Journal of Accounting Research
Vol. 17 No. 2 Autumn 1979
Printed in U.S.A.

Adaptive Expectations, Time-Series Models, and Analyst Forecast Revision

LAWRENCE D. BROWN* AND MICHAEL S. ROZEFF†

Interim earnings reports are of continuing interest to both practitioners and academics in the accounting/finance community. Among practitioners, the FASB is modifying *APB Opinion No. 28* on interim financial reporting and has issued a discussion memorandum on the subject (May 25, 1978). The Financial Executives Research Foundation has lately issued its report on interim financial statements (Schiff [1978]). In academic circles, recent research has focused upon how interim reports affect the accuracy of security analysts' earnings forecasts. The evidence shows clearly that, conditional upon the receipt of interim reports, analysts typically improve the accuracy of their forecasts of both annual and future quarterly earnings (Crichfield, Dyckman, and Lakonishok [1978] and Brown and Rozeff [1979*b*], respectively).[1]

Since security analysts are capital market participants who actually use interim reports, their forecasting behavior should be of academic

* Associate Professor, State University of New York at Buffalo; † Associate Professor, University of Iowa. [Accepted for publication December 1978.]

[1] Earlier literature dealt with how interim reports affect annual earnings forecasts of time-series models (Green and Segall [1966; 1967], Brown and Niederhoffer [1968], Coates [1972], and Reilly, Morgenson, and West [1972]). Note that the predictive content of interim reports for improving forecasts of annual earnings is not synonymous with their content for improving forecasts of future quarterly earnings (see Barnea, Dyckman, and Magee [1972] and Brown and Rozeff [1979*b*] for theoretical and empirical analyses of the difference). Briefly, improved forecasts of future quarterly earnings are generally sufficient to produce improved annual earnings forecasts, but the converse does not hold: improved annual earnings forecasts do not necessarily imply improved forecasts of future quarterly earnings. This is because annual earnings forecasts can be (and generally are significantly) improved by substituting realized earnings for forecasts of those quarters of the year that have passed and leaving unchanged earlier forecasts of future quarterly earnings.

interest. In this paper, we analyze three issues relating to analysts' forecasting behavior: how do security analysts use interim reports to revise their forecasts of future quarterly earnings? Are analysts' forecast revisions concordant with the time-series properties of quarterly accounting earnings? How important to analysts are interim reports vis-à-vis alternative information sources?[2]

In broader terms, we investigate how market participants formulate and revise expectations (forecasts). Expectations variables occur frequently in economic models. Their measurement requires either a supplementary prediction model or direct measurement, with modeling the usual choice. Generally, expectations of economic variables have been modeled by the "adaptive expectations" model.[3]

Forecast revision in the adaptive expectations model is summarized by a reaction coefficient which specifies the direction and size of response to recent forecast error. To obtain testable implications for these coefficients using analyst data, we turn to the recent literature on the time-series properties of quarterly accounting earnings per share (Watts [1975], Foster [1977], Griffin [1977], and Brown and Rozeff [1979*a*]). This research suggests that as few as three Box and Jenkins [1970] *ARIMA* models satisfactorily account for the quarterly earnings per share generating processes of most firms.

The time-series properties of quarterly accounting earnings relate to analyst behavior in several ways. First, to the extent that human forecasters do not neglect information implicit in the time-series properties of the variable being forecasted and rely upon it rather than alternative information sources, both forecasts and forecast revisions of the analyst and time-series models will be similar. Second, high correlations have in fact been found between analysts' forecasts and time-series model predictions (Cragg and Malkiel [1968], Pesando [1975]). Third, *ARIMA* models share a common revision process, namely, the adaptive expectations model (Nelson [1973, pp. 157ff.]), previously used to model other types of annual earnings forecast revisions (see n. 3). By investigating the revision processes of the three primary time-series models of quarterly earnings and by taking into account the known empirical parameter estimates of these models, we can obtain several testable implications for analyst data. Furthermore, in the process, some integration of these two

---

[2] Other important questions—such as the usefulness of audited (annual) versus unaudited (interim) reports, and what items within interim reports provide information—are beyond the scope of this study.

[3] Its many applications to economics include (1) hyperinflation (Cagan [1956], Sargent and Wallace [1973], and Khan [1977]), (2) the "cobweb" theory controversy (Nerlove [1958; 1961], Mills [1961], and Muth [1961]), (3) the term structure of interest rates (Meiselman [1962]), (4) formulation of businessmen's price expectations (Turnovsky [1970]), and (5) experimental situations in which only the past time series of the variable to be predicted is provided to the subject (Schmalensee [1976]). The adaptive expectations model has recently been introduced in the accounting literature to examine security analysts' forecast revisions of annual earnings (Abdel-khalik and Espejo [1978]).

branches of research is achieved. That is, analyst behavior is represented via a model known to have descriptive validity for the time-series properties of quarterly accounting earnings, but at the same time the observed analyst revision behavior tells us which time-series model(s) the analyst appears to regard as describing quarterly earnings behavior.

In Section 1, we obtain algebraic expressions for the one-quarter-ahead forecast revisions of the three main time-series models of quarterly accounting earnings per share. These are used to model analyst revision, with the empirical tests on analyst data appearing in Section 2. Section 3 extends the derivation and tests to forecast horizons of two and three quarters. A brief summary concludes the paper.

1. *One-Quarter-Ahead Forecast Revisions*

In the standard *ARIMA* notation, the three Box and Jenkins models which have received primary attention as possible generators of quarterly accounting earnings per share are (1) the (0, 1, 1) × (0, 1, 1), (2) the (1, 0, 0) × (0, 1, 0) + constant, and (3) the (1, 0, 0) × (0, 1, 1) models.[4] We examine how these models produce revised forecasts in order to develop testable models of analyst revisions. To obtain expressions for the one-quarter-ahead forecast revisions, we first ascertain how each model formulates its forecasts (see Box and Jenkins [1970, chap. 5]). For this purpose, let:

z_t = actual earnings per share in quarter t, and
$\hat{z}_t(k)$ = model forecast from quarter t of earnings per share k quarters ahead.

Now consider two forecasts of second-quarter earnings, one conditional upon the fourth-quarter earnings of the prior year (denoted as quarter t), and the other conditional upon the first-quarter earnings of the current year (denoted quarter $t + 1$).[5] These are a two-quarter and one-quarter-ahead forecast, respectively. For model (1), the (0, 1, 1) × (0, 1, 1) model, these two forecasts are:

$$\hat{z}_t(2) = z_{t-2} + (\hat{z}_t(1) - z_{t-3}) - \Theta_4 a_{t-2} + \theta_1 \Theta_4 a_{t-3} \quad (1)$$

$$\hat{z}_{t+1}(1) = z_{t-2} + (z_{t+1} - z_{t-3}) - \theta_1 a_{t+1} - \Theta_4 a_{t-2} + \theta_1 \Theta_4 a_{t-3}, \quad (2)$$

where θ_1, Θ_4 are moving average parameters, $0 < \theta_1, \Theta_4 < 1$, and a_t is a random error term.[6]

---

[4] These models appear in Watts [1975] and Griffin [1977], Foster [1977], and Brown and Rozeff [1979*a*], respectively.

[5] The discussion can be generalized to the other one-quarter-ahead forecasts by altering the subscripts. For example, two forecasts of third-quarter earnings can be compared, $\hat{z}_{t+1}(2)$ and $\hat{z}_{t+2}(1)$, conditional upon the first- and second-quarter earnings, respectively.

[6] The requirement that θ_1 and Θ_4 be nonnegative, rather than lie inside the unit circle, is based on the empirical parameter estimates when the *ARIMA* models are estimated using quarterly earnings data. (See, for example, Foster [1977] or Griffin [1978].) Model invertibility requires only that $|\theta_1| < 1$ and $|\Theta_4| < 1$.

Now, by subtracting (1) from (2), the one-quarter-ahead forecast revision of second-quarter earnings conditional upon first-quarter earnings can be determined.

$$\hat{z}_{t+1}(1) - \hat{z}_t(2) = (z_{t+1} - \hat{z}_t(1)) - \theta_1 a_{t+1}; \tag{3}$$

since $a_{t+1} = z_{t+1} - \hat{z}_t(1)$, equation (3) can be rewritten as:

$$\hat{z}_{t+1}(1) - \hat{z}_t(2) = (1 - \theta_1)(z_{t+1} - \hat{z}_t(1)).^7 \tag{4}$$

In model (2), the (1, 0, 0) × (0, 1, 0) + c model, where c is a constant:

$$\hat{z}_t(2) = z_{t-2} + \phi_1(\hat{z}_t(1) - z_{t-3}) + c, \tag{5}$$

$$\hat{z}_{t+1}(1) = z_{t-2} + \phi_1(z_{t+1} - z_{t-3}) + c, \tag{6}$$

so that:

$$\hat{z}_{t+1}(1) - \hat{z}_t(2) = \phi_1(z_{t+1} - \hat{z}_t(1)), \tag{7}$$

where ϕ_1 is a model parameter and $0 < \phi_1 < 1$.[8]

In model (3), the (1, 0, 0) × (0, 1, 1) model:

$$\hat{z}_t(2) = z_{t-2} + \phi_1(\hat{z}_t(1) - z_{t-3}) - \Theta_4 a_{t-2}, \tag{8}$$

$$\hat{z}_{t+1}(1) = z_{t-2} + \phi_1(z_{t+1} - z_{t-3}) - \Theta_4 a_{t-2}, \tag{9}$$

so $$\hat{z}_{t+1}(1) - \hat{z}_t(2) = \phi_1(z_{t+1} - \hat{z}_t(1)), \tag{10}$$

again with ϕ_1 a parameter and $0 < \phi_1 < 1$.

From (4), (7), and (10), it is seen that for a one-period-ahead revision, (aside from different parameters) the three models all revise forecasts in the same general way, namely:

$$\hat{z}_{t+1}(1) - \hat{z}_t(2) = \gamma(z_{t+1} - \hat{z}_t(1)), \tag{11}$$

where γ is a parameter with $0 < \gamma < 1$. This forecast revision process is readily recognizable as a simple adaptive expectations process. In other words, the revision of the second-quarter number conditional upon first-quarter data is obtained by taking a fraction (γ) of the most recent one-quarter-ahead forecast error, defined as the actual first-quarter earnings number (z_{t+1}) minus the forecast of same made one period prior ($\hat{z}_t(1)$).

2. *Tests of One-Quarter-Ahead Model*

We test equation (11) on analysts' forecasts with linear regressions of:

$$(i)\ (\hat{z}_{t+1}(1) - \hat{z}_t(2)) \quad \text{on} \quad (z_{t+1} - \hat{z}_t(1))$$

$$(ii)\ (\hat{z}_{t+2}(1) - \hat{z}_{t+1}(2)) \quad \text{on} \quad (z_{t+2} - \hat{z}_{t+1}(1))$$

$$(iii)\ (\hat{z}_{t+3}(1) - \hat{z}_{t+2}(2)) \quad \text{on} \quad (z_{t+3} - \hat{z}_{t+2}(1)).$$

[7] At $t + 1$, a_{t+1} is the realized one-quarter-ahead forecast error. See Box and Jenkins [1970, p. 129].

[8] ϕ_1 is found to be nonnegative when these models are estimated on quarterly earnings data. Strictly speaking, model stationarity requires only that $|\phi_1| < 1$.

The dependent variables in these three regressions are the analysts' one-quarter-ahead forecast revisions of quarters two, three, and four, respectively, conditional upon the first, second, and third interim reports, while the independent variables are the one-quarter-ahead earnings forecast errors made in predicting these three interim reports.

From (11), we infer that the intercept terms in the regressions should be zero for consistency with the adaptive expectations model. From the empirical properties of the three time-series models of quarterly earnings per share, we infer that the slope terms should be greater than zero and less than one in magnitude.

The analyst forecasts are derived from a sample of fifty Value Line firms and five years of quarterly forecast data (1972–76).[9] Sample sizes are 250 except for missing data. The structure of Value Line forecasts allows us to conduct the three tests of two-to-one-quarter-ahead forecast revision noted above.

The estimated regression models appear in table 1. In all three cases, a significant portion of the analyst's forecast revision is explained by the most recent one-quarter-ahead forecast error. The estimated regression intercepts are small and, except for the one-quarter-ahead revision conditional upon the third interim report, insignificantly different from zero. The slope coefficients are in all cases more than two standard errors greater than zero and less than one.

The significance of the regressions and the negligible intercepts indicate that analyst revisions of expectations of future quarterly earnings are consistent with the adaptive expectations model. From the estimated magnitudes of the slope coefficients, it appears that analyst forecast revisions are at least qualitatively consistent with the time-series properties of quarterly accounting earnings, since, as for the three primary models, reaction coefficients lie in the range from zero to one.

Nevertheless, the analyst reaction coefficients provide an interesting contrast with the estimated parameters (ϕ, θ) of the time-series models. In the latter, the estimated parameters are constrained to a single value, independent of the conditioning quarterly report. For analysts, reaction coefficients of 0.70, 0.28, and 0.57 are observed for quarters one, two, and three, respectively, and the 95-percent confidence intervals for these estimates (0.60 to 0.80, 0.16 to 0.40, and 0.45 to 0.69, respectively) show limited overlap. This evidence suggests a nonuniform reaction to forecast error by quarter and thus indicates that interim reports have different predictive content depending on the quarter in which they appear.

Before concluding, however, that the data are consistent with greater content in the first report than in the second and third, and greater content in the third report than the second, one should note that the three regression experiments are not strictly comparable for this purpose. An unavoidable feature of the methodology is that the first-quarter

[9] The sample for 1972–75 is described in Brown and Rozeff [1978].

TABLE 1

Adaptive Expectations Tests with Quarterly Analyst Earnings Forecasts

Conditioning Report	Forecast Revised		Regression[a,b,c]
First-quarter report	Second quarter	$\hat{z}_{t+1}(1) - \hat{z}_t(2)$	$= 0.00 + 0.70\,(z_{t+1} - \hat{z}_t(1))$ $R^2 = 0.41$
			(0.01) (0.05)
	Third quarter	$\hat{z}_{t+1}(2) - \hat{z}_t(3)$	$= 0.00 + 0.27\,(z_{t+1} - \hat{z}_t(1))$ $R^2 = 0.18$
			(0.01) (0.04)
	Fourth quarter	$\hat{z}_{t+1}(3) - \hat{z}_t(4)$	$= 0.00 + 0.16\,(z_{t+1} - \hat{z}_t(1))$ $R^2 = 0.06$
			(0.01) (0.04)
Second-quarter report	Third quarter	$\hat{z}_{t+2}(1) - \hat{z}_{t+1}(2)$	$= -0.01 + 0.28\,(z_{t+2} - \hat{z}_{t+1}(1))$ $R^2 = 0.08$
			(0.02) (0.06)
	Fourth quarter	$\hat{z}_{t+2}(2) - \hat{z}_{t+1}(3)$	$= 0.02 + 0.13\,(z_{t+2} - \hat{z}_{t+1}(1))$ $R^2 = 0.03$
			(0.02) (0.05)
Third-quarter report	Fourth quarter	$\hat{z}_{t+3}(1) - \hat{z}_{t+2}(2)$	$= -0.07 + 0.57\,(z_{t+3} - \hat{z}_{t+2}(1))$ $R^2 = 0.29$
			(0.02) (0.06)

[a] Fourth quarter of previous year = t; first quarter of current year = $t+1$; second quarter = $t+2$; third quarter = $t+3$.
[b] $\hat{z}_t(k)$ = forecast from quarter t of earnings per share k quarters ahead, z_{t+k}.
[c] Standard errors in parentheses beneath regression coefficients.

revision is of the second-quarter number, the second-quarter revision is of the third-quarter number, etc. If quarters two, three, and four are not equally difficult to predict, we might expect (applying Bayesian theory) that, conditional upon a given forecast error, less adjustment would be made in forecasts for the quarters more difficult to predict, that is, those for which the prior distributions are more diffuse. Thus, inferences concerning the relative degree of content or usefulness of particular interim reports cannot be drawn unless one assumes that all three quarters are equally difficult to predict.

Some information on the importance to analysts of alternative information sources is contained in the R^2's of the three regression models. In all cases, a majority of the variance is unexplained by the adaptive model.[10] A plausible inference is that the variance unexplained by forecast error is explainable by extra-earnings information which influences analyst revision. This explanation is consistent with recent evidence (Brown and Rozeff [1978], Crichfield, Dyckman, and Lakonishok [1978]) that, in accuracy of forecasting, analysts generally outperform time-series models, which are restricted to earnings data. If extra-earnings data are the reason for the relatively low power of the adaptive model in explaining analyst revisions of future quarterly earnings, it would appear that anywhere from 59 to 92 percent of analyst one-quarter-ahead forecast revisions must be explained by nonearnings information.[11]

3. *Two- and Three-Quarter-Ahead Forecast Revision*

The above methodology can be applied to revisions of forecasts at longer horizons. Again, the time-series models provide a starting point to model analyst revision. However, in this case, the three models give two competing and starkly different revision mechanisms. Consider first the three- to two-period-ahead forecast revision of model (2), the (1, 0, 0) × (0, 1, 0) + c model. Since:

$$\hat{z}_t(3) = z_{t-1} + \phi_1(\hat{z}_t(2) - z_{t-2}) + c, \quad \text{and} \tag{12}$$

$$\hat{z}_{t+1}(2) = z_{t-1} + \phi_1(\hat{z}_{t+1}(1) - z_{t-2}) + c, \tag{13}$$

it follows that:

---

[10] When our data is used with the annual forecast methodology of Abdel-khalik and Espejo [1978], an R^2 of 0.70 results, which compares well with their R^2 of 0.62 from a different sample. The lower R^2's obtained using the future quarterly earnings method thus result from differences in method, not sample data. The higher R^2 of the annual method can be explained by its inclusion of a common term on both sides of the regression model, namely, $(z_{t+1} - \hat{z}_t(1))$, and by the fact that the dependent variable (the annual forecast revision) contains two terms, $(z_{t+2} - \hat{z}_t(2))$ and $(z_{t+3} - \hat{z}_t(3))$ which are correlated with the independent variables $(z_{t+2} - \hat{z}_{t+1}(1))$ and $(z_{t+3} - \hat{z}_{t+2}(1))$.

[11] Incomplete specification of the model generating analyst revisions may also contribute to the low R^2's. For this reason, although the results are suggestive, a more sophisticated design may be required more fully to ascertain the relative importance of interim reports to analyst revisions.

$$\hat{z}_{t+1}(2) - \hat{z}_t(3) = \phi_1(\hat{z}_{t+1}(1) - \hat{z}_t(2)), \tag{14}$$

but substituting from (7), we obtain:

$$\hat{z}_{t+1}(2) - \hat{z}_t(3) = \phi_1^2(z_{t+1} - \hat{z}_t(1)). \tag{15}$$

Like the one-quarter-ahead revision, the two-quarter-ahead revision of this model is solely a function of the most recent one-quarter-ahead forecast error and suggests an adaptive model with zero intercept. The reaction coefficient is, however, ϕ_1^2 rather than ϕ_1. It is easy to show that for the n-quarter-ahead revision, the model parameter is raised to the power n.

Model (3), the (1, 0, 0) × (0, 1, 1) model, also results in the revision mechanism given by (15). It follows that, since the model parameters are empirically less than one, if analysts revise forecasts in accordance with either of these two autoregressive models, the analyst reaction to current forecast error will be a decreasing function of forecast horizon.

By contrast, the revision mechanism for model (1), the (0, 1, 1) × (0, 1, 1) model, is identically the same for all horizons as for a one-quarter-ahead horizon. For example, consider the two-quarter-ahead revision of third-quarter earnings conditional upon the first interim report.

$$\hat{z}_t(3) = z_{t-1} + (\hat{z}_t(2) - z_{t-2}) - \Theta_4 a_{t-1} + \theta_1\Theta_4 a_{t-2}, \tag{16}$$

$$\hat{z}_{t+1}(2) = z_{t-1} + (\hat{z}_{t+1}(1) - z_{t-2}) - \Theta_4 a_{t-1} + \theta_1\Theta_4 a_{t-2}, \tag{17}$$

and, subtracting (16) from (17):

$$\hat{z}_{t+1}(2) - \hat{z}_t(3) = \hat{z}_{t+1}(1) - \hat{z}_t(2) = (1 - \theta_1)(z_{t+1} - \hat{z}_t(1)). \tag{18}$$

For the n-quarter-ahead revision of the (0, 1, 1) × (0, 1, 1) model, it is straightforward to show that the revision continues to equal $(1 - \theta_1)(z_{t+1} - \hat{z}_t(1))$. In other words, since empirically $0 < \theta_1 < 1$, if analysts revised in accordance with this time-series model, they would raise or lower forecasts at all horizons by an identical amount, depending upon whether the forecast errors were positive or negative. In the regression tests, then, the slope coefficients for revisions at several horizons, contingent upon a given interim report, would be the same.

The empirical tests using analyst data are contained in table 1. Conditional upon the first-quarter report, table 1 shows the revisions at horizons of one, two, and three quarters ahead, that is, revision of the second-, third-, and fourth-quarter reports. We note immediately that the magnitudes of the slope coefficients, 0.70 < 0.27 < 0.16, as horizon lengthens are inconsistent with the revision mechanism of the (0, 1, 1) × (0, 1, 1) model and are consistent with that of the two autoregressive models. Moreover, the 95-percent confidence intervals for these estimates (0.60 to 0.80, 0.19 to 0.35, and 0.08 to 0.24, respectively) show limited overlap, reinforcing the conclusion that the magnitudes of the slope coefficients are not consistent with the moving average model. In table 1, we also see that conditional upon the second interim report, the revision coefficients for third- and fourth-quarter earnings are 0.28 and 0.16, respectively, again showing a decline as horizon lengthens. It appears that in revising forecasts, analysts treat the earnings data as if they had autoregressive components. This behavior is consistent with Foster's [1977] observation that the quarterly earnings data of most firms have an autoregressive component, and with the evidence in Brown and Rozeff [1979*a*] that the (0, 1, 1) × (0, 1, 1) model suggested by Watts [1975] and Griffin [1977] does not appear to be the model generating the quarterly earnings-per-share data of most firms.

In the longer horizon tests, additional evidence appears which indicates that analyst expectations are to some extent adaptive. The regressions are all significant and the intercepts are all insignificantly different from zero. Again, the slope coefficients are more than two standard errors greater than zero and less than one, in concordance with the time-series model parameters. And again, analyst reaction to earnings forecast error explains only a fraction of their revision of expectations, indicating that nonearnings information is an important determinant of forecast formation and revision.

4. *Summary*

Adaptive expectations are a significant element in security analysts' revision of expectations of future quarterly earnings per share. In our sample, analysts responded to earnings forecast error as if they were behaving in an adaptive manner, raising (lowering) their forecasts of future quarterly earnings when they underpredicted (overpredicted) this quarter's earnings per share. The explanatory power of the adaptive model was generally less than 50 percent, suggesting to us that information outside the earnings time-series process is also an important determinant of analyst forecast revision of future quarterly earnings.

Analyst adaptive behavior at a one-quarter-ahead horizon was similar to that of the three primary time-series models of quarterly accounting earnings per share, in that the reaction coefficients were between zero and one, as are the empirical parameter estimates of these models. At longer horizons, the analyst behavior corresponded to the autoregressive time-series models, rather than the moving average model. If analysts are rational and behave according to the "true" underlying time-series model, this is evidence that the correct time-series model should incorporate an autoregressive parameter.

Insofar as the results on security analysts' expectations of future quarterly earnings reflect on the use of adaptive expectations models as proxies for expectations held by economic actors in general, one can infer that such models probably give reasonable results in terms of the signs and magnitudes of the model coefficients. But if our findings are typical of expectations models constructed for other economic time series, it would appear that adaptive expectations models are rather noisy. In the case of future quarterly earnings, they explain less than half the variance in the revision process.

REFERENCES

ABDEL-KHALIK, A. R., AND J. ESPEJO. "Expectations Data and the Predictive Value of Interim Reporting." *Journal of Accounting Research* (Spring 1978): 1-13.

BARNEA, A., T. DYCKMAN, AND R. MAGEE. "Discussion of the Predictive Content of Interim Reports—A Time Series Analysis." *Empirical Research in Accounting: Selected Studies, 1972.* Supplement to *Journal of Accounting Research* 10: 145–55.

BOX, G. E. P., AND G. M. JENKINS. *Time Series Analysis: Forecasting and Control.* San Francisco: Holden-Day, 1970.

BROWN, L. D., AND M. S. ROZEFF. "The Superiority of Analyst Forecasts as Measures of Expectations: Evidence from Earnings." *Journal of Finance* (March 1978): 1-16.

———. "Univariate Time-Series Models of Quarterly Accounting Earnings Per Share: A Proposed Model." *Journal of Accounting Research* (Spring 1979): 179–89.

———. "The Predictive Value of Interim Reports for Improving Forecasts of Future Quarterly Earnings." *The Accounting Review* (July 1979).

BROWN, P., AND V. NIEDERHOFFER. "The Predictive Content of Quarterly Earnings." *Journal of Business* (October 1968): 488–97.

CAGAN, P. "The Monetary Dynamics of Hyperinflation." In *Studies in the Quantity Theory of Money*, edited by M. Friedman. Chicago: University of Chicago Press, 1956.

COATES, R. "The Predictive Content of Interim Reports—A Time Series Analysis." *Empirical Research in Accounting: Selected Studies, 1972.* Supplement to *Journal of Accounting Research* 10: 132–44.

CRAGG, J. G., AND B. G. MALKIEL. "The Consensus and Accuracy of Some Predictions of the Growth of Corporate Earnings." *Journal of Finance* (March 1968): 67–84.

CRICHFIELD, T., T. DYCKMAN, AND D. LAKONISHOK. "An Evaluation of Security Analysts' Forecasts." *The Accounting Review* (July 1978): 651–68.

FINANCIAL ACCOUNTING STANDARDS BOARD. *Interim Financial Accounting and Reporting, FASB Discussion Memorandum.* Stamford, Conn.: FASB, 1978.

FOSTER, G. "Quarterly Accounting Data: Time-Series Properties and Predictive Ability Results." *The Accounting Review* (January 1977): 1-21.

GREEN, D., JR., AND J. SEGALL. "The Predictive Power of First Quarter Earnings Reports: A Replication." *Empirical Research in Accounting: Selected Studies, 1966.* Supplement to *Journal of Accounting Research* 4: 21–35.

———. "The Predictive Power of First-Quarter Earnings Reports." *Journal of Business* (January 1967): 44–54.

GRIFFIN, P. A. "The Time-Series Behavior of Quarterly Earnings: Preliminary Evidence." *Journal of Accounting Research* (Spring 1977): 71–83.

KHAN, M. S. "The Variability of Expectations in Hyperinflations." *Journal of Political Economy* (August 1977): 817–27.

MEISELMAN, D. *The Term Structure of Interest Rates.* Englewood Cliffs, N.J.: Prentice-Hall, 1962.

MILLS, E. S. "The Use of Adaptive Expectations in Stability Analysis: Comment." *Quarterly Journal of Economics* (May 1961): 330–35.

MUTH, J. F. "Rational Expectations and the Theory of Price Movements." *Econometrica* (July 1961): 315–35.

NELSON, C. *Applied Time Series Analyses for Managerial Forecasting.* San Francisco: Holden-Day, 1973.

NERLOVE, M. "Adaptive Expectations and the Cobweb Phenomena." *Quarterly Journal of Economics* (May 1958): 227–40.

——— "The Use of Adaptive Expectations in Stability Analysis: Reply." *Quarterly Journal of Economics* (May 1961): 335–38.

PESANDO, J. "On the Accuracy and Formation of Life Insurance Cash Flow Forecasts." *Journal of Business* (January 1975): 20–26.

Reilly, F. K., D. L. Morgenson, and M. West. "The Predictive Ability of Alternate Parts of Financial Statements." *Empirical Research in Accounting: Selected Studies, 1972*. Supplement to *Journal of Accounting Research* 10: 105–24.

Sargent, T. J., and N. Wallace. "Rational Expectations and the Dynamics of Hyperinflation." *International Economic Review* (June 1973): 328–50.

Schiff, M. *Accounting Reporting Problems—Interim Financial Statements*. New York: Financial Executives Reseach Foundation, 1978.

Schmalensee, R. "An Experimental Study of Expectation Formation." *Econometrica* (January 1976): 17–41.

Turnovsky, S. J. "Empirical Evidence on the Formation of Price Expectations." *Journal of the American Statistical Association* (December 1970): 1441–54.

Watts, R. "The Time Series Behavior of Quarterly Earnings." Working paper, University of Newcastle, April 1975.