Comparing Inflation Expectations of Households and Economists: Is a Little Knowledge a Dangerous Thing?

by Michael F. Bryan
and William T. Gavin

Michael F. Bryan is an economist and William T. Gavin is an economic advisor at the Federal Reserve Bank of Cleveland.

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Many economic decisions depend on the inflation expectations of market participants. For example, households consider future inflation when making intertemporal decisions about consumption, savings, and leisure, and investors allow for potential inflation when estimating the real returns on investments.

For a number of reasons, empirical researchers are paying increasing attention to survey measures of inflation expectations. While reduced-form forecasts are readily available as proxies for inflation expectations, their use generally assumes a long period of policy and structural stability. In the presence of policy and other structural shifts in the economy, direct measures of expectations may adapt to changing conditions faster than model-based ones.

Survey measures of inflation expectations are important to research economists because they provide data on an otherwise unobservable variable. Wallis (1980) and Pesaran (1981) derived the conditions required to identify behavioral parameters in simultaneous rational expectation models. They showed that the assumptions needed to identify behavioral parameters in rational expectation models are arbitrary; these assumptions generally are not implied by economic theory and cannot be tested. Kaufman and Woglom (1983) have suggested using observable survey-based measures of expectations to estimate otherwise unidentifiable, policy-invariant parameters in rational expectation models.

Measures of inflation expectations are important to the Federal Reserve because it has the responsibility for managing the money supply in a way that fosters price stability. Expectations of inflation can influence the linkage between money, interest rates, and prices. Inflation expectations have become especially important in recent years due to the Federal Reserve's disinflationary strategy.

In this paper, we examine the inflation forecasts from two surveys: one taken from households, and the other taken from professional economists.[1] While the state of the art in economic forecasting is still primitive, economists would probably like to believe that they are able to make better inflation forecasts than laymen. In order to determine whether this is so, we compare these two survey forecasts to each other and to a time-series forecast. Pearce (1979) showed that, for the period from 1959 to 1976, a simple univariate ARIMA model produced more accurate out-of-sample inflation forecasts than did a survey of professional economists. We have included a similar model to test whether the Pearce results are valid for recent years and to see how the time series model fares against the

1 Gramlich (1983) presents statistics suggesting that both the economist and the household survey measures of inflation expectations are biased and inefficient. Bryan and Gavin (1986) show that his main results are derived from a mis-specified model. When the specification error is corrected, the Michigan survey of household inflation expectations passes the standard tests for unbiasedness. However, there remains dwbt about the properties of the inflation expectation series derived from the Livingston survey of professional economists.

households' inflation forecast. Embarrassingly enough, our results suggest that the knowledge which economists bring to the forecasting exercise may have made their inflation forecasts less accurate than both the more naive forecast of households and the forecasts generated from a simple, atheoretical, time-series model.

I. Conditional Efficiency of the Survey Forecasts

This section presents results comparing the forecasts of inflation? The household survey of inflation, compiled by the University of Michigan's Survey of Consumer Finances, records 12-month consumer price forecasts for approximately 1,000 randomly selected households. The economists' survey measure is constructed by Joseph Livingston of the *Philadelphia* Inquirer, where year-ahead inflation forecasts of approximately 50 economists are summarized semi-annually.[3]

A simple procedure for evaluating the relative efficiency of competing forecasts is discussed by Granger and Newbold (1977). Since it is only in special cases that we know the minimum attainable forecast variance, they suggest using a criterion of "conditional efficiency" to evaluate forecast accuracy. A forecast is said to be conditionally efficient with respect to another if the variance of that forecast's error is not significantly greater than the variance of the forecast error fiom a combined forecast. In the case of multiple, linearly independent forecasts (P_1^e, $P_2^e \ldots P_n^e$), the "conditionally efficient" forecast, say P_1^e, is defined such that in the ordinary least squares (OLS) regression:

$$(1)\quad P_t = \alpha + \beta_1\ {}_{t-1}P_{1t}^e + \beta_2\ {}_{t-1}P_{2t}^e + \ldots + \beta_n\ {}_{t-1}P_{nt}^e + u_t;$$

where $E(u_t) = 0$ and $E(u_t u_t') = \sigma_u^2 I$, then, $\alpha = 0$, $\beta_1 = 1$, and $\beta_i = 0$ for $i > 1$.

Specifically, we estimated the following equation over the 1949-84 period:

$$(2)\quad P_t = \alpha + \beta_1\ {}_{t-1}P_{1t}^e + \beta_2\ {}_{t-1}P_{2t}^e + u_t$$

where: ${}_{t-1}P_{1t}^e$ = the forecast of inflation for year t fiom the Livingston Survey made in year t-1, and

${}_{t-1}P_{2t}^e$ = the forecast of inflation for year t fiom the Michigan Survey made in year t-1.

The results of this estimation are reproduced at the top of table 1. F-tests were conducted on the joint hypothesis that $\alpha=0$, $\beta_i=1$, and $\beta_{n\neq i}=0$ for $i = 1, 2$. The University of Michigan survey of households was found to be conditionally efficient for both the June and the December inflation forecasts (that is, the hypothesis $\beta_2=1$ and $\beta_1=0$ could not be rejected at the 5 percent level of confidence). This means that the year-ahead forecast of inflation for the survey of households could not be significantly improved using additional information fiom the Livingston survey of economists. However, the economists' survey could have been improved given information contained in the household forecast. That is, the hypothesis that $\beta_1=1$ and $\beta_2=0$ could be rejected at the 5 percent level of confidence (F = 9.17 for the June inflation forecasts and 4.35 for the December inflation forecasts).

Because the Michigan survey results are derived fiom qualitative survey data before 1966, it is not clear what influence knowledge of past experience may have had on developing the procedures used to generate the numerical data and, consequently, on the survey's *ex post* accuracy. We separated the sample at 1966 to examine the period for which the Michigan survey data included only quantitative estimates of inflation.

We also included the one year-ahead univariate time-series forecast of inflation (${}_{t-1}P_{3t}^e$) in the conditional efficiency tests for the post-1966 period to compare the performance of the two surveys against a relatively simple, atheoretical model of inflation.4

2 Other surveys not examined in this paper include the NBER-ASA quarterly survey of inflation expectations a 3 the Money Market Services monthly survey of inflation expectations. Both represent surveys of economists. Victor Zamowitz examines the NBER-ASA in a number of papers. See Zarnowitz (1984) for a recent paper and references to earlier work. Pearce (1985) provides an analysis of the Money Market Services survey of inflation expectations.

3 The form of the Michigan survey has changed substantially over the years. For example. prior to 1966, panel participants were merely asked for qualitative responses. Between the second quarter of 1966 and the second quarter of 1977 respondents had categories of price increases suggested to them, and those who expected prices to fall were not asked to quantify their response. Only since the third quarter of 1977 did Michigan survey panelists actually forecast the rate of inflation. See Juster and Comment (1980) fw a description of the procedures used to derive the household inflation expectations from the Michigan survey data; a summary of this paper is published as an appendix in Noble and Fields (1982). Livingston Survey responses are compiled by the research staff of the Federal Reserve Bank of Philadelphia. The mean expected inflation rate derived from the Livingston survey uses the methodology proposed by Carlson (1977).

4 The time-series model was not included in the full-sample tests fw conditional efficiency because the early observations were needed to generate the out-of-sample forecasts.

The time-series forecast is similar to the one used by Pearce *(1979)*. Specifically, the model used to generate the time-series forecasts is:

$$(3)\quad P^m_t = P^m_{t-1} - \theta a_{t-1} + a_t;\ E(a_t) = 0,$$
$$E(a_t a_t') = \sigma^2_a I.$$

where P^m is the monthly inflation rate (approximated by the first difference in logarithms of the Consumer Price Index) and a is the error. Notice that the n-step-ahead forecast of a first-order moving average model is equal to the one-step-ahead forecast. Three F tests were conducted on the separate hypotheses that each of the forecasts was "conditionally efficient," as defined in *(1)*. The model were conditionally efficient, relative to the survey of economists.

II. An Analysis of Survey Forecast Errors

In *table 2*, we show the mean absolute error (MAE), the root mean square error (RMSE) and the Theil decomposition of the forecast error for the two survey measures of inflation expectations.[5] The Theil decomposition evaluates the portion of the error due to bias (U^M), the portion due to the difference of the regression coefficient from unity (U^R), and the portion due to residual variation (U^D). In an optimal forecast, we expect to find U^M and U^R approximately equal to zero and U^D close to one.

TABLE 1

Conditional **Efficiency** of Alternative Forecasts

Entire Sample

	α	β1	β2	R^2	DW	SEE
1949-1985 June forecasts	*0.71*	*0.12*	*0.89*	*0.69*	*1.57*	*2.10*
t-statistics	*(1.27)*	*(0.46)*	*(3.27)*			
F-statistics		9.17**	*1.19*			
1949-1984 December forecasts	1.13	0.69	0.28	0.67	1.25	2.15
t-statistics	(1.90)	(1.98)	(0.81)			
F-statistics		4.35*	2.02			

Post-1965 **Years**

	α	β1	β2	β3	R^2	DW	SEE
1965-1985 June forecasts	*0.157*	*-0.196*	*0.792*	0.433	*0.73*	*1.63*	*1.81*
t-statistics	*(0.12)*	*(-0.54)*	*(1.97)*	*(1.23)*			
F-statistics		6.41**	*1.11*	*1.87*			
1966-1984 December forecasts	2.743	*0.142*	*-0.690*	*1.167*	*0.59*	*1.18*	*2.28*
t-statistics	*(1.74)*	*(0.28)*	*(-1.02)*	(2.55)			
F-statistics		3.57*	*2.09*	*0.79*			

NOTES: t-ratios for a and β around 0 are in parentheses.
F-statistics are calculated for each β_i under the joint hypothesis that a = 0, $\beta_i = 1$, and $\beta_{n \neq i} = 0$ for i = 1 to 3, respectively.
** = significant at 1 percent.
* = significant at 5 percent.

results of these tests are presented at the bottom of *table 1.*

For both the June and December inflation forecasts, only the survey of professional economists could have been improved given information from the other forecasts. Hence, we could not reject the hypothesis that the household survey and the atheoretical time-series

Over the full period, the Michigan survey has the lowest mean absolute error and the highest value for U^D, while the Livingston forecast does relatively poorly. Only about *70* percent of the Livingston forecast error was residual

5 For a description of this procedure, see Theil (1966) pp. 33-36.

variation. That is, about 30 percent of the economists' inflation error appears to be nonrandom.

In the post-1966 period, which includes the simple time-series model, the time-series model has the lowest mean absolute error, the lowest mean square error, and the lowest residual bias. The Michigan survey of households has the highest portion of the forecast error attributed to residual variation (96 percent). The Livingston survey of professional forecasts is the least accurate inflation guess of the three, and the errors in this survey have a proportionately large nonrandom component.

Alternative Forecast Accuracy

Time Period	Model	MAE	RMSE	U^M	U^R	U^D
June 1949 - June 1984						
	Livingston	1.902	2.715	0.240	0.022	0.738
μ_p = 4.37	Michigan	1.607	2.264	0.074	0.010	0.916
s_p = 3.56						
June 1966 - June 1984						
	Livingston	2.257	2.900	0.194	0.013	0.794
μ_p = 6.64	Michigan	1.904	2.377	0.043	0.000	0.957
s_p = 3.22	Time-series	1.870	2.335	0.018	0.107	0.876

NOTE: μ_p is the average actual inflation rate, s_p is the standard deviation of actual inflation. The time-series forecasts are in-sample forecasts for the period 1949 through 1965. After 1965, the forecasts are 12 months ahead. The model was re-estimated every six months. The first-order MA parameter ranged from a high of 0.729 in 1973 to a low of 0.684 in 1983.

TABLE 2

was 2.335 percent in the post-1966 period, and that the difference between the Michigan and Livingston forecast errors was only 0.5 percent.

Anecdotal evidence for this argument is provided by the generally thin trading in the CPI futures market. Since June 21, 1985, the Coffee, Sugar, and Cocoa Exchange in New York City has made a market in CPI futures contracts. If there were a significant amount of risk uniquely associated with uncertainty about movements in consumer prices (apart from uncertainty about the behavior of interest rates which have very active futures markets), then we would expect active trading in this financial vehicle. However, such active trading has not occurred.

Empirical support for this incentive argument is given by Hafer and Resler (1982), who identified each of the Livingston respondents with one of six professional affiliations. Hafer and Resler argued that only economists employed by nonfinancial businesses had direct and strong incentives to produce accurate inflation forecasts. They show that this group produced better forecasts than did economists from academia, commercial banks, investment banks, the Federal Reserve System, and others. This argument is based on the notion that economists with more incentive to produce a better forecast will spend more resources gathering better information.

This line of reasoning is consistent with the supposition that the mean of the Michigan survey would be a better forecast than any individual economist's forecast. The survey of 1,000 households combines information about inflation in a way that would be very expensive for an individual economist to replicate.

Furthermore, there is a high degree of communication among economists about their forecasts, so that the already small number of respondents in the Livingston survey

III. Is a **Little Knowledge** a Dangerous **Thing?**

Why is the Michigan survey of households a more accurate and less "biased inflation forecast than the Livingston survey? We suggest several possibilities. One may be that the large sample of households is relatively more representative of the participants in the market for the basket of goods covered by the Consumer Price Index. No individual actually buys the representative basket of goods; the basket will vary with demographics and income class. It may be that any small, homogeneous group of consumers would misforecast the inflation rate as badly as do economists. It seems likely that the 50 or so economists in the Livingston survey are as homogenous a group as one might put together from a subset of the Michigan sample. Furthermore, they are highly unlikely to be a representative sample, since they are almost all male and well-paid in comparison to the average consumer.

Another reason for the Livingston economists' relatively poor forecasts may simply be that they have little incentive to do better. The average size of the error from the best forecast is large relative to the difference between the alternative forecast errors. In ***table 2*** we saw that the root mean square error of the time-series forecast may not represent much independent information. This is in strong contrast with the survey in which Michigan respondents are asked to forecast the rate of inflation in the things they buy. This latter survey was designed by specialists to get independent information from a representative sample of consumers. Our results may simply reflect the superior design of the Michigan survey.

Another potential reason for the inferiority of the economists' forecasts is that they may have been relying on econometric models to forecast inflation. Econometric models used during this period typically estimated inflation as an adaptive process, that is, as a weighted average of past inflation rates. Figlewski and Wachtel (1981) show that the poor forecasts in the Livingston survey appear to have been formed in this way. Vanderhoff (1984) presents further evidence that economists' forecasts went astray in much the same way as did econometric forecasts that were based on linear models assumed to have constant parameters.

The naive forecasts of households and the ARIMA model appear to be have captured the essentially nonstationary aspects of the process generating inflation in a way that economists using econometric models did not. We note that there has been a growing tendency for economists to incorporate time-series methods in their econometric models; in particular, economists have been more conscious of the possibility that the variables they study may be generated by nonstationary processes.

IV. Conclusion

We may draw several conclusions from this study. First, none of the forecasts perform well in an absolute sense. The differences among the forecasts are small relative to the size of the mean error of even the best forecast.

Second, we would clearly choose the Michigan survey over the Livingston survey of economists on the basis of historical accuracy. The mean forecast from the Livingston survey has been shown to perform relatively poorly; it does worse than a simple time-series model and worse than a forecast derived from a survey of households. However, the Livingston survey may be useful if one accepts the notion that it is an accurate historical representation of economists' beliefs. For instance, since policymakers rely on economists' forecasts, the Livingston survey may help us understand policymakers' past errors.

Finally, the relatively simple time-series model has performed about as well as the Michigan survey. Thus, for those who seek timely forecasts of the CPI, we recommend this ARIMA model. For those researchers who need an observable measure of expectations, the Michigan survey is more likely to represent the expectations of rational, maximizing agents, than is the extensively-used Livingston survey of economists.

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