The “Rationality” of Survey-Based Inflation Forecasts

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The notion that economic agents rationally form their expectations about future economic events has emerged as a critically important hypothesis with profound implications for macroeconomic policy. For example, modern hypotheses relating to the Phillips curve emphasize that it is the departure of actual inflation from expected inflation that cause any short-run trade-off that may exist between inflation and unemployment. Consequently, empirical tests of many macrotheoretic models require the identification not only of directly observable phenomena, such as inflation and unemployment, but also of expectations or anticipations of these phenomena.

The measurement of generally nonobservable phenomena, such as inflation expectations, poses a difficult challenge in constructing empirical tests for macro models that include such variables. It is first necessary to identify an inflation expectations proxy that is consistent with the assumptions of the underlying model. As a result, tests of theories, such as the natural rate hypothesis, that employ proxy measures for inflation expectations (such as autoregressive procedures) are joint tests of both the underlying theory and the validity of the expectations proxy.

Presumably, autoregressive procedures are used because they are less costly than opinion surveys. When survey-based data on inflation expectations are readily available, this cost argument loses some of its force. Nevertheless, it is important to determine which of the two measures is appropriate for testing various economic theories; that is, whichever measure conforms most closely to the requirements of the underlying theory becomes the measure of choice. For instance, tests of rational expectations models should first establish that the measures of expectations conform to the criteria of rationality. This paper examines whether one particular set of survey data — the Livingston data — meets specified criteria of rationality.¹

Tests of Rational Expectations

The hypothesis of rational inflation expectations, pioneered by John Muth, holds that expectations about future inflation are formed in a manner that fully reflects all currently available and relevant information.² Stated somewhat differently, the observed rate of inflation differs from the expected rate of inflation only by some random error. Thus, the rationality hypothesis can be stated algebraically as:

\[ \pi_t = \pi_t^* + \mu_t \]

where \( \pi_t \) is the actual rate of inflation during period \( t \), \( \pi_t^* \) is the rate of inflation expected at time \( t-1 \) for period \( t \), and \( \mu_t \) is a random variable with mean zero and variance \( \sigma^2 \).

Expressed in this form, i.e., inflation expectations are unbiased estimates of observed inflation, the rationality hypothesis can be tested empirically by estimating the equation.

\[ \pi_t = B_0 + B_1 \pi_t^* + \mu_t \]

where \( \pi_t^* \) represents the survey-based expected inflation rate for period \( t \) made at period \( t-1 \). The notion of rational expectations, then, corresponds to the joint hypothesis that \( B_0 = 0 \) and \( B_1 = 1 \). In addition, \( \mu_t \) should exhibit no evidence of autocorrelation.

Pesando and Figlewski and Wachtel subjected the Livingston expectations series to this test of rationality.¹ Pesando was unable to reject the joint hypothesis using consensus inflation forecasts from each survey for the periods 1959-1969 and 1962-1969. Figlewski and Wachtel, however, were able to reject the null hypothesis using a pooled time series/cross-section sample of 1,864 individual forecasts for the period 1947-1975.

An additional criterion for rationality requires that inflation forecasts be efficient; in other words, the process by which inflation expectations are formed should be identical to the process that actually generates observed inflation. Consequently, any evidence suggesting that some of the relevant information set is not being fully (i.e., efficiently) utilized would indicate rejection of rationality. Pesando tested this notion of rationality by hypothesizing that both the expectations of inflation and inflation itself are described by the history of inflation. Mathematically, this interpretation of rationality can be expressed as:

\[ \pi_t = \sum_{i=1}^{n} B_i \pi_{t-i} + \mu_t \]

\[ \pi_t^* = \sum_{i=1}^{n} B_i' \pi_{t-i} + \mu_{t-1} \]

Efficiency requires that \( B_i = B_i' \) for all \( i \). Pesando, Carlson, and Mullineaux directly tested the efficiency of the Livingston inflation forecasts by estimating equation (3) and then applying an F-test to the sum of the squared residuals.³ Pesando was not able to reject the efficiency criterion at standard confidence levels for the period 1959-1969. Carlson, using the same time period but a revised version of the Livingston data, found that the inflation forecasts do not satisfy the efficiency criterion.⁶

Mullineaux, on the other hand, demonstrated that the error variances of equations (3a) and (3b) estimated by Pesando and Carlson are not homogeneous. Consequently, the F-test used by Pesando and Carlson is inappropriate.⁷ Mullineaux proposed an alternative efficiency test that involves estimating the equation:

\[ \text{FE}_t = (\pi_t - \pi_t^*) = b_0 + \sum_{i=1}^{n} b_i \pi_{t-i} + \varepsilon_t \]

where \( \varepsilon_t = \mu_t - \mu_{t-1} \). The forecast error (FE) is reexpressed on past inflation rates known at the time the forecast was made. Efficiency requires that FE be

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³Alternatively, equation (1) can be rewritten as \( \pi_t = \pi_t^* + \varepsilon_t \), that is, any departure of actual from expected inflation is a random variable with mean zero and variance \( \sigma^2 \).

unrelated to any information known at the time \((t-1)\)
the forecast was formed. In other words, all the
informational content of past inflation rates is fully
utilized in forming expectations. Thus, the null hypoth-
\[ \text{esis is that } b_1 = 0 \text{ and } b_2 = 0 \text{ for all } i, \ldots, n. \]
In addition, efficiency requires that the error term be
serially uncorrelated, or \(\text{Cov}(\epsilon_t, \epsilon_s) = 0\) for \(t \neq s\).
Using Carlson's version of the Livingston data, Mulli-
neaux was unable to reject the efficiency hypothesis
for the period 1959-1969.10

Pearce, using Carlson's data set and another test of
efficiency, concluded that "the survey respondents did
not efficiently use the information in the past history
of the Consumer Price Index (CPI) when forming
their expectations of inflation."11 Thus, it appears that
efficiency tests of the Livingston inflation expectations
data are sensitive to the type of tests used, to the
version of the Livingston data used, and to the time
period examined.

This article demonstrates that these test results are
also sensitive to assumptions about the length of the
forecast horizon. Therefore, it is particularly impor-
tant to determine the actual period over which Liv-
ingston respondents are making their forecasts. The
nature of this problem can be illustrated by a careful
review of the survey method.

**The Forecast Horizon and the Forecast Error**

Livingston conducts his survey each spring and fall,
requesting respondents to indicate their predictions
about a number of economic indicators including the
CPI. For example, in the spring survey they are asked
to predict what the level of the CPI will be in the
following December and June. Because the question-
naires are mailed in April and usually are returned in
May, two interpretations can be made about the fore-
cast horizon. If, as Carlson assumes, the survey re-
spondents know only the April CPI, then they are
implicitly predicting an 8-month rate-of-change (April
to June of the following year). Alternatively, Jacobs
and Jones argue that a more reasonable assumption
is that the respondents actually know or have an accu-
rate estimate of the May CPI.12 This, of course,
means that the forecast CPI implies a 7-month (or
13-month) rate of inflation.

The choice of the forecast horizon can affect the
results of the bias and efficiency tests, especially if
the forecast is interpreted loosely as a prediction of a
steady inflation. Mullineaux and Resler each made this
assumption; i.e., they assume that the prediction is a
constant rate-of-change for any period within a given
forecast horizon.13 This assumption is often conven-
tient and may not be inappropriate when the investi-
gation focuses on the process that generates the fore-
cast. It may pose problems, however, when efficiency
tests, such as those represented by equation (4), are
conducted.

Because the survey respondents are, in fact, fore-
scasting an inflation rate over a 7- or 8-month horizon,
it is desirable to evaluate equation (4) by calculating
the forecast error over that time horizon. For example,
\(FE_x\) should be calculated by taking the difference be-
tween the actual rate of inflation occurring between
April (or May) and December and the rate of infla-
tion predicted for that period. This forecast error
should be regressed against lagged inflation rates
known to the forecaster as of April (or May). This
approach differs from Mullineaux's procedure in which
\(FE_x\) was computed as of the time the next forecast was
made (i.e., October). This approach seems inappro-
priate for evaluating the efficiency of the forecasts,
especially since the forecasts exhibit expectations of
accelerating inflation. The next section reevaluates the
tests for bias and efficiency in light of these new tim-
ing assumptions.

**Empirical Results**

To investigate the importance that assumptions
about the forecast horizon have on tests for bias and

10It should be noted that, although the heterogeneous variance
problem that plagued the Chow tests of Pesando and Carlson
is alleviated here, the procedure employed does require the
maintained hypothesis of independent errors.

11Mullineaux also found that for the data set used by Pesando
(i.e., inflation forecasts inferred from the originally published
versions of Livingston data), the hypothesis of efficiency is
rejected.

12Pearce, "Comparing Survey and Rational Measures . . . . " p. 451. Pearce statistically analyzes the forecast errors ob-
tained by using either the Livingston forecasts or forecasts
generated from a continuously updated moving average model [MA(1)] of the monthly CPI series.

13Jacobs and Jones, "Price Expectations in the United States:
1947-1975."

14This essentially requires that inflation forecasts are linear.
Thus, changes from one point to another within the fore-
cast horizon will not be distinguishable. If, however, infla-
tion expectations are not linear over different time horizons
(e.g., 6 or 8 months), then the assumption of a steady rate
of inflation prediction is vitiated. The fact that the 14-month
forecasts are greater than the 8-month forecasts in 38 out
of 40 observations from 1959-1978 suggests that the assump-
tion of a constant rate of inflation within the 8- or 14-month
periods may not be appropriate. See Mullineaux, "On Test-
ing for Rationality," In. 3. See also, David H. Resler, "The
Formation of Inflation Expectations," this Review (April
1980), pp. 2-12.
efficiency (and hence rationality), the three alternative forecast horizons discussed in the preceding section are utilized in direct empirical comparisons. Based on these forecast horizons, three forecast error series are calculated and employed in the efficiency tests reported below. To reiterate, these alternative FE, series are determined by assuming an April-October forecast horizon (Mullineaux), a May-December forecast horizon (Jacobs-Jones), and an April-December forecast horizon. All tests use Carlson’s version of the Livingston data (i.e., sample average CPI forecasts from which the expected inflation rate is generated).

To facilitate computation of the appropriate F-statistics, the following sample periods are used: 1959-1969, 1959-1975, and 1959-1978 excluding the 1971-1973 period of price controls of various phases.\(^\text{14}\)

To test for bias in the inflation forecasts, equation (2) is estimated and an F-test on the joint hypothesis that \(B_0 = 0\) and \(B_1 = 1\) is conducted for each of the alternative forecast horizons.\(^\text{15}\) The F-values calculated for this test are presented in table 1, and allow rejection of the null hypothesis at the 1 percent level, irrespective of the sample period chosen. This result contrasts directly with Pesando’s but is consistent with the findings of Figlewski and Wachtel, who found the Livingston data to be biased.\(^\text{16}\) An examination of the individual coefficients, \(B_0\) and \(B_1\), indicated that the joint hypothesis is rejected primarily because \(B_1\) exceeds unity for all the sample periods. Nevertheless, the results indicate a tendency for \(B_1\) to decline toward unity as more recent observations are added to the sample, suggesting that forecasters gradually adjusted to the accelerating inflation of the 1960s and early 1970s.\(^\text{17}\)

Table 2 presents additional information on the accuracy of the inflation expectations series. Although the root-mean-squared error and mean error statistics vary only slightly between forecast horizons, the Theil statistics indicate that the fraction of forecast error due to bias is reduced somewhat by using the May-December horizon. It is interesting to note that, of all of the horizons examined, the April-December assumption continually yields statistics suggesting greater problems with bias than variance or covariance in the forecasts.\(^\text{18}\)

Although unbiased forecasts satisfy one criterion for rationality, it is common to find properties of bias in other non-survey-based inflation forecasts. For instance, Lombra and Moran note that, while the Federal Reserve Board staff’s forecasts of nominal GNP are unbiased, its forecasts of GNP’s real and inflation components show evidence of systematic errors.\(^\text{19}\)

It is possible that inflation forecasts can show evidence of systematic bias yet still be characterized as unbiased forecasts. For example, Pesando, “A Note on the Rationality . . .” and Figlewski and Wachtel, “The Formation of Inflationary Expectations.”

### Table 1

<table>
<thead>
<tr>
<th>Bias Test for “Short-Run” Inflation Forecasts</th>
<th>F-Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Period</td>
<td>F-Values</td>
</tr>
<tr>
<td>1959-1969</td>
<td>F(2.52)</td>
</tr>
<tr>
<td>1959-1975</td>
<td>F(1.30)</td>
</tr>
<tr>
<td>1959-1978</td>
<td>F(2.05)</td>
</tr>
</tbody>
</table>

\(^\text{14}\)This truncated 1959-1978 sample period was chosen to exclude observations of forecasts errors that occurred during the period of wage and price controls. It seems reasonable that forecasters would have encountered considerably more difficulty in forecasting inflation during this period, since the controls were applied unevenly and gradually relaxed at unpredictable intervals.

\(^\text{15}\)To facilitate computation of the appropriate F-statistics, equation (2) was modified slightly. Specifically, subtracting \(\bar{x} \cdot \bar{\epsilon}_t\) from each side of (2) produces:

\[ (2') \quad \bar{x}_t = \bar{x}_t \cdot \bar{\epsilon}_t = B_0 + (B_1 \cdot \beta) \cdot \bar{x}_t + \bar{\epsilon}_t. \]

The null hypothesis then implies that the estimated slope and intercept of equation (2’) be jointly equal to zero.


\(^\text{17}\)In studies of the process by which inflation forecasts are generated, more definitive evidence indicates that this process has changed over time. For more detail about this evidence, see Donald J. Mullineaux, “Inflation Expectations and Money


Because acceptance of the efficiency hypothesis in the present context requires that \( b_i = 0 \) for all \( i = 1, \ldots, n \) and that the estimated relationships indicate no evidence of serial correlation, the statistics of primary interest are the reported F-values and the Durbin-Watson and Durbin-h statistics. The reported F-value is pertinent for testing the joint hypothesis that all the \( b_i \) (\( i = 1, \ldots, 5 \)) are concurrently zero. Both the Durbin-Watson and Durbin-h statistics test for the presence of serial correlation. Although the Durbin-Watson statistic is usually appropriate, Durbin has shown that the \( h \) statistic is more efficient when the set of independent variables includes a lagged dependent variable. Because Mullineaux has interpreted equation (4) as containing a lagged dependent variable, both statistics are reported.

Ordinary least squares estimates of equation (4), using the alternative FE\(_t\) series and sample periods, are presented in table 3. These results differ considerably from those of Mullineaux, and they highlight the importance of specifying the time period over which FE\(_t\) is calculated. If FE\(_t\) is evaluated at the end of the period over which the respondents were forecasting inflation (e.g., December), the efficiency hypothesis is rejected in all but one instance. The results for the three different time periods are now discussed in greater detail.

Turning first to the 1959-1969 period, the reported F-statistic for the May-December and the April-October forecast horizons indicates that the efficiency criterion is satisfied. Recalling that the April-October horizon corresponds to the assumption made by Mullineaux, these results are essentially consistent with his. The Durbin-h statistic for the April-October horizon, however, indicates the presence of negative serial correlation, even though the Durbin-Watson statistic falls within the indeterminate range. Since

20For purposes of comparison, Mullineaux's estimation results are presented here:

\[
\pi_{t-1}, \pi_{t-2} = -0.232 + 0.237\pi_{t-1}, -0.051\pi_{t-3} + 0.251\pi_{t-4},
\]

\[
(1.91) (1.44) (0.27) (1.36)
\]

\[
+ 0.050\pi_{t-1} + 0.083\pi_{t-2},
\]

\[
(0.25) (0.48)
\]

\[
R^2 = 0.102, h = 1.89, F = 1.48.
\]

The difference between Mullineaux's results and those in table 3 may well be due to the use of different computer algorithms. As such, the difference between the Durbin-h values may not be representative of true differences in the respective residual processes.

Table 3

Efficiency Test Results

<table>
<thead>
<tr>
<th>Forecast horizon</th>
<th>Coefficients</th>
<th>Summary statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>b₀</td>
<td>b₁</td>
</tr>
<tr>
<td>April-October</td>
<td>-0.244</td>
<td>0.244</td>
</tr>
<tr>
<td>(0.46) (1.48)</td>
<td>(0.26) (1.37)</td>
<td>(0.26) (0.48)</td>
</tr>
<tr>
<td>May-December</td>
<td>-0.493</td>
<td>0.193</td>
</tr>
<tr>
<td>(1.02) (1.19)</td>
<td>(0.61) (1.10)</td>
<td>(0.58) (0.22)</td>
</tr>
<tr>
<td>April-December</td>
<td>-0.345</td>
<td>0.218</td>
</tr>
<tr>
<td>(0.88) (1.79)</td>
<td>(0.36) (2.16)</td>
<td>(0.13) (0.47)</td>
</tr>
<tr>
<td>April-October</td>
<td>0.695</td>
<td>0.397</td>
</tr>
<tr>
<td>(1.53) (2.82)</td>
<td>(0.02) (0.55)</td>
<td>(1.44) (0.71)</td>
</tr>
<tr>
<td>May-December</td>
<td>0.442</td>
<td>0.435</td>
</tr>
<tr>
<td>(1.91) (3.29)</td>
<td>(0.61) (0.64)</td>
<td>(2.43) (1.40)</td>
</tr>
<tr>
<td>April-December</td>
<td>0.717</td>
<td>0.368</td>
</tr>
<tr>
<td>(1.74) (2.86)</td>
<td>(0.22) (0.35)</td>
<td>(2.21) (1.23)</td>
</tr>
<tr>
<td>April-October</td>
<td>0.649</td>
<td>0.300</td>
</tr>
<tr>
<td>(1.44) (2.06)</td>
<td>(0.35) (0.28)</td>
<td>(1.41) (0.56)</td>
</tr>
<tr>
<td>May-December</td>
<td>0.414</td>
<td>0.340</td>
</tr>
<tr>
<td>(0.96) (2.43)</td>
<td>(1.06) (0.29)</td>
<td>(2.31) (1.07)</td>
</tr>
<tr>
<td>April-December</td>
<td>0.668</td>
<td>0.269</td>
</tr>
<tr>
<td>(1.69) (2.11)</td>
<td>(0.63) (0.06)</td>
<td>(2.26) (1.10)</td>
</tr>
</tbody>
</table>

1Test results based on equation (4).
2Values in parentheses represent absolute values of t-statistics.
3R² is the coefficient of determination corrected for degrees of freedom; D.W. is the Durbin-Watson statistic; h is the Durbin-Watson statistic; S.E.E. is the standard error of the equation; F is the calculated F-value to test the joint hypothesis that all bₖ (k = 1, ..., 5) equal zero, and F* represents the relevant critical F-value.

Efficiency requires no serial correlation among the residuals, the hypothesis of efficiency for the April-October horizon remains unresolved. Unlike these two forecast horizons, however, the results based on using the April-December assumption clearly permit rejection of the efficiency hypothesis.22

In contrast to the results for the 1959-1969 period, the hypothesis of efficiency is unambiguously rejected at the 5 percent level for each forecast horizon examined during the entire 1959-1978 sample period. The hypothesis is also rejected at the 1 percent level for the May-December and April-December horizon periods. Based on these test results, the period from 1959-1978 does not appear to be one in which Livingston forecasters, on average, efficiently utilized the information contained in the history of observed inflation rates.

Similarly, when the period of wage price controls is excluded, the efficiency criterion is not satisfied if the forecast error is calculated at the end of the forecast period (e.g., in December). For instance, when the forecast error is measured at the end of the period over which the forecast is made, the F-test permits a rejection of the efficiency hypothesis at the 5 percent level.23 The efficiency hypothesis is not re-

22It should be recalled that the April-December forecast horizon does not require the special assumptions necessary to construct the competing forecast error series. We know that Livingston supplies the April CPI to the survey recipients and specifically asks for their December CPI forecast.

23The efficiency hypothesis cannot be rejected, however, at the 1 percent level when the 8-month (April-December) forecast horizon is employed.
jected only when the forecast error is evaluated in October (as in Mullineaux).

**Efficiency of the 12-Month Forecasts**

Most previous analyses of the Livingston inflation forecasts focus on the short-run (8-month) forecasts. Because the respondents are asked at each survey date to predict the level of the CPI for the following December and June, the forecasts embody both an 8-month and a 14-month (long-run) prediction of the inflation rate. This section examines the rationality of the 14-month forecasts.

The methodology used here slightly modifies the approach used for the 8-month forecasts. Specifically, the lagged inflation rates in equation (4) are now interpreted as occurring over 12-month periods (again, observed in either April or October). This assumption requires that the estimation of these equations for the 14-month forecasts be modified.

Because the forecasts are made at 6-month intervals, this new interpretation means that the first lagged term in equation (4) contains information that overlaps from the previous period, if all available observations are included in the estimation procedure. Such overlapping observations may introduce serial correlation into the equation. To avoid this problem, separate estimations of equations (2) and (4) are made for each semiannual observation of the 14-month forecast; that is, each sample period is split into two data sets, one consisting only of the June forecasts and the other consisting only of the December forecasts. With these modifications, equations (2) and (4) are estimated for the three time periods used in the previous section.

The analysis first examines the 14-month forecasts for bias. F-statistics were computed from the regressions of equation (2) for each semiannual forecast series over each sample period. These F-values reported in table 4, again indicate that the forecasts are biased. Table 5 provides the statistics for Theil’s analysis of the forecast errors. These results also show that 33-54 percent of the forecast error is due to bias. Nevertheless, as with the “short-run” forecasts, the portion due to bias declines as new data are added.

The efficiency test is then applied to the 14-month forecast errors. The forecast errors are consistently measured as of the end of the period over which the forecast was made. The F-statistics and the Durbin-Watson statistics for these equations are reported in table 6. In contrast to the 8-month (April-December) inflation forecasts, the results for the 14-month forecasts do not permit rejection of the efficiency hypothesis. Because halving the sample period severely reduces the degrees of freedom, these results should be interpreted with considerable caution. Nevertheless, the F-statistics suggest that the errors in the 14-month forecasts are not correlated with observations of past inflation available at the time the forecast was made. The Durbin-Watson statistics, however, indicate that the hypothesis of no serial correlation cannot be rejected nor accepted. Thus it appears that, based on the F-test, the 14-month forecasts comply with the efficiency criterion.

These contrasting results for the 8-month and 14-month forecast horizons cast some doubt on the findings that the Livingston forecasts are not formed efficiently. This disparity may indicate that forecasters are better able to anticipate longer-term movements in economic variables, such as inflation, relative to explaining the short-term vagaries of the time series. For instance, if the actual rate of inflation is accelerating within the 14-month period, the forecaster may be able to forecast efficiently the overall rate of change but not be able to forecast the rate within shorter sub-periods.

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24 Introduction of serial correlation tends to bias the efficiency test toward rejecting the null hypothesis. Recall that an additional criterion for efficiency is that the estimation be free of autocorrelation.

### Table 5

**Analysis of 14-Month Forecast Errors**

<table>
<thead>
<tr>
<th>Forecast horizon assumption</th>
<th>Sample period</th>
<th>AMSE</th>
<th>Theil statistics</th>
<th>RMSE</th>
<th>Mean error</th>
<th>( U^m )</th>
<th>( U^v )</th>
<th>( U^c )</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>1959-69</td>
<td>1.120</td>
<td>0.824</td>
<td>0.540</td>
<td>0.337</td>
<td>0.123</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1959-78</td>
<td>1.964</td>
<td>1.298</td>
<td>0.436</td>
<td>0.208</td>
<td>0.356</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1959-78(^a)</td>
<td>2.022</td>
<td>1.383</td>
<td>0.468</td>
<td>0.222</td>
<td>0.310</td>
<td></td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>1959-69</td>
<td>1.182</td>
<td>0.782</td>
<td>0.439</td>
<td>0.474</td>
<td>0.088</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1959-78</td>
<td>2.065</td>
<td>1.190</td>
<td>0.326</td>
<td>0.198</td>
<td>0.477</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>1959-78(^a)</td>
<td>1.976</td>
<td>1.133</td>
<td>0.329</td>
<td>0.194</td>
<td>0.477</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1RMSE is the root-mean-squared error; \( U^m \) is the Theil bias coefficient; \( U^v \) the variance coefficient; and \( U^c \) the covariance coefficient.

\(^a\)Omits the 1971-1973 price control years.

### Table 6

**Efficiency Test Results: 14-Month Forecasts**

<table>
<thead>
<tr>
<th>Sample period</th>
<th>June forecasts</th>
<th>December forecasts</th>
<th>F(^*) (0.05, 0.01)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>F</td>
<td>D.W.</td>
</tr>
<tr>
<td>1959-69</td>
<td>11</td>
<td>0.426</td>
<td>1.38</td>
</tr>
<tr>
<td>1959-78(^a)</td>
<td>20</td>
<td>1.049</td>
<td>1.88</td>
</tr>
<tr>
<td>1959-78(^a)</td>
<td>18</td>
<td>0.875</td>
<td>1.34</td>
</tr>
</tbody>
</table>

1N is the respective sample size; F is the calculated F-statistic; D.W. is the Durbin-Watson test statistic; and \( F^* \) represents the relevant critical F-value.

\(^a\)Omits the 1971-1973 price control years.

### Summary

This paper has reexamined the rationality of the inflation forecasts contained in the Livingston survey data by emphasizing that the inflation forecast error should be calculated in a manner consistent with the forecast horizon used by the survey respondents. Specifically, empirical tests for bias and efficiency of the forecasts were employed to determine the effect that changes in the assumption about the forecast horizon have on the conclusions of previous investigations. The test for bias indicated that, regardless of the forecast horizon or the sample period used, the Livingston forecasts exhibited characteristics of bias.

The "efficiency" test suggested by Mullineaux was also employed. These test results indicate that over the period, 1959-1969, only one forecast horizon (April-December) could be judged unambiguously inefficient. When the 1959-1978 period is examined, however, the results for each forecast horizon allow rejection of the efficiency hypothesis. When the period of wage-price controls is deleted from this sample period, only the April-October forecast horizon is judged efficient.

These findings imply that conclusions regarding the forecast efficiency (and, therefore, rationality) of the Livingston inflation expectations are sensitive to the period over which the forecast error is evaluated. Because the survey respondents are asked specifically to predict the level of the CPI for the following June or December, it seems appropriate that tests of
efficiency be formulated to measure the forecast error only after the actual value of the predicted CPI becomes known. When this approach is used in conjunction with the assumption of either a May-December or April-December forecast horizon, the results indicate that the forecasters did not efficiently use the information available at the time of the survey in five out of six samples. This conclusion contrasts sharply with that reached when the forecast error is calculated at the time the forecasts are made (i.e., April or October).

Finally, evidence about the bias and efficiency of the 14-month forecasts indicates that these longer forecasts are efficient, even though, like the 8-month forecasts, they are apparently biased. Although the apparent disparity in the efficiency tests between the "short-" and "long-run" forecasts is somewhat puzzling, it suggests that the forecasters are more efficient at predicting longer term inflation trends than short-term movements in the series.

The evidence presented here indicates that Carlson’s sample average forecasts of the rate of CPI inflation in the Livingston data do not conform to two criteria of rationality. Consequently, the use of these data in empirical investigations of rational expectations models appears to have serious limitations. In addition, the observation that these survey-based inflation expectations fail to conform to rationality criteria suggests that adjustments in expectations evolve slowly. This further implies that, even if inflation forecasts are ultimately rational, fully anticipated short-run monetary policy actions may have important economic effects since inflation expectations adapt slowly. These and other possible implications of the apparent non-rationality of survey-based expectations deserve further study.

We would like to thank Don Mullineaux and Doug Pearce for their helpful comments on an earlier draft of this paper. Their contributions in no way imply complete agreement with the opinions expressed herein.