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THE STRUCTURE OF EXPECTATIONS OF THE WEEKLY MONEY SUPPLY ANNOUNCEMENT

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ABSTRACT

This paper examines the structure of expectations of the weekly money supply announcement in the late 1970s. The data used are from a weekly telephone survey of money market participants. The rationality and structure of expectations are explored with the data organized in three ways: the mean response to each weekly survey, the pooled sample of individual responses, and time series of responses by each individual in the survey. The effect of data aggregation on rationality tests is investigated. The structure of the expectations data are also examined and it is found that both strong regressive influences and adaptive learning characterize the data.

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The emphasis on the role of money in macroeconomic theory and policy discussions in recent years has led to an increased interest in expectations concerning the growth of the money supply. Although the structure and accuracy of expectations are of paramount theoretical importance, these issues are difficult to analyze because expectations are not easily observable. Occasionally, directly observable expectations from surveys can be utilized. In this paper we analyze the structure of expectations concerning the weekly announcement of the change in the money supply with data from a survey of forecasts made by financial market participants.

The weekly announcement of the money supply is often viewed as an important piece of information concerning past and future monetary policy and financial market conditions. Consequently, financial market participants make an effort to forecast the announcement and use the announced information in evaluating the state of the economy. Elsewhere (Urich and Wachtel [1981]; Urich [1982]), we have analyzed the effect of these expectations and forecast errors on market interest rates.

The data used in this study were obtained from Money Market Services, a San Francisco firm which has collected weekly forecasts of the change in the money supply from a telephone poll of about 50 government securities dealers since mid-1977. The Federal Reserve's data release emphasizes the week-to-week change in the money supply, and Money Market Services obtains forecasts of the change in the narrowly defined money supply, M1. It is these data that are given the most attention by market participants.[1]

We have data for 95 weeks extending from the beginning of March 1978 to the end of January 1980. The analysis of the structure of expectations requires the identification of individuals' responses over time which could only be made with a sub-sample of 20 regular survey respondents. For the analysis of forecast accuracy, all the available data could be utilized, but there were no apparent differences between the results presented below and those with the entire data set.

The empirical examination of the data is divided into two sections. The first is concerned with standard tests for the rationality of forecasts and the second presents estimates of some models of expectations formation.

Although this study represents the first examination of the data just described, there are several studies of the structure and rationality of directly measured expectations of other economic data. The most familiar of these is the Livingston data on price expectations which makes use of a semi-annual survey of forecasters that began in 1947.[2] The Livingston data are, however, very different from the data used here. They reflect expectations

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[1] Money Market Services conducted its poll on Tuesday and again on Thursday morning to obtain expectations of the change in the money supply which was announced on Thursday. In this paper, we only use expectations from the Thursday survey, since preliminary work indicated little difference between the two surveys. The survey procedures were changed when the money supply announcement was shifted to Friday in January 1980, after the end of our sample period.

[2] For a description, see Wachtel (1977) and for a discussion of modelling and rationality, see Figlewski and Wachtel (1981). Friedman (1980) examines interest rate expectations.

of economic events over a 6 or more month horizon, while our data concerns expectations formed each week of the data announced at the end of the week. Thus, the structures of the expectations formation process are likely to be very different.

Rationality of Forecasts

The money supply change forecasts made by financial market participants should make use of all available relevant information or, in other words, be rational forecasts. Two common tests for rationality are applied to these data: tests for the unbiasedness and for the efficiency of the forecasts. Forecasts are unbiased if the null hypothesis $(\alpha, \beta) = (0, 1)$ cannot be rejected from the regression:

$$M = \alpha + \beta EM + u \qquad (1)$$

where M is the announced change in the money supply and EM is the expected change.[3]

The test for efficiency is based on the idea that rational forecasts utilize any available information which affects the actual money supply. As discussed by Pesando (1975), forecasts are weak-form efficient if the actual and expected money supply series share a common time series structure. Experimentation with various ARIMA specifications indicates that a second

[3]The actual change in the money supply used throughout the paper is defined as $M_t = m_t - m_{t-1}$, where m_t is the first announcement of the money supply in week t. The results reported are the same when the money supply change is defined as $m_t - m'_{t-1}$, where m'_{t-1} is the revision for the money supply in week t-1 announced in week t.

order autoregressive structure provides an adequate representation of the actual weekly money supply change data:

$$M = \beta_0 + \beta_1 M_{-1} + \beta_2 M_{-2} \qquad (2)$$

If the expectations are efficient, they should incorporate this information in the same fashion:

$$EM = \beta_0' + \beta_1' M_{-1} + \beta_2' M_{-2} \qquad (3)$$

That is, efficiency implies that $(\beta_0, \beta_1, \beta_2) = (\beta_0', \beta_1', \beta_2')$. A direct test of the efficiency hypothesis is from the regression:

$$(M-EM) = \gamma_0 + \gamma_1 M_{-1} + \gamma_2 M_{-2} \qquad (4)$$

Expectations are efficient if the null hypothesis that $(\gamma_0, \gamma_1, \gamma_2) = (0, 0, 0)$ cannot be rejected.[4]

Even if the time series model given by equation (2) is misspecified, rejection of the null hypothesis on the coefficients of equation (4) implies that efficiency is rejected. Non-zero coefficients in equation (4) indicate that there exists readily available information (prior changes in the money supply) which could be used to systematically reduce the forecast errors. That is, there is evidence of inefficient use of available information.

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[4]For both the unbiasedness and efficiency hypotheses, the test statistics are based on the joint distribution of the regression coefficients. Generally, for the model $y = X\beta + u$ where b is the least squares estimator of β, the test statistic for the null hypothesis that β is equal to the particular value β_0 is:

$$F = (\beta_0 - b)' X'X(\beta_0 - b)/KS_e^2$$

Where K is the number of elements in the vector b, S_e is the standard error of the regression and F is distributed with K and N-K degrees of freedom.

Efficiency and unbiasedness tests of survey data are usually applied to a time series of the mean survey responses. This procedure is common because individual survey responses are often unavailable. However, it introduces an aggregation bias which can severely distort the results of rationality tests, as will be discussed below. Results with the survey means are shown to illustrate the extent of the bias. For this study, a pooled cross section-time series of individual survey responses is utilized to test for rationality.

It is also possible that some but not all of the respondents provide rational forecasts. Thus, it is useful to test for differences among respondents by examining the rationality of each individual. For this purpose, the data are organized into 20 time series, each one of which is the weekly forecasts of an individual respondent. An additional benefit of this procedure is that it avoids a problem associated with the pooled sample. That sample is so large that small forecasts errors lead to rejection of the rationality hypotheses when standard statistical tests are applied.

An analysis of variance is used to test the pooled sample against the set of time series for each respondent. To anticipate our results, the pooled sample is rejected in favor of this last alternative for both testing equations. Finally, the tests on the individual time series will show a greater incidence of forecast bias than would be indicated by chance and little indication of informational inefficiency. The discussion begins with the tests for unbiasedness.

Figlewski and Wachtel (forthcoming) have shown that the use of a sample of survey means for the unbiasedness tests introduces a specification error.

The survey mean may not be a rational forecast even when all individual forecasts are rational. The precise relationship between the pooled and survey mean has been investigated by Dietrich and Joines [forthcoming]. The slope coefficient in the unbiasedness equation (1) from the pooled data, β^P, and from the aggregated (survey mean) data, β^M, are related in the following manner:

$$\frac{\beta^M}{\beta^P} = 1 + \frac{\sum_t^T \sum_i^N (EM_{it} - EM_t)^2}{N \sum_t^T (EM_t - \overline{EM})^2}$$

where EM_{it} is the money supply change expectation of the i^{th} respondent in week t, EM_t is the mean survey response in week t, $\overline{EM}$ is the overall mean and T and N are the number of weeks and respondents, respectively. It is clear from the above that $\beta^M \geq \beta^P$. With our data, the slope coefficients in both the bias equations are less than one, so β^M, which is larger, is closer to one. Aggregation to survey means then increases the likelihood of accepting the null hypothesis of unbiasedness.

Results for the unbiasedness tests are shown in the top panel of Table 1. For the sake of comparison, results with the survey means are shown in equation (1). They are followed by results with the pooled sample, equation (2). It is clear that the aggregation of the sample into a time series of survey means has a large effect on the results. As discussed earlier, β is closer to unity with the aggregated sample.[5] Thus, the data in that common form suggests that the null hypothesis of unbiasedness cannot be rejected.

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[5]Similar aggregation bias results were found by Figlewski and Wachtel (1981) in a study of the Livingston survey data on inflationary expectations.

With the preferred pooled sample $\beta = .77$ and the null hypothesis is rejected.[6] However, this result may be suspect because of heteroscedasticity among the residuals from each survey week. The standard errors of the residuals for each week from equation (2) in Table 1 are used to make a heteroscedasticity correction. Each observation is divided by the standard error of the residuals for that week from equation (2). The re-estimated equation is (3) in Table 1 which indicates an ever larger slope bias.

As noted earlier, an alternative way of examining the data is to test for the rationality of the forecasts of individual respondents. The test results for the 20 individuals in the sample are shown in Table 2. The disaggregation of the pooled data sample into separate regressions for each respondent adds significantly to the explanatory power of the unbiasedness equation. That is, the model estimated in Table 1, equation 2:

$$M_t = \alpha + \beta EM_{it} + u_{it}$$

is tested against the alternative model:

$$M_t = \alpha_i + \beta_i \; EM_{it} + u_{it} \qquad i=1,\ldots,20$$

shown in Table 2. The F-statistic which is 6.90 with (2,1852) degrees of freedom indicates that the model using the pooled data sample can be rejected. In addition, the null hypothesis of unbiasedness can be rejected at the 5% level for 11 of the 20 forecasters and at the 1% level for 2 of the 20. There is clearly a greater incidence of bias than would be expected from

[6] It is easy to reject the null hypothesis because the regression is estimated from a large number of observations which determines the degrees of freedom. However, there are not that many truly independent observations since the dependent variable has values which repeat for each survey respondent.

sampling variation. The evidence of bias in forecast behavior in the sample period is therefore quite strong; about half of the forecasters were making systematic errors in this period.[7]

The presence of serial correlation in the unbiasedness equations would indicate systematic errors that could readily be corrected. For the 20 individual respondents, all but one of the equations show no indication of first order serial correlation. Examination of higher order autocorrelations of the forecast errors for each of the 20 individuals provided only a few instances of significant autocorrelations.

Turning now to the efficiency test, only results with the pooled sample are shown since the least squares estimates of the coefficients for the pooled and means samples are exactly the same because the right hand side variables are the same for each individual. Although the F-statistics for the efficiency tests in Table 1 indicate that the null hypothesis can be rejected (i.e., prior changes in the money supply contain information that could be used to reduce the forecast error), the coefficients are very small.[8]

Additional and perhaps more relevant evidence is provided by examining the efficiency of each of the 20 individual respondents. This form of data organization yields a significant increase in the explanatory power of the

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[7] This may not be surprising because the sample period is one of tumultuous change in financial markets. In particular, the last 11 surveys (out of 95) took place after the Federal Reserve's announced change in operating procedures (on October 6, 1979). Although there are not enough surveys to examine forecast behavior after the Fed's shift to monetary aggregates targets, it is useful to see if these surveys are unduly influencing the reported results. For the truncated sample, 9 out of 20 forecasters show bias (at the 5% significance level). Thus, the conclusions are unaffected by the inclusion of the post-October 1979 data.

[8] It is interesting to note that when the sample of survey means is used, the null hypothesis of efficiency is not rejected. The F-statistic is 1.13 with (3, 92) degrees of freedom.

efficiency equations. The F-statistic for the comparison of the pooled regression to the 20 individual regressions is 5.68, with (3, 1792) degrees of freedom. The individual regressions lend support to the efficiency hypothesis since none of the F-statistics for the null hypothesis of zero coefficients is significant at the five percent level (see Table 2).[8a] Furthermore, there is no indication of serial correlation among the residuals in the efficiency tests for the individual respondents.

It is clear from the above discussion that the analysis of the rationality of money supply expectations is highly dependent upon the form of the data used for the tests. If we apply the usual and erroneous procedures applied to surveys of forecasts, which is to study the mean of the forecasts for each survey, the data seems to support the rationality hypothesis. However, when the same statistical tests are applied to the disaggregated or pooled data, the rationality hypotheses are resoundingly rejected. Due to the very large size of the pooled sample, economically inconsequential deviations from rationality can lead to rejection of the null hypothesis. To avoid this problem, the tests were also applied to the behavior over time of each individual respondent. Furthermore, analysis of variance tests indicate that this form of data organization is superior for both the unbiasedness and efficiency tests. With this preferred sample design, a large proportion of the respondents exhibit systematic biases, although they all provide informationally efficient forecasts.

Finally, Theil's decomposition of the mean square error of forecast provides a graphic picture of the forecast error. The decomposition of the mean square error into three components is given by:

[8a]This result is also true when the sample period ends just before the change in Federal Reserve operating procedures (October 6, 1979).

$$\frac{1}{N}\Sigma(M - EM)^2 = (\bar{M} - \overline{EM})^2 + (1 - \beta)^2 S^2_{EM} + (1 - r^2) S^2_M$$

where β is the slope coefficient from the unbiasedness test, S^2_{EM} and S^2_M are the variance of EM and M, respectively, and r is the correlation of EM and M. The three terms on the right hand side represent bias (the error of the mean forecast), inefficiency and random effects, respectively. The decomposition for the pooled sample (Table 1, equation (2)) is:

$$3.075 = (.537 - .620)^2 + (1 - .767)^2(1.874) + (1 - .377)(4.055)$$

The random term accounts for 94.4% of the mean square error, the bias term 2.3% and the inefficiency term 3.3%. There is very little variation in the results of the decomposition among the 20 individual forecasters. The random term is always more than 90% of the total mean square error.

The results indicate a remarkable similarity among the forecasters. In all cases, the expected monetary change (EM) averages substantially more than the actual chamge (M). For the whole sample, $\overline{EM}$ is about 1.7 times the size of $\bar{M}$, and the differences among the 20 individuals are very small. Consequently, as seen in Table 2, the constant in the unbiasedness equation is always negative and the slope always less than one.[9] That is, all the forecasters tend to over-estimate the change in the money supply in this two-year period and their predictions are much less volatile than the actual changes. The variance of the actual changes is more than twice the size of the variance in the predicted changes.

Theil also suggested the inequality coefficient as a summary measure of forecast accuracy. It is given by:

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[9]Friedman's study of interest rate expectations and Figlewski and Wachtel's study of inflationary expectations also indicate that the slope is less than one.

$$U^2 = \frac{\Sigma(EM - M)^2}{\Sigma EM^2}$$

which has a value of zero if all forecasts are perfect and one if the forecasts have the same mean square error as the naive extrapolation of no change in the money supply. The individual survey respondents are quite similar; the values of U^2 range from .67 to .87.

Structure of Expectations

The economics literature discusses several models for the structure and formation of expectations which can be applied to the survey data on the expected change in the money supply. In this section, some standard model structures are specified and estimated. The specifications are tested against each other to see whether the data favor a particular structure for expectations formation. The particular models investigated are for adaptive, extrapolative and regressive expectations.

The adaptive expectations model is given by:

$$EM - EM_{-1} = \beta(M_{-1} - EM_{-1})$$

which states that the change in expectations is a partial response to previous forecast errors. The extrapolative model suggests that forecasts change in response to past changes in the actual data:

$$EM - EM_{-1} = \gamma(M_{-1} - M_{-2}).$$

Normally, adaptive and extrapolative influences would be indicated by significant positive estimates of β and γ respectively. Negative coefficients are evidence of regressive influences which means that the survey respondents expect past errors or actual changes to be reversed. Alternatively, the regressive model can be specified directly as

$$EM - EM_{-1} = \lambda(M^*_{-1} - M_{-1})$$

where M* is a normal change in the money supply and positive estimates of λ indicate that forecasts change because a regression towards M* is expected. That is, if the last announced change (M_{-1}) is less than the normal change, then expectations are adjusted up by some fraction of the deviation from normal.

As written above, the models examine only the influence of the most recent errors or changes in the money supply on EM. Since the money supply expectations are formed each week, it seems reasonable to expect that the explanatory variables for any number of earlier weeks could also influence the current expectation. For example, the generalization of the adaptive model is given by:

$$(EM - EM_{-1}) = \beta_0 + \sum_{i=1}^{k} \beta_i(M_{-i} - EM_{-i})$$

where estimates of the β's can be both positive and negative. Forecast errors may at first be viewed as random and then re-interpreted as an indication of underlying change. Similarly, the persistence of errors in one direction provides cumulative evidence about trends in the money supply which should be interpreted differently than the one time occurrence of a forecast error.

Estimates of the generalized models with the pooled time series-cross section survey data are shown in Table 3 where the lags are arbitrarily limited to eight weeks. The normal money supply change for the regressive model is specified to be a constant, as explained below. The extrapolative and regressive models (which include the same right hand side values, lags of M, in different function forms) have R^2s that approach .5, which is twice as large as the R^2 from the adaptive model.

The first lag coefficient in the adaptive model is negative which suggests a regressive influence. It indicates that an unanticipated increase in the money supply leads forecasters to revise down their expected change. That is, such a change is viewed as temporary and it is expected that it will be offset, at least partially, in the next week. The second lagged forecast error has a positive coefficient, which is only slightly larger in absolute value than the coefficient on the first lag. The long term effect of a forecast error, given by the sum of the lag coefficients, is positive. However, the sum of the lag coefficients is .12, suggesting a rather small impact of forecast error on the revision of forecasts. Thus, the adaptive model indicates that a forecast error is viewed initially as a statistical or policy aberration which is expected to be offset by technical adjustments in the money supply in the next week. However, maintained forecast errors lead to a small adjustment of expectations in the direction of the error.

The consistently negative coefficients in the extrapolative equation and the explanatory power of the regressive equations support the presence of regressive influences on the formation of expectations. The normal change in the money supply, M*, is determined by the Federal Reserve policy targets. The growth targets imply a small weekly change in the money supply. Given the short time period under study, and the small variation in Fed targets, the implied weekly change is virtually constant. In this case the regressive model reduces to a regression on a constant and lagged values of M. Negative coefficients on the independent variables are consistent with the regressive model.[10] The results are supportive of the regressive hypothesis. The first lag coefficient is very large and the sum is somewhat smaller. This suggests that a change in the money supply that is greater than the normal change is followed by an immediate reduction in the expected change.

It is of interest to see whether any particular model structure dominates the others. To do so, the pairwise test of alternative hypotheses suggested by Davidson and MacKinnon [1981] can be applied. If there are two model specifications given by $y = f(\cdot)$ and $y = g(\cdot)$, respectively, then the null hypothesis that the first specification is true can be tested by estimating:

$$y = f(\cdot) + \alpha \, \hat{y}g$$

where $\hat{y}g$ is the predicted value from $y = g(\cdot)$. If the first specification $f(\cdot)$, is true (relative to the alternative, $g(\cdot)$), then α will not differ significantly from zero.

The t-statistics for the pairwise specification tests are given at the bottom of Table 3. The model for the null hypotheses is listed at the left and the alternatives are the column heads. The results indicate that the regressive specification dominates the extrapolative. However, the adaptive model adds explanatory power to both of the others and vice versa.

[10] Since there is ample reason to think that the Fed often ignores, perhaps temporarily, its aggregates targets, an alternative specification of M* was considered. The effective Fed policy and the banking system's interaction with it may be revealed by an examination of actual money supply changes in the recent past. With this in mind, an alternative regressive equation which specifies the normal change of the money supply as the average of observed changes in the past 8 weeks was estimated. However, the test of alternative specifications discussed in the text indicated that the specification presented is superior.

Since the various model specifications need not be viewed as mutually exclusive, an appropriate model might include both regressive and adaptive influences. An equation which includes both of these effects on the determination of expectations is given by:

$$EM - EM_{-1} = .92 - 1.69\ M_{-i} + .82(M_{-i} - EM_{-i})$$
$$MSE = 1.25 \qquad R^2 = .686$$

where the coefficients are the sums of three lag coefficients for both the regressive and adaptive terms. The equation indicates that both adaptive and regressive influences play distinct and strong roles in the formation of money supply expectations in this period. The R^2 of the equation is substantially higher than for the individual models in Table 3. However, these models are best viewed as descriptive of the influences that have determined expectations in this period rather than estimates of the structure of expectations formation that can be used for predictive purposes.

Conclusions

In this paper we have used an especially rich set of survey data to examine the structure and formation of expectations of the weekly change in the money supply. We emphasize the importance of using the data in disaggregated form. Our main conclusions can be summarized as follows:

(i) Standard testing products for forecast rationality can be misleading. Our preferred procedure is to examine the accuracy of each of the survey respondents individually. For about half of the respondents there is evidence of bias, although their forecasts are always efficient.

(ii) The examination of models of expectations formation indicate that there is a strong regressive influence on expectations. There is, in addition, evidence that adaptive learning from past errors characterizes the data. A model that includes both influences explains well over half of the variation in the week-to-week change in expectations of the weekly change in the money supply.

Table 1. Rationality Tests

Sample	Unbiasedness: $M = \alpha + \beta EM$				
	α	β	F^a	R^2	N
(1) Survey Means	-.29 (1.6)	1.06 (7.5)	1.31	.377	95
(2) Pooled	-.12 (2.8)	.77 (26.8)	55.7	.275	1892
(3) Pooled with heteroscedasticity correction	-.03 (1.6)	.58 (38.1)	33.3	.456	1892

Sample	Efficiency: $(M - EM) = \gamma_0 + \gamma_1 M_{-1} + \gamma_2 M_{-2}$					
	γ_0	γ_1	γ_2	F^b	R^2	N
(4) Pooled	-.22 (5.3)	.04 (2.0)	-.08 (3.9)	20.2	.02	1852
(5) Pooled with heteroscedasticity correction	-.18 (7.9)	.05 (4.2)	-.04 (3.9)	31.0	.05	1852

[a] Ho: $(\alpha, \beta) = (0, 1)$

[b] Ho: $(\gamma_0, \gamma_1, \gamma_2) = (0, 0, 0)$

Absolute values of t-statistics are shown in parentheses.

Table 2. Rationality of Individuals' Forecasts

Individual	Unbiasedness Test α	β	R^2	F	DW	Efficiency Test F
1	-.21	.94	.29	1.02	2.05	1.70
2	-.15	.72*	.28	4.51*	2.66	1.35
3	.04	.90	.32	.29	2.02	.74
4	-.19	.92	.33	1.18	2.00	1.05
5	-.37*	.94	.35	3.31*	2.02	2.32
6	-.24*	.85	.34	3.01	2.20	1.44
7	-.29*	.85	.33	3.64*	2.13	2.28
8	-.15	.78	.27	2.73	2.12	1.34
9	-.13	.74	.23	3.61*	2.20	1.45
10	-.08	.67*	.27	5.62*	2.08	1.43
11	.02	.70*	.22	2.63	2.23	1.14
12	-.18	.81*	.27	2.42	2.30	.73
13	.02	.63*	.18	3.99*	2.32	.82
14	-.11	.80	.30	2.05	2.34	.49
15	-.17	.88	.31	1.42	2.38	1.08
16	-.04	.73*	.29	3.38*	2.19	.34
17	-.06	.68*	.20	3.61*	2.29	.56
18	-.08	.71*	.27	4.11*	2.03	.80
19	-.03	.66*	.25	5.13*	2.23	1.34
20	-.16	.73*	.30	4.64*	2.16	1.35

Unbiasedness test:

$M = \alpha + \beta\, EM$

F-statistic is for H_o: $(\alpha, \beta) = (0, 1)$.

Efficiency test:

$(M - EM) = \gamma_0 + \gamma_1 M_{-1} + \gamma_2 M_{-2}$

F-statistic is for H_o: $(\gamma_0, \gamma_1, \gamma_2) = (0,0,0)$.

*Indicates:

i) α is more than one standard deviation away from 0,

ii) β is more than two standard deviations away from 1,

iii) F-tests are significant at the 5% level.

Table 3. Models of Expectations Formation

Coefficient	Adaptive[a]		Extrapolative[b]		Regressive[c]	
constant	.04	(.86)	.01	(.21)	.17	(3.4)
i = 1	-.29	(10.6)	-.59	(31.7)	-.62	(31.9)
2	.34	(12.5)	-.53	(17.6)	.02	(0.7)
3	.03	(1.0)	-.52	(12.6)	-.03	(1.3)
4	.06	(2.3)	-.41	(8.6)	.06	(2.6)
5	-.08	(2.9)	-.27	(5.9)	.08	(3.4)
6	-.18	(6.5)	-.29	(7.3)	-.07	(3.2)
7	.17	(6.3)	-.15	(5.2)	.09	(4.3)
8	.07	(2.5)	-.05	(2.7)	.06	(3.3)
Sum of lags	.12		-2.81		-.41	
R^2	.22		.48		.49	
MSE	3.23		2.07		2.06	

Tests of Alternative Specifications

	Adaptive	Extrapolative	Regressive
Ho: Adaptive	-	41.3	44.3
Ho: Extrapolative	-10.7	-	4.2
Ho: Regressive	-10.5	1.3	-

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[a] $EM - EM_{-1} = \beta_0 + \Sigma\beta_i(M_{-i} - EM_{-i})$.

[b] $EM - EM_{-1} = \gamma_0 + \Sigma\gamma_i(M_{-i} - M_{-i-1})$

[c] $(EM - EM_{-1}) = \lambda_0' - \Sigma\lambda_i(M^*_{-i} - M_{-i-1})$

Since M* is constant,

$$EM - EM_{-i} = \lambda_0 - \Sigma\lambda_i M_{-i}$$

References

Davidson, Russel and James MacKinnon, "Several Tests for Model Specification in the Presence of Alternative Hypotheses," Econometrica, 49 (May 1981).

Dietrich, J. Kimball and Douglas Joines, "Rational Expectations, Informational Efficiency and Tests Using Survey Data," Review of Economics and Statistics, forthcoming.

Figlewski, Stephen and Paul Wachtel, "The Formation of Inflationary Expectations," Review of Economics and Statistics, 63 (February 1981), 1-10.

__________ and __________, "Testing for the Rationality of Expectations Using Survey Data," Review of Economics and Statistics, forthcoming.

Friedman, Benjamin, "Survey Evidence on the 'Rationality' of Interest Rate Expectations," Journal of Monetary Economics, 6 (October 1980), 453-65.

Pesando, James E., "A Note on the Rationality of the Livingston Price Expectations," Journal of Political Economy, 83 (August 1975), 849-58.

Urich, Thomas, "The Information Content of Weekly Money Supply Announcements," Journal of Monetary Economics, 10 (1982), 73-88.

__________ and Paul Wachtel, "Market Response to the Weekly Money Supply Announcement in the 1970's," Journal of Finance, December 1981

Wachtel, Paul, "Survey Measures of Expected Inflation and Their Potential Usefulness" in Joel Popkin, ed., Analysis of Inflation: 1965-1974, Ballinger for the National Bureau of Economic Research, 1977.