip forecasts and the inflation forecast of the GDP deflator given by the Fed's chairman's twice yearly Congressional testimony. They find that the Greenbook is a better forecaster than the Blue Chip but that both are similar to the forecast given in the Congressional testimony, which is the central tendency of the forecasts given by the FOMC board members and the non-voting Federal Reserve Bank presidents.

Another paper that studies the Greenbook forecasts is by Atkeson and Ohanian (2001). They evaluate the usefulness of Phillips Curves for forecasting inflation (GNP/GDP deflator). They find that Phillips Curve models are not more accurate than a naïve model (random walk). In addition, they compare the naïve model to the Greenbook forecast and find that the errors from each are about the same over 1984-1996.

Carroll (2003) models inflation expectations of households and professionals. In a preliminary exercise, he shows that the SPF forecast does have additional information above what is contained in lagged inflation. He expands the set of lagged inflation measures to also include the CPI minus food and energy and the CPI weighted median but he does not examine the Greenbook.

This paper combines the literature on forecasts and core inflation by testing whether forecasts generated by econometric models such as the Greenbook and surveys of professionals contain more information than simple backward-looking measures of inflation. This paper finds

that the Greenbook forecast and the SPF forecast both contain additional information over that contained in lagged inflation measures. I test the robustness of this result using a variety of models. I also find that the Greenbook forecast may contain more information than the SPF forecast in a 1984-2000 sample but my results are not as strong as those presented by Romer and Romer (2000) due to different samples.

An interesting question to examine given the result that the Greenbook forecast has substantial information about future inflation is what is a good proxy of the Greenbook forecast? Most of the previous literature[1] on forming inflation expectations has not examined the Greenbook forecast since these papers are modeling either household's or professionals' forecast formation. The Greenbook forecasts are produced by the Board of Governors staff with the help of a large scale econometric model (Atkeson and Ohanian, 2001). Since the Greenbook is confidential and only released with a five-year lag the public may want a proxy of the Greenbook forecast that they can use to keep them informed of the Fed's inflation projections.

I examine lagged inflation measures (lagged headline, lagged minus food and energy and lagged median) and the SPF forecast as possible proxies for the Greenbook forecast of inflation. When only considering lagged inflation measures as possible proxies, the CPI minus food and energy inflation rate is a better proxy as the forecast horizon increases. Once the SPF inflation forecast is included, the SPF inflation forecast is a good proxy for the Greenbook inflation forecast. By using the SPF forecast as a proxy, the public is able to have an accurate gauge of what the Fed believes are future inflation pressures in the economy.

2. Data

[1] See Sheridan (2003), Carroll (2003 and 2006), Ball and Croushore (2003), Orphanides and Williams (2004) and Branch (2004) for more details.

The data are publicly available and I use quarterly inflation rates with monthly observations as in Romer and Romer (2000). I obtain price indices of the CPI and CPI minus food and energy (CPIX) from the Bureau of Labor Statistics website. The weighted median CPI inflation rate (CPIMED) is from the website of the Federal Reserve Bank of Cleveland. For the weighted median I take the monthly inflation rates and compute a price index. From this price index, I then obtain the inflation rates. The measures of inflation expectations are the median forecast of the CPI inflation rate from the Survey of Professional Forecasters and the quarterly and four-quarter CPI forecasts from the Greenbook of the Federal Open Market Committee; both are available from the Federal Reserve Bank of Philadelphia. I will discuss in next section the different inflation rates that are used in empirical analysis.

The Greenbook forecasts (GRF) are released with a five-year lag. I use the Greenbook data through 2000. In addition, earlier work by Smith (2005) indicates that the measure that is core inflation, defined as the best forecaster of inflation, varies across monetary policy regimes; therefore, the sample starts in 1984. The end of sample is December 2000 for the Greenbook forecasts and April 2005 for the remaining variables. I present the results from the 1984-2000 sample in the paper; the results with the April 2005 end sample date can be obtained from the author upon request.[2] The number of observations in the empirical analysis varies because I use matched data. When using the SPF forecasts, which there are only four a year, I only use the actual inflation data that appear in the same months giving 68 observations. When using the GRF forecasts, which there are eight a year, there are 136 observations. For the regressions including both the SPF and GRF there are only 50 matched observations.

3. Empirical Analysis

[2] Results from the 1984-2005:04 sample support the same conclusions.

I start the analysis using a modified version of equation 2 from Romer and Romer (2000). They ask if the Greenbook forecasts have additional information over the information contained in commercial forecasts and they find that the Greenbook forecasts do contain additional information about future inflation.[3] I modify their equation to compare the forecasting ability of the Greenbook forecast and the SPF forecast with lagged inflation measures. These lagged inflation measures are lagged inflation, lagged inflation minus food and energy and lagged weighted median inflation. The regression (encompassing test) is

$$\pi_{ht} = a + b_1 * \pi^{a}_{ht-3} + b_2 * \pi^{f}_{ht} + u_{ht} \qquad (1a)$$

where π_{ht} is the actual inflation rate in the quarter *h* quarters after the month *t*, π^{a}_{ht-3} is the lagged inflation measure (either aggregate, minus food and energy or median) and π^{f}_{ht} is the forecast (SPF or GRF) of π_{ht}.[4] In addition to this first variation, I examine the information content of the two forecasts in the following regression, which is the Romer and Romer (2000) equation 2:

$$\pi_{ht} = a + b_1 * \pi^{f1}_{ht} + b_2 * \pi^{f2}_{ht} + u_{ht} \qquad (1b)$$

where π^{f1}_{ht} is the SPF forecast and π^{f2}_{ht} is the Greenbook forecast. This equation and all others are estimated by Ordinary Least Squares (OLS) with Newey-West corrected standard errors due to the overlapping observations.

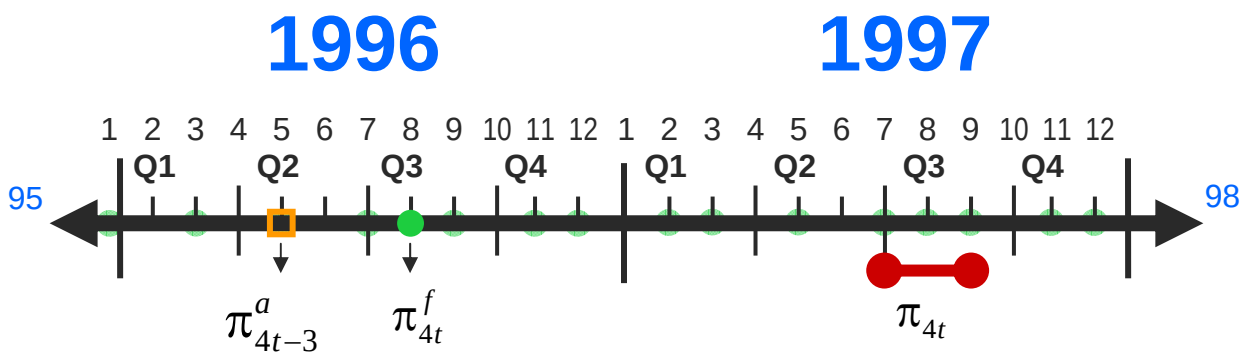
The timing of the data is important. Using the August 1996 FOMC meeting as our observation point, the diagram shows the timing of the Greenbook forecast and the lagged inflation measure relative to the actual inflation data. In this example, the forecaster is trying to

[3] Most of Romer and Romer's analysis is for the GNP deflator but footnote 16 discusses the information content of the Greenbook and commercial forecasts of the CPI.

[4] A procedure similar to the one in Romer and Romer is followed to calculate the inflation rates for both the dependent variable and the lagged inflation measures. The annualized quarterly inflation rates are calculated from the quarterly averages of the price indices. The data are at a monthly frequency. For the inflation variables each month in a given quarter has the same inflation rate. See Romer and Romer (page 434) for more details. The lagged inflation measures are lagged by three months or 1 quarter to ensure only data known prior to time *t* are used.

predict inflation four quarters ahead (π_{4t}) and uses either the three month prior annualized quarterly inflation rate (π^{a}_{4t-3}), or the forecast (π^{f}_{4t}) generated in August 1996.

Diagram 1: Equation 1 Timing



Also, borrowing from Romer and Romer (2000) I run a modified version of equation 3. The first variation is

$$\bar{\pi}_{ht} = a + b_1 * \bar{\pi}^{a}_{ht-15} + b_2 * \bar{\pi}^{f}_{ht} + \bar{u}_{ht} \qquad (2a)$$

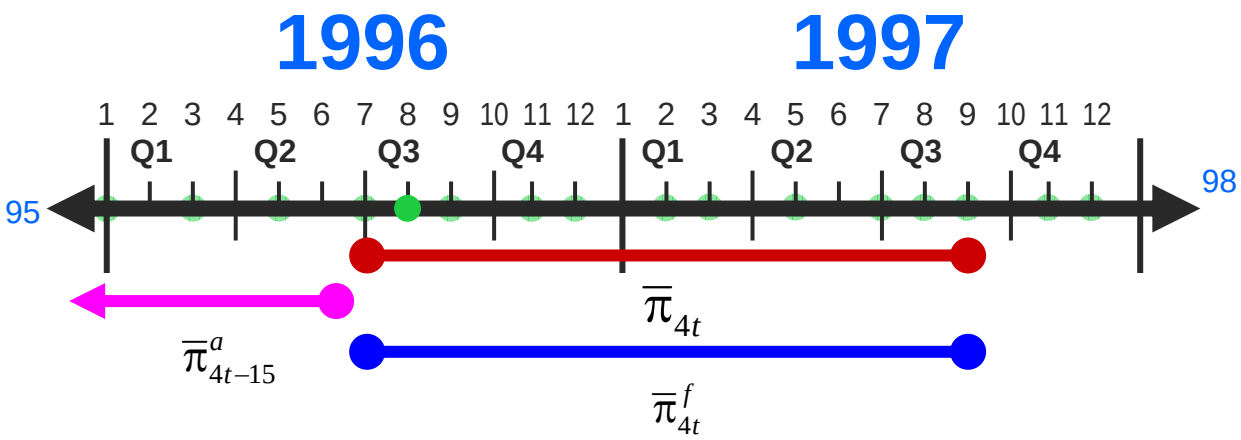
and the second variation is

$$\bar{\pi}_{ht} = a + b_1 * \bar{\pi}^{f1}_{ht} + b_2 * \bar{\pi}^{f2}_{ht} + \bar{u}_{ht} \qquad (2b)$$

where $\bar{\pi}_{ht}$ is average inflation up to *h* quarters, $\bar{\pi}^{a}_{ht-15}$ is the *h* quarter previous inflation rate and $\bar{\pi}^{f}_{ht}$ is the average over the forecast over the next *h* quarters. In this paper *h=4*.[5] These averages average data over 5 quarters. The timeline below illustrates the timing of the data with August 1996 as the observation point.

[5] The inflation rate is lagged to ensure that data in the dependent variable do not overlap with the lagged inflation rates.

Diagram 2: Equation 2 Timing



Tables 1A, 1B and 1C present the results from equations 1 and 2. In Tables 1A and 1B, the results indicate that the SPF forecast and the Greenbook forecasts provide additional information (b_2 is significant) about future inflation over the information provided in lagged inflation measures including the weighted median. When combined with CPIMED, both the SPF and the Greenbook forecast can predict current and next quarter's inflation well. Also, examining the regressions using the averages, the results provide evidence that the forecasts again provide more information than the lagged inflation measures. Predicting the quarterly inflation rate several quarters ahead is difficult since there may be a large amount of noise (due to shocks) in the quarter-over-quarter inflation rates. These shocks may hit one quarter and then be reversed the next. By averaging the quarterly forecasts, the quarter-to-quarter fluctuations are smoothed out and the forecast may perform well over the entire forecast horizon even if the forecasts further out perform poorly since the high frequency noise is removed. In Table 1C, it seems that the Greenbook forecast may provide additional information above the information in the SPF forecast but the coefficient estimates are very imprecise.[6]

[6] Romer and Romer do not present their results for the CPI in detail. They discuss that the coefficient on the GRF is positive for all horizons but only significant at the 4 quarter horizon or greater. My results are consistent with theirs.

In addition, I run two additional regressions to test the robustness of the results presented in Table 1. First, I lag the Greenbook and the SPF forecasts by one month. Romer and Romer perform a similar exercise to ensure that they are not giving the Fed additional information that was not available to private forecasters. By lagging either the Greenbook or the SPF forecast by one month when combined with lagged inflation, I assure that I have not given forecasters access to information that is not yet available. Second, I build a dataset that specifically matches the Greenbook dates with the CPI releases and the approximate SPF dates[7] with the CPI releases. For all inflation measures, I take the last month that was available when either the Greenbook or the SPF forecast was made and find the annualized inflation rate over the last three months.[8] The results under these two alternative specifications are similar to those above.[9]

Since the coefficients on the quarterly forecasts are insignificant at the longer horizons, we might question their usefulness for monetary policy. Generally, for monetary policy purpose, the Fed wants a forecast of inflation over the next year. The average forecast may provide a proxy. I propose several additional regressions that test the power of the information available in the SPF forecast and the Greenbook forecast to predict next year's inflation. I undertake this analysis in two ways. First, I study how well the forecasts and inflation measures (measured as quarterly rates) predict future inflation (measured as year-over-year inflation) and second, I use year-over-year inflation rates for both the dependent and independent variables.

For the regressions using quarterly forecasts and inflation measures, I calculate the dependent variable as the year-over-year inflation rate from the quarterly average of the CPI

[7] The SPF dates prior to the 1990 Philadelphia Fed administration of the SPF are unknown. Since, the SPF is collected in the second month of each quarter, my rule of thumb is that forecasters have the statistical releases from the end of the previous quarter but not from the first month of the current quarter.
[8] I calculate the average price level over each 3 month period and from the average price level I calculate the three-month (quarterly) inflation rate at a monthly frequency.
[9] The results are available from the author upon request.

price index. There are two variations of the regression. The first combines lagged inflation measures and forecasts in the following regression:

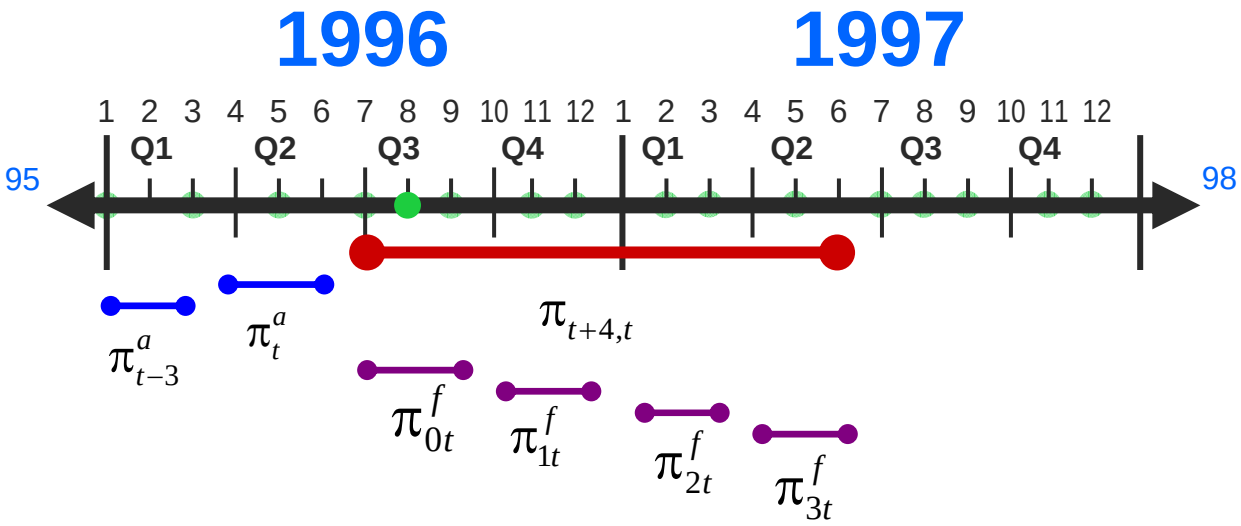
$$\pi_{t+4,t} = a + b_1 * \pi_t^a + b_2 * \pi_{t-3}^a + b_3 * \pi_{t-6}^a + b_4 * \pi_{t-9}^a + b_5 * \pi_{0t}^f + b_6 * \pi_{1t}^f + b_7 * \pi_{2t}^f + b_8 * \pi_{3t}^f + u_{t+4} \quad (3a)$$

and the second combines the two forecast measures in the following regression:

$$\pi_{t+4,t} = a + b_1 * \pi_{0t}^{f1} + b_2 * \pi_{1t}^{f1} + b_3 * \pi_{2t}^{f1} + b_4 * \pi_{3t}^{f1} + b_5 * \pi_{0t}^{f2} + b_6 * \pi_{1t}^{f2} + b_7 * \pi_{2t}^{f2} + b_8 * \pi_{3t}^{f2} + u_{t+4} \quad (3b)$$

where $\pi_{t+4,t}$ is the four-quarter ahead inflation rate and the other variables are defined as in equation 1. Recall that the frequency of the data is monthly but the forecasts and the lagged inflation measures are calculated as quarterly inflation rates. The timing of the dependent and independent variables are illustrated below.

Diagram 3: Equation 3 Timing



The results in Tables 2A and 2B present the coefficient estimate of the constant and the Wald tests testing the restrictions that sum of the coefficients on the lagged inflation rates and the

sum of the coefficients on the forecasts equal one. This regression is similar to the average regression (equations 2a and 2b) except equations 2a and 2b average the CPI level over 18 months; the average inflation variable includes the current quarter and the four future quarters.[10] In equations 3a and 3b, the dependent variable is over four quarters. The sum of the coefficients on the forecasts in most cases cannot be rejected as significantly different from one whereas the sum on the lagged inflation rates can be rejected. The exception is when the forecast is combined with the weighted median. Initially, this might indicate that the median provides some information about future inflation. Upon further examination, I find that none of the coefficients on the lagged weighted median inflation rates are significant. Finally, taking a look at the regression with both forecasts indicates that more of the information about future inflation comes from the Greenbook than the SPF.

Another regression to test the usefulness of the forecast for monetary policy is to regress the 12-month ahead CPI inflation rate on the inflation measures over the previous 12 months and on the forecast of inflation over the next 12 months. This regression simplifies the information that is used for the independent variables and might provide a simple way for the public to forecast future inflation. For the SPF forecast, the forecasters are specifically asked for a forecast of the CPI inflation rate over the next year. For the Greenbook, I use the four-quarter ahead forecast. In the Greenbook, the forecasts are given by year so I use the same year forecast for the January through June FOMC meetings and I use the next year forecast for the July through December FOMC meetings. The data for these Greenbook forecasts start in 1990; therefore, I limit the sample from 1990 to 2000.

[10] The procedure to find the average is the same as the one used in Romer and Romer (2000).

For the regression with annual forecasts and previous year's inflation measures, I calculate the dependent variable as the percentage change in the monthly CPI, $\left(\frac{P_{t+12}}{P_t}-1\right)*100$. The previous year's inflation measures (CPI, CPIX and CPIMED) are also calculated as the percentage change, $\left(\frac{P_t}{P_{t-12}}-1\right)*100$. Again, there are two variations of the regression. The first combines an inflation measure with a forecast in the following regression:

$$\pi_{t+12,t} = a + b_1 * \pi^a_{t,t-12} + b_2 * \pi^f_{t+12,t} + u_{t+12} \quad (4a)$$

and the second is the following:

$$\pi_{t+12,t} = a + b_1 * \pi^{SPF}_{t+12,t} + b_2 * \pi^{GRF}_{t+12,t} + u_{t+12} \quad (4b)$$

where $\pi^a_{t,t-12}$ is the previous 12-month inflation rate of the CPI, CPIX and CPIMED and $\pi^f_{t+12,t}$ is the forecast of next year's inflation rate for both the Greenbook and the SPF.

The results in Tables 3A, 3B and 3C show that the Greenbook has information about next year's inflation. The coefficients on the Greenbook forecasts are also not significantly different from one indicating that the Greenbook forecast is an accurate predictor of future inflation.[11] The SPF forecast does not perform well or seem to have much information about future inflation.[12] Finally, turning to the regression with the Greenbook forecast and the SPF forecast, I find that the Greenbook forecast does have more information that the SPF forecast.

Overall, these results suggest that the Greenbook forecast and the SPF forecast have more information than lagged inflation measures including the weighted median inflation rate, which

[11] I also ran regressions in which the Greenbook forecast variable was lagged one month. The results are similar to those presented here.

[12] The sample for the SPF forecast is longer than for the Greenbook. However, when running regression 3a using the 1984-2000 sample the results are roughly consistent with those presented here. There was not overwhelming significance of the SPF forecast variable in those regressions.

has been found to be a good forecaster of future inflation in previous studies. I find that the Greenbook forecast is not more informative than the SPF forecast under all specifications, contrary to the findings of Romer and Romer (2000). One reason for the different result is that my sample is more recent than Romer and Romer's sample. This result suggests some convergence of forecasts, which may be due to less variation in inflation since the Great Moderation, or perhaps professional forecasts have learned about the goals and targets of the Fed through greater Fed transparency.[13]

Determining how forecasts are made is an expanding part of the economic literature. Recent work by Sheridan (2003), Carroll (2003 and 2006), Ball and Croushore (2003), Orphanides and Williams (2004) and Branch (2004) explore how agents (either households or professionals) form their inflation expectations. The question I am interested in that most of these papers have not examined is what is a good proxy of the Greenbook forecast? A proxy of the Greenbook forecast is of interest since the Greenbook is used for monetary policy decisions. It is not feasible for the public to put together a large econometric model of the economy to forecast inflation but if the public can use simple inflation measures and/or other forecasts to deduce the Greenbook forecast it may lead to a better understanding of monetary policy decisions.

It is outside the scope of this paper to determine how forecasts are made and in light of the information contained in the forecasts, the second question that this paper examines is finding a good proxy for the Greenbook inflation forecast. A good proxy has the following characteristics: unbiased, no other data available at time *t* helps and the effects of the Fed's proprietary information are small. This paper addresses the first criterion and partially addresses the second. The only alternative data I consider is lagged inflation.

[13] See Gamber and Smith (2008) for a more detailed analysis of this question.

I test if any of the lagged inflation measures (CPI, CPIX and CPIMED) or the SPF forecast meets the criteria for a good proxy. Given that I have forecasts over several future time horizons, I also examine whether the measure that is the best proxy changes as the forecast horizon changes.

The first regression for determining a proxy of the Greenbook forecast compares the relative contribution of each of the lagged inflation measures (CPI, CPIX and CPIMED). The regression is

$$\pi_{ht}^{GRF} = a + b_1 * \pi_{ht-3}^{cpi} + b_2 * \pi_{ht-3}^{cpix} + b_3 * \pi_{ht-3}^{cpimed} + u_t \qquad (5a)$$

where π_{ht}^{GRF} is the Greenbook CPI forecast of the inflation rate in the quarter *h* quarters after the month *t*, $\pi_{ht-3}^{cpi}, \pi_{ht-3}^{cpix}, \pi_{ht-3}^{cpimed}$ are the lagged inflation measures. In Table 4, it seems that the proxy of the Greenbook forecast changes over the forecast horizon. During the current quarter (forecast horizon=0) the best proxy is combination of the lagged CPI and lagged CPIX inflation rates. As the forecast horizon lengthens, more of the weight shifts to the CPIX inflation rate. This result may arise since the Fed may be using the minus food and energy inflation rate as its goal ('target') inflation rate for monetary policy. The CPIMED inflation rate is not relevant as a proxy for the Greenbook but perhaps this is because it is a relatively new inflation measure that has not made its way into models of the economy or policy makers' radar screen.

Besides examining past inflation rates, the public can also use professionals' forecast of inflation as a proxy for the unknown Greenbook forecasts. I test if this would be useful in the following regression:

$$\pi_{ht}^{GRF} = a + b_1 * \pi_{ht-3}^{cpi} + b_2 * \pi_{ht-3}^{cpix} + b_3 * \pi_{ht-3}^{cpimed} + b_4 * \pi_{ht}^{SPF} + u_t \qquad (5b)$$

where all variable are defined as in equation 4a and π_{ht}^{SPF} is the SPF forecast of the inflation rate in the quarter *h* quarters after the month *t*. The results are also presented in Table 4. The SPF

inflation forecast is an excellent proxy of the Greenbook forecast. Generally, placing a weight of one on the SPF inflation forecast will provide a good (unbiased and does not need additional inflation data to help explain the Greenbook) proxy of the Greenbook inflation forecast. This information that the SPF is a good proxy for the Greenbook is useful to the public who then can rather cheaply gather the SPF inflation forecast every quarter.

4. Conclusions

This paper has examined the information content in forecasts of CPI inflation from the Greenbook and the Survey of Professional Forecasters compared to the information in lagged inflation measures. I find that the Greenbook and the SPF forecast contain more information about future inflation than any lagged inflation measure including the weighted median, which had been found to be a good forecaster of inflation. Given these results and the fact that the Greenbook is only released with a five-year lag, I examine if any of the lagged inflation measures or the SPF inflation forecast provides a good proxy of the Greenbook inflation forecast. I find that the public may want to use the SPF inflation forecast as a proxy of the Greenbook inflation forecast. This result gives the public an accurate idea of the forecast that the Federal Reserve is using when making monetary policy decisions and may help align the Fed's and the public's inflation expectations.

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Table 1A- Tests of Additional Information for Inflation (Greenbook)

$$\pi_{ht} = a + b_1 * \pi^{a}_{ht-3} + b_2 * \pi^{GRF}_{ht} + u_{ht}$$

Sample: 1984 – 2000

Forecast horizon **(Quarters)**	**a**	**b1**	**b2**	**Adjusted R^2**	**N**
CPI					
0	0.03(0.12)	0.03(0.04)	0.95(0.04)*	0.86	136
1	-0.02(0.52)	0.10(0.11)	0.86(0.16)*	0.41	136
2	0.88(0.53)	0.21(0.20)	0.48(0.19)*	0.20	136
3	1.16(0.59)	-0.09(0.08)	0.66(0.22)*	0.14	136
4	0.90(0.59)	-0.13(0.10)	0.77(0.20)*	0.22	136
Average	0.51(0.40)	-0.03(0.13)	0.82(0.12)*	0.50	136
CPIX					
0	0.04(0.17)	0.02(0.06)	0.96(0.03)*	0.86	136
1	0.18(0.47)	-0.04(0.21)	0.94(0.22)*	0.40	136
2	1.03(0.54)	0.18(0.21)	0.45(0.21)*	0.16	136
3	1.16(0.58)*	-0.15(0.20)	0.74(0.29)*	0.14	136
4	0.90(0.60)	-0.19(0.19)	0.84(0.26)*	0.21	136
Average	0.63(0.40)	-0.19(0.14)	0.96(0.14)*	0.51	136
CPIMED					
0	0.01(0.25)	0.02(0.08)	0.96(0.03)*	0.86	136
1	-0.35(0.64)	0.23(0.27)	0.82(0.21)*	0.41	136
2	0.43(0.78)	0.43(0.29)	0.36(0.19)	0.19	136
3	0.68(0.76)	0.31(0.31)	0.40(0.25)	0.14	136
4	0.58(0.75)	0.17(0.27)	0.56(0.21)*	0.21	136
Average	0.48(0.61)	0.00(0.24)	0.80(0.14)*	0.50	136

* indicates significance at 5%

Standard errors in parentheses.

Table 1B- Tests of Additional Information for Inflation (SPF)

$$\pi_{ht} = a + b_1 * \pi^{a}_{ht-3} + b_2 * \pi^{SPF}_{ht} + u_{ht}$$

Sample: 1984 - 2000

Forecast horizon **(Quarters)**	**a**	**b1**	**b2**	**Adjusted R^2**	**N**
CPI					
0	-0.46(0.31)	-0.18(0.09)	1.30(0.11)*	0.77	68
1	0.16(0.64)	-0.01(0.17)	0.91(0.25)*	0.25	68
2	0.65(0.58)	0.23(0.22)	0.52(0.26)*	0.20	68
3	0.67(0.80)	-0.09(0.10)	0.78(0.29)*	0.13	68
4	0.57(0.83)	-0.11(0.12)	0.80(0.28)*	0.01	68
Average	0.29(0.48)	-0.06(0.11)	0.89(0.13)*	0.44	68
CPIX					
0	-0.29(0.36)	-0.16(0.08)	1.24(0.09)*	0.76	68
1	0.13(0.63)	-0.21(0.33)	1.12(0.40)*	0.26	68
2	0.61(0.64)	0.10(0.27)	0.64(0.33)	0.16	68
3	0.68(0.83)	-0.06(0.24)	0.75(0.41)	0.12	68
4	0.52(0.86)	-0.14(0.22)	0.85(0.40)*	0.13	68
Average	0.32(0.48)	-0.17(0.12)	1.00(0.14)*	0.45	68
CPIMED					
0	-0.03(0.46)	-0.23(0.12)	1.23(0.08)*	0.77	68
1	0.01(0.75)	0.14(0.33)	0.80(0.27)*	0.25	68
2	0.20(0.78)	0.38(0.32)	0.48(0.26)	0.18	68
3	0.38(0.84)	0.37(0.32)	0.42(0.33)	0.14	68
4	0.32(0.90)	0.28(0.26)	0.49(0.25)	0.14	68
Average	0.20(0.63)	0.05(0.21)	0.80(0.14)*	0.44	68

* indicates significance at 5%

Standard errors in parentheses.

Table 1C- Tests of Greenbook Additional Information for Inflation

$$\pi_{ht} = a + b_1 * \pi_{ht}^{SPF} + b_2 * \pi_{ht}^{GRF} + u_{ht}$$

Sample: 1984 - 2000

Forecast horizon

(Quarters)	**a**	**b1**	**b2**	**Adjusted R^2**	**N**
0	-0.23(0.27)	0.33(0.17)	0.72(0.13)*	0.88	50
1	0.002(0.75)	0.15(0.65)	0.81(0.64)	0.30	50
2	0.91(0.73)	0.09(0.53)	0.57(0.46)	0.21	50
3	1.13(1.27)	-0.28(1.05)	0.88(0.81)	0.14	50
4	1.30(1.22)	-1.04(1.15)	1.60(0.94)	0.19	50
Average	0.52(0.60)	-0.07(0.77)	0.85(0.66)	0.47	50

* indicates significance at 5%

Standard errors in parentheses.

Table 2A- Tests of Greenbook Additional Information (Quarterly lags)
Sample 1984-2000

GRF & CPI

Constant	0.69	(0.45)
Adjusted R^2	0.34	
N	136	
		Probability
Sum of lags of CPI	-0.04	0.00
Sum of leads of GRF	0.77	0.17

GRF & CPIX

Constant	0.70	(0.46)
Adjusted R^2	0.35	
N	136	
		Probability
Sum of lags of CPIX	-0.25	0.00
Sum of leads of GRF	1.00	0.99

GRF & CPIMED

Constant	0.43	(0.74)
Adjusted R^2	0.36	
N	136	
		Probability
Sum of lags of CPIMED	0.24	0.02
Sum of leads of GRF	0.56	0.03

GRF & SPF

Constant	1.22	(0.85)
Adjusted R^2	0.36	
N	50	
		Probability
Sum of leads of SPF	-0.78	0.03
Sum of leads of GRF	1.41	0.53

Standard errors in parentheses.

Table 2B - Tests of SPF Additional Information (Quarterly lags)
Sample 1984-2000

SPF & CPI

Constant	0.50	(0.62)
Adjusted R^2	0.28	
N	68	
		Probability
Sum of lags of CPI	-0.04	0.00
Sum of leads of SPF	0.84	0.46

SPF & CPIX

Constant	0.50	(0.64)
Adjusted R^2	0.27	
N	68	
		Probability
Sum of lags of CPIX	0.07	0.00
Sum of leads of SPF	0.86	0.62

SPF & CPIMED

Constant	0.26	(0.75)
Adjusted R^2	0.30	
N	68	
		Probability
Sum of lags of CPIMED	0.34	0.02
Sum of leads of SPF	0.52	0.02

Standard errors in parentheses.

Table 3A - Tests of Greenbook Additional Information (Year-over-year)

$$\pi_{t+12,t} = a + b_1 * \pi^{a}_{t,t-12} + b_2 * \pi^{GRF}_{t+12,t} + u_{t+12}$$

Sample 1990-2000

	A	b1	b2	Adjusted R^2	N
CPI	0.77(0.48)	-0.11(0.11)	0.80(0.20)*	0.38	88
CPIX	0.77(0.44)	-0.22(0.16)	0.92(0.23)*	0.40	88
CPIMED	0.97(0.60)	-0.12(0.19)	0.75(0.16)*	0.38	88

Table 3B - Tests of SPF Additional Information (Year-over-year)

$$\pi_{t+12,t} = a + b_1 * \pi^{a}_{t,t-12} + b_2 * \pi^{SPF}_{t+12,t} + u_{t+12}$$

Sample 1990-2000

	a	b1	b2	Adjusted R^2	N
CPI	1.43(0.51)*	-0.05(0.29)	0.50(0.37)	0.23	44
CPIX	1.45(0.49)*	-0.01(0.25)	0.45(0.31)	0.23	44
CPIMED	1.25(0.75)	0.14(0.29)	0.36(0.19)	0.24	44

Table 3C - Tests of Greenbook Additional Information (Year-over-year)

$$\pi_{t+12,t} = a + b_1 * \pi^{SPF}_{t+12,t} + b_2 * \pi^{GRF}_{t+12,t} + u_{t+12}$$

Sample 1990-2000

	a	b1	b2	Adjusted R^2	N
SPF	0.97(0.60)	0.00(0.17)	0.60(0.31)	0.32	32

* indicates significance at 5%

Standard errors in parentheses.

Table 4 - Proxy for Greenbook Inflation Forecast

Sample 1984-2000

$$\pi_{ht}^{GRF} = a + b_1 * \pi_{ht-3}^{cpi} + b_2 * \pi_{ht-3}^{cpix} + b_3 * \pi_{ht-3}^{cpimed} + u_t$$

Forecast Horizon	Constant		CPI		CPIX		CPIMED		SPF		Adjusted R2	N
0	0.61		0.21	*	0.41	*	0.15				0.34	136
	(0.66)		(0.09)		(0.18)		(0.28)					
1	1.50	*	-0.06		0.73	*	-0.15				0.42	136
	(0.39)		(0.04)		(0.12)		(0.16)					
2	0.90	*	-0.07		0.74	*	0.04				0.65	136
	(0.33)		(0.06)		(0.14)		(0.14)					
3	0.57		-0.00		0.68	*	0.12				0.73	136
	(0.35)		(0.05)		(0.14)		(0.16)					
4	0.48		0.01		0.63	*	0.21				0.70	136
	(0.37)		(0.06)		(0.15)		(0.17)					

$$\pi_{ht}^{GRF} = a + b_1 * \pi_{ht-3}^{cpi} + b_2 * \pi_{ht-3}^{cpix} + b_3 * \pi_{ht-3}^{cpimed} + b_4 * \pi_{ht}^{SPF} + u_t$$

0	0.10		-0.04		0.00		-0.19		1.19	*	0.86	50
	(0.32)		(0.12)		(0.14)		(0.18)		(0.07)			
1	0.18		-0.15		0.20		-0.29	*	1.18	*	0.82	50
	(0.29)		(0.05)		(0.13)		(0.12)		(0.15)			
2	-0.12		-0.11		0.16		-0.03		0.98	*	0.86	50
	(0.25)		(0.06)		(0.12)		(0.11)		(0.13)			
3	-0.83	*	0.00		-0.05		0.16		1.07	*	0.92	50
	(0.19)		(0.04)		(0.08)		(0.09)		(0.08)			
4	-0.90	*	0.04		-0.16		0.24	*	1.09	*	0.93	50
	(0.23)		(0.03)		(0.08)		(0.10)		(0.08)			

* indicates significance at 5%

Standard errors in parentheses.