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The Information Content of Annual Earnings Announcements

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The information content of earnings is an issue of obvious importance and is a focal point for many measurement controversies in accounting. This paper empirically examines the extent to which common stock investors perceive earnings to possess informational value. The study directs its attention to investor reaction to earnings announcements, as reflected in the volume and price movements of common stocks in the weeks surrounding the announcement date.

Valuation theory has long posited a relationship between earnings and the value of common stock. Miller and Modigliani postulate that one important element in determining the value of common stock is the product of earnings times the appropriate earnings multiplier for that risk class.[1] Graham, Dodd, and Cottle take a similar position with respect to the computation of their "intrinsic value" of common stock securities.[2] MM also provide empirical evidence that suggests if reported earnings are adjusted for measurement errors through the use of instrumental variables, the adjusted earnings are useful in the prediction of the market value of electric utility firms. In fact, the evidence indicated that the earnings term was the most important explanatory variable in the valuation equation.[3] The relationship is a necessary condition for earnings to have information content,

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[1] Merton H. Miller and Franco Modigliani, "Some Estimates of the Cost of Capital to the Electric Utility Industry, 1954–57," *American Economic Review*, LVI (June, 1966), 341.

[2] Benjamin Graham, David L. Dodd, and Sidney Cottle, *Security Analysis* (New York: McGraw-Hill, 1962), 443ff.

[3] Miller and Modigliani, *op. cit.*, p. 373. The thrust of their study was directed to value of the firm rather than value of common stock. However, the MM model contains an explicit relationship between the two, and the statements made above apply with equal force to the value of common stock.

but the evidence does not preclude the possibility that the opposite may be true.

Although there are many reasons for adopting the position that earnings lack informational value, two are frequently offered. (1) Measurement errors in earnings are so large that it would be better to estimate the value of common stock directly from the instrumental variables rather than use earnings as an intermediate step. (2) Even though earnings might convey information, there are other sources available to investors that contain essentially the same information but are more timely. By the time annual earnings are released, any potential information content has already been processed by investors and is impounded in the market price. The implication of both arguments is earnings reports have little or no information content.

The issue is of major concern to the accounting profession because its outcome directly reflects upon the utility of the accounting activity. One approach to examining this issue is to specify an expectations model of how investors relate reported earnings to market prices. The paper presented by Benston at last year's Conference followed such an approach.[4] Benston found price changes were largely insensitive to earnings, which taken at face value is unfavorable to the utility of earnings data. But such results are always difficult to interpret because the lack of an observed relationship may be due to either one or both of two factors. Either no relationship exists or the expectations model was improperly specified. It is impossible to determine the extent to which the negative findings are due to the latter rather than the former.

The approach taken here is to apply tests that require no assumption about the expectations models of investors. Note that the issue under consideration is of a positive rather than a normative nature—that is, the question of concern is not whether investors *should* react to earnings but rather whether investors *do* react to earnings.

Definitions of Information Content

Information has been defined as a change in expectations about the outcome of an event.[5] Within the context of this study, a firm's earnings report is said to have information content if it leads to a change in investors' assessments of the probability distribution of future returns (or prices), such that there is a change in equilibrium value of the current market price.[6]

[4] George J. Benston, "Published Corporate Accounting Data and Stock Prices," *Empirical Research in Accounting: Selected Studies, 1967*, Supplement to Vol. 5, *Journal of Accounting Research*, pp. 1–54.

[5] Henri Theil, *Economics and Information Theory* (Chicago and Amsterdam: Rand McNally and North Holland Publishing Company, 1967), Ch. 1.

[6] A further stipulation is often made that information concerns changes in expectations about an event that is a *parameter of a decision model*. Defining earnings information in terms of its impact on future returns (or prices) is consistent with that further

Although neither the direction nor the magnitude of the price change can be specified without knowing the expectations model(s) of investors, the variability of price changes is likely to be greater when earnings are announced than at other times during the year.[7]

Another definition of information states that not only must there be a change in expectations but the change must be sufficiently large to induce a change in the decision-maker's behavior. According to this definition, a firm's earnings report possesses informational value only if it leads to an altering of the optimal holding of that firm's stock in the portfolios of individual investors. The optimal adjustment might be to buy more shares or to sell some or all of the shares already held. In either event, the shift in portfolio position would be reflected in the volume. If earnings reports have information content, the number of shares traded is likely to be higher when the earnings report is released than at other times during the year.[8]

Relationships between Price and Volume Tests

The relationships posited above are consistent with the economist's notion that volume reflects a lack of consensus regarding the price. The lack of consensus is induced by a new piece of information, the earnings report. Since investors may differ in the way they interpret the report, some time may elapse before a consensus is reached, during which time increased volume would be observed. If consensus were reached on the first transaction, there would be a price reaction but no volume reaction, assuming homogeneous risk preferences among investors. If risk preferences differ, there still could be a volume reaction, even after the equilibrium price had been reached.

An important distinction between the price and volume tests is that the former reflects changes in the expectations of the market as a whole while the latter reflects changes in the expectations of individual investors. A

stipulation. For support, see the literature on portfolio theory, especially Harry M. Markowitz, *Portfolio Selection: Efficient Diversification of Investments* (New York: John Wiley & Sons, 1959).

[7] The change in equilibrium price is in addition to any price change that would normally occur in the absence of any earnings announcement. The assumption is that the two price changes are positively correlated, independent, or mildly correlated. If there were strong negative correlation, the price change variability might not be greater at the announcement date. In the light of previous research in the behavior of security prices, the assumption of independence is most likely to be the correct one. See Eugene F. Fama, "The Behavior of Stock Market Prices," *Journal of Business*, XXXVIII (January, 1965), 34–105.

[8] As a final parenthetical comment on definitions of information, note that *reduction of uncertainty* was not one of the definitions chosen. It should be apparent that in a dynamic situation (i.e., where probability distribution assessments are changing over time), a decision maker may be more uncertain about a given event after receiving a message about the event than he was before he received the message. To use Theil's terminology, the entropy may increase as a result of a message, yet the message has information content. See Theil, *op. cit.*, Ch. 2.

piece of information may be neutral in the sense of not changing the expectations of the market as a whole but it may greatly alter the expectations of individuals. In this situation, there would be no price reaction, but there would be shifts in portfolio positions reflected in the volume. Because the price reflects the expectations of many investors, it may imply a very efficient forecast of earnings for several weeks prior to the announcement.[9] If so, the price test may be less sensitive than volume to earnings reports.

The foregoing discussion suggests that a reaction may be observed in only one of the tests or that the two tests may not respond equally. If neither test responds, the utility of earnings data and the study's sample design will be suspect.

Sample Design

Selection of Sample. The study is based upon a sample of annual earnings announcements released by 143 firms during the years 1961 through 1965. Six criteria were used in the selection of the sample firms.

(1) The firm must be on the Compustat tape; (2) the firm must be a member of the New York Stock Exchange; (3) the fiscal year must end on a date other than December 31; (4) no dividends were announced in the same week as the earnings announcement; (5) no stock splits were announced during the 17 week period surrounding the announcement of earnings; and (6) there were less than 20 news announcements per year appearing in the *Wall Street Journal*. Table 1 indicates the extent to which each criterion affected the sample size.

Criterion (1) was selected because the Compustat population represents over 90 per cent of the total market value of the common stocks of publicly held corporations and hence is a relevant population for study. A secondary reason is the ease with which financial statement items can be obtained for the Compustat firms relative to firms not on the tapes. Although no financial statement data are needed for the earlier phases of this study, eventually the scope will be extended to relating market prices to the financial statement items, namely the earnings numbers.

Criterion (2) was used because weekly price and volume data on NYSE firms are relatively easy to obtain. The Center for Research in Security Prices (CRSP) provided tapes which contain daily price, volume, and transaction information on all firms on the NYSE for the years 1961 through 1965.[10]

Criterion (3) was selected in order to avoid a clustering of announcement

[9] Efficiency is defined in terms of $E(\hat{x} - x^*)^2$, where $\hat{x}$ is the forecasted value of reported earnings and x^* is actual value. The closer the expectation is to zero, the more efficient the forecast is. Note that a forecast may be unbiased but very inefficient. The distinction between efficiency and unbiasedness is more important to the interpretation of the findings presented later.

[10] Without the cooperation of CRSP, the data collection chore would have been overwhelming.

dates during any time period. Without this criterion, the sample data would exhibit a large clustering of announcements in the months of February, March, and April because two out of three Compustat firms are 12/31 firms. In subsequent analysis, an attempt will be made to remove the effects of market-wide events from the individual security's volume and price data. When earnings announcements cluster, they become a form of market-wide price indexes and the volume statistics. Hence, any attempt to remove the effects of market-wide events would eliminate the effects of the earnings report as well.

The purposes of criteria (4) and (5) are similar in that they attempt to minimize any ambiguity associated with an observed reaction in the week of the earnings announcement. If these criteria were not applied, there would be a joint effect, and it would be extremely difficult to separate the announcement effects of dividends or stock splits from those of the earnings report.[11] Criterion (6) was chosen so that there would be weeks where few, if any, announcements were released. To the extent that news items are announced in weeks other than the earnings announcement week, comparing those weeks with the earnings announcement week compares the information content of the earnings reports with that of other types of news announcements, which is not the issue under study.

Both the direction and magnitude of any potential bias introduced by the selection criteria are difficult to assess. Criteria (1) and (2) led to the selection of the larger firms in the economy. The average total assets (per financial statements) for the 143 firms in 1965 was 167 million dollars, and their average market value of common stock outstanding in 1965 was 189 million dollars. The effect of selecting larger firms would tend to induce a bias against earnings reports because the larger firms are generally associated with a greater flow of additional information than smaller firms.

The effect of criterion (3) was twofold: (a) Out of the subpopulation of Compustat, NYSE firms, the criterion tended to select the smaller firms, even though they are probably still larger than average for the economy as a whole. In 1965, the average total assets for Computsat, NYSE firms were 441 million dollars, and the average market value of common stock outstanding was 564 million dollars. (b) A greater proportion of retailers and food processors appears in the sample than would have been obtained if firms had not been restricted non-12/31 firms. Retailers comprise 14.6 per cent of the sample, while 17.5 per cent of the firms are food processors. The expected percentages would have been 6.8 and 10.0, respectively, if

[11] A pilot study with similar objectives did not exclude firms with dividend announcements in the same week as earnings. The investor reaction in terms of volume was almost twice as large as the reaction observed in this study. Stock splits were excluded because previous research has found that stock splits possess information content. See Eugene F. Fama, *et al.*, "The Adjustment of Stock Prices to New Information," Report 6705 (Center for Mathematical Studies in Business and Economics, Graduate School of Business, University of Chicago, 1967), forthcoming in the *International Economic Review*.

a random sample were drawn from the Compustat, NYSE subpopulation. With respect to the implications for information content, there are to be no obvious reasons why these firms would constitute a biased sample, with the one exception that retailers tend to report financial statement data monthly which would tend to induce a bias against finding informational value in annual earnings reports. In fact, in the analysis described later, both the price and volume reactions were less dramatic for the retailers and food processors than for the other firms in the sample.

It is possible that the selection criteria, especially criterion (6), may induce some bias in the opposite direction. As long as the criteria are visible ex ante, the population for which the study's findings are relevant can be easily identified. Also, the sample criteria can be relaxed in future studies to discover the generality of the findings presented here for other populations.

Data Collection. The first step was the identification of firms that would comprise the sample. Meeting the criteria in any one of the five years (1961–1965) was a sufficient condition for a firm's inclusion for that year. The result was a sample of 143 firms. Because all firms did not meet the criteria in every year, the 143 firms gave rise to 506 annual earnings announcements. The date of the earnings announcement was obtained from the *Wall Street Journal Index.*

The distributions of financial statement dates and announcement dates appear in Table 2. Restricting the sample to non-12/31 firms was successful in reducing the clustering of dates. The most frequent month in which the fiscal year ended (June) represents only 23.8 per cent of the sample, while an unrestricted sample would have resulted in 67 per cent in a single month (December). With respect to announcement dates, the highest three-month period (September, October, and November) contains 37.6 per cent of the announcements, while under an unrestricted sampling procedure the highest percentage would have been approximately 67 per cent (during February, March, and April). The most frequent month of announcement (October) represents 13.4 per cent of the announcements, which is only slightly higher than the percentage that would be obtained under a completely uniform distribution throughout the year (9.1 per cent).

One by-product of the data gathering was some insight into the time lag between the financial statement date and the announcement date (see Table 3). The median lag was 9 weeks, only 3 per cent of the announcements were made by the end of 4 weeks, and 93 per cent of the earnings had been reported by the end of 13 weeks. A possible avenue for future research would be to study the information content of the time lag itself (e.g., is "bad" news reported less rapidly than "good" news?).

Definition of Variables. The next step was to compute the following variables for each firm on a weekly basis for the 261 weeks (from January 1, 1961 to December 31, 1965):

$$V_{it} = \frac{\text{no. of shares of firm } i \text{ traded in week } t}{\text{no. of shares outstanding for firm } i \text{ in week } t} \times \frac{1}{\text{no. of trading days in week } t},$$

$$V_{Mt} = \frac{\text{no. of shares traded for all NYSE firms in week } t}{\text{no. of shares outstanding for all NYSE firms in week } t} \times \frac{1}{\text{no. of trading days in week } t},$$

$$R_{it} = \ln\left[\frac{D_{it} + P_{it}}{P'_{it-1}}\right],$$

$$R_{Mt} = \ln\left[\frac{(SP)_t}{(SP)_{t-1}}\right],$$

D_{it} = cash dividend "paid" on share of firm i in week t,
P_{it} = closing price for share of firm i at end of week t,
P'_{it-1} = closing price at end of week $t - 1$, adjusted for capital changes (e.g., stock splits and stock dividends),
$(SP)_t$ = closing value of *Standard and Poor's Price Index* at end of week t,
$(SP)_{t-1}$ = closing value at end of week $t - 1$.

V_{it} is a weekly average of the daily percentage of shares traded. Weekly volume was divided by the number of shares outstanding so that the results would not be dominated by those firms with the largest number of shares outstanding. The percentage of shares traded per week were then divided by the number of trading days in order to adjust for the fact that not all weeks have the same number of trading days.

V_{Mt} reflects the level of volume for all NYSE firms. The weighting scheme implicit in this volume index assigns greater weight to percentage of shares traded of firms with the larger number of shares outstanding. While this feature is not entirely satisfying, its use is defended on the grounds that this index is much easier to obtain than an index that assigns equal weight to all firms and because there is no reason to believe the use of this index leads to either an upward or a downward bias in the findings regarding the information content of earnings reports.

R_{it} is the natural logarithm of the price relative and can be viewed as a measure of price change or as the rate of return of the security assuming continuous compounding.[12] R_{Mt} is a similar measure for 425 industrial

[12] The properties of R_{it} are further described in Fama, *op. cit.*; Benjamin F. King, "Market and Industry Factors in Stock Price Behavior," *Journal of Business*, XXXIX (January, 1966), 139–90; James H. Lorie and Lawrence Fisher, "Rates of Return on Investment in Common Stocks," *Journal of Business*, XXXVII (January, 1964), 1–21.

NYSE firms. This statistic has some limitations as a market-wide index of price change and in many respects is less preferable than some recently developed indexes, notably Fisher's Link Relative.[13] However, again its use is defended on the same grounds as those for the market-wide index of volume. The Fisher Link Relative has been computed for monthly data only. To construct a similar index on a weekly basis is a research project in itself. Not only is the S & P index easier to obtain but it was found in other studies that results were insensitive to which index is used.[14] Within the context of this study, there is no reason to believe that the use of the S & P based index will lead to an overstatement or understatement of the information content of earnings reports.

Volume Analysis—Unadjusted for Market Influences

V_{jt} was computed for each week t in the report period for each of the 506 earnings announcement j. The report period is defined as the 17 week period surrounding the announcement date (8 weeks before the announcement week, and 8 weeks after). Then the $\bar{V}_t$ (averaging across j) was computed for each of the 17 weeks, and the results appear in Figure 1. The dotted line denotes the value of $\bar{V}_t$ in the nonreport period (i.e., that portion of the 261 weeks not included in the 17 week report periods).

The evidence indicates a rather dramatic increase in volume in the announcement week (week 0). In fact, the mean volume in week 0 is 33 per cent larger than the mean volume during the nonreport period, and it is by far the largest value observed during the 17 weeks. Investors do shift portfolio positions at the time of the earnings announcement, and this shift is consistent with the contention that earnings reports have information content.

The contention is further supported by the behavior of investors in the other weeks. Eight weeks prior to the announcement, volume is below normal, which suggests that investors may postpone their purchases and sales of the security until the earnings report is released. The four weeks after the announcement, when the annual reports are received, exhibit slightly above normal volume and hence permit a more thorough evaluation of the earnings data.

The investor response appears to be very rapid, for almost all of the above-normal activity occurs during week 0. This finding supports previous studies that also show investors respond quickly (as reflected in price changes) to new pieces of information (see Fama, *et al.*).

Perhaps some comment is in order regarding the overall level of volume throughout the year. The volume statistics reported in Figure 1 are multi-

[13] For a discussion of the S & P Index vis-à-vis Fisher's Index, see Lawrence Fisher, "Some New Stock Market Indices," *Journal of Business*, XXXIX (January, 1966), 191–225.

[14] Fama, *et al.*, *op. cit.*

plied by the factor of 10^3. The average volume in the nonreport period is .00112—that is, the average daily percentage of shares traded is slightly greater than one-tenth of one per cent of the shares outstanding. This implies an annual turnover of approximately 25 per cent and a weekly turnover of .5 of one per cent. If corporation X has 10 million shares outstanding, during a normal week 50,000 shares will be traded with an expected volume of 66,667 shares during the earnings report week.

Volume Analysis—Adjusted for Market Influences

The section will present an analysis which attempts to remove the effects of market-wide events upon the individual security's volume. The motivation for the analysis is two-fold. (1) It is possible that the abnormally high volume may be caused in part by market-wide pieces of information that are released at the same time as the earnings announcements. Since the earnings announcements are released almost uniformly throughout the year, this is not a very plausible explanation of the findings. Nevertheless, removing the market wide effects should allay any fears that this unlikely situation does account for the results. (2) More importantly, the analysis will serve to reduce "noise" in the volume data. Noise is any movements in volume due to unspecified factors, one of which is market-wide events that would cause increases in the volume.

Analysis for Nonreport Period. The following model was used to abstract from market-wide factors:[15]

$$V_{it} = a_i + b_i V_{Mt} + e_{it}\,.$$

Estimates of a_i and b_i were obtained from linear regressions based upon observations from the nonreport period. The observations from the report period were deleted from the regression because if earnings announcements have information content, the assumptions of the classical regression model are violated during the report period (e.g., $E(e_{it}) \neq 0$).

Some summary statistics relating to the regressions appear in Table 4. The mean volume of the sample firms is much higher than that of the market index. One reason is the different weighting scheme implicit in each measure. The market index assigns greater weight to firms with the greater number of shares outstanding. If these firms have lower volume (expressed as a percentage of shares outstanding), then the market index would be expected to have a lower mean. Another explanation is that the sample

[15] The rationale for using this particular model is two-fold: (1) It is a simple relationship, and there is no obvious reason why a more complex model would be more appropriate. (2) It is analogous to the model that will be used to remove effects of market-wide events upon the price changes of individual securities. The paper will later indicate that such a model seems to be a reasonable way to characterize price changes. Hence, it would seem reasonable to assume a similar process is generating volume over time as well.

selection criterion implicitly favored higher turnover securities. But it is not obvious why that should be true nor what implication it has for inferences regarding information content.

The average correlation coefficient was low, implying that removing the influence of V_{Mt} should have little effect upon the analysis. In spite of the low association, the sign of the correlation coefficient was positive for 139 firms and negative for only 4. These two findings taken together suggest that the market influence on an individual firm's volume is significantly different from zero but that its magnitude is small.[16]

The residual, e_{it}, is that portion of an individual security's volume that cannot be explained by market-wide events as reflected in V_{Mt}. The mean of e_i (averaging across time for given firm i) is forced to be zero by the mechanics of the regression computations. However, the mean of e_t (average across firms for a given week t) may be nonzero. An inspection of its distribution for the 261 weeks provides some interesting insights (see Figure 2).

The distribution is skewed to the right, as indicated by the fact that 58 per cent of $\bar{e}_t$ are negative and 42 per cent are positive. The median of $\bar{e}_t$ is $-.02$ and its mean is zero (again this must be true because of the mechanics of the regression computations). The e_{it}'s are even more asymmetrical, with 64.6 per cent negative and 35.4 per cent positive. One interpretation of the asymmetry is that information is provided to investors in discontinuous "lumps" rather than smoothly or continuously over time.

Residual Analysis for the Report Period. The residual, e_{jt}, was computed for each week t of the report period for each of the 506 earnings announcements j in the following manner:

$$e_{jt} = V_{jt} - a_i - b_i V_{Mt} \qquad \begin{aligned} i &= 1, \cdots, 143 \\ j &= 1, \cdots, 506 \\ t &= -8, \cdots, +8 \end{aligned}$$

where a_i and b_i were obtained from the regressions in the nonreport period.[17] Then the $\bar{e}_t$ was computed for each of the 17 weeks, and the results appear in Figure 3. A positive residual implies above normal volume; negative, below normal; and zero, normal volume.

The behavior of the volume residual is the same as that of the previous analysis. There is a large peak in week 0, where the mean volume is approximately 30 per cent higher than during the nonreport period (i.e., .33/1.12, mean residual in week 0/mean volume in the nonreport period) and is about 40 per cent higher than the mean volume in the weeks prior

[16] The probability that the expected value of the correlation coefficient is less than or equal to zero is less than 1 chance in 100,000.

[17] Note that the subscript i refers to firm i or security i, but j refers to an earnings announcement. Hence a_i and b_i may be used a maximum of five times; its frequency of use will depend upon the number of earnings announcements of firm i or security i included in the sample of 506 announcements.

to the announcement. Again the volume during these weeks is abnormally low, while slightly above normal volume persists for four weeks following the announcement week. The interpretation of these findings is the same as that of the previous analysis. In short, the results are very consistent with the contention that earnings announcements possess information content.

Because a comparison of mean values can often be misleading, two additional comparisons were made to see how unusual is an $\bar{e}_t$ of .33, which was the value observed in week 0. The first comparison examined the values of $\bar{e}_t$ in the report period and those in the nonreport period (see Figure 2). Out of the 261 nonreport period values of $\bar{e}_t$, only 4 had values exceeding .33. Although such a comparison is admittedly a crude approximation, it does suggest that the value in week 0 is unusually high.

Moreover this comparison tends to understate the unusual nature of the week 0 residual. The $\bar{e}_t$ during the nonreport period is based upon a maximum of 143 observations per mean, while the $\bar{e}_t$ in week 0 (as well as the rest of the report period) was based upon 506 observations. Since the e_{it}'s are less than perfectly correlated, the dispersion of the distribution of $\bar{e}_t$ would decrease as the number of observations per mean increases. Hence, if the distribution in the nonreport period were also based upon 506 observations per mean, its dispersion would be smaller and the number of values above .33 would be fewer. Another factor leading to an understatement is that $\bar{e}_t$ in the nonreport period was based upon residuals taken from the same week, while the mean residual in week 0 was based upon observations taken from different weeks. If contemporaneous residuals are more highly correlated than noncontemporaneous residuals (and the evidence suggests they are), then a distribution of $\bar{e}_t$ in the nonreport period based upon noncontemporaneous observations would have a smaller dispersion and fewer values above .33.[18] The major point is the comparison indicates that the mean residual in week 0 is unusually high, in spite of the fact that the comparison tends to understate how unusual it really is.

A second comparison involved the analysis of the frequency of positive residuals in each report period week as compared with the number during the nonreport period (see Figure 4). The behavior of the positive residuals is consistent with the previous relationships observed in Figures 1 and 3. Prior to the announcement, the frequency of positive residuals is below that of the nonreport period, while the frequency is slightly above normal after the announcement. By far the largest frequency occurs in week 0, and there is an extremely small probability that such a high number of positive residuals could have occurred by chance.[19] This second comparison suggests the same inference drawn from the first—namely, the volume in week 0 is an unusually high value. In sum, the behavior of volume uniformly

[18] The serial correlation is reflected in the positive autocorrelation coefficient of the residuals (see Table 4). Another indication is that the four values of $\bar{e}_t$ exceeding .33 occurred in a five-week period.

[19] The probability is less than 1 chance in 100,000.

supports the contention that earnings have information content for individual investors.

In some respects, these findings do not reflect the entire extent to which activity is above normal in week 0. Not all of the earnings announcements of the 143 firms were used—in fact, only 506 out of a possible 715. The 17 week periods surrounding the remaining 209 are included in the nonreport period. This will tend to induce a bias against earnings reports since volume activity is increased in the nonreport period by the inclusion of the 209 "report periods." The extent of this bias could be serious because one of the reasons for placing a report in the 209 group was the announcement of earnings and dividends in the same week which would produce even more price and volume activity than the 506 announcements studied. However, there are also compensating factors. Although the activity in week 0 was above normal, the activity in the weeks prior were below normal for the 506 observations. If this tends to be true of the deleted announcements as well, the bias may not be so great. If the 209 observations were deleted from the nonreport period, to be completely consistent, other types of news announcements would also have to be deleted for the same reasons. The result would be virtually no observations in the nonreport period. Since the nonreport period does include these events, it is important to stress the fact that comparing the earnings report periods with the nonreport period involves a comparison of the information content of earnings reports with the average amount of information being released during the nonreport period. By necessity, this is a bias against earnings reports since the appropriate comparison would be a nonreport period with no information at all.

Price Analysis—Adjusted for Influence of Market-Wide Events

If earnings reports convey information in the sense of leading to changes in the equilibrium value of the current market price, the magnitude of the price change (without respect to sign) should be larger in week 0 than during the nonreport period. The first step in making this prediction operational is to remove the effect of market-wide events upon the individual security's price change. The reasons for wishing to abstract from these events are similar to those cited in the volume analysis.[20] The model used here was first suggested by Sharpe, and it provided the motivation for using an analogous model for volume.[21] The Sharpe model states:

$$R_{it} = a_i + b_i R_{Mt} + u_{it}.$$

R_{it} is a measure of the price change of security i during time period t, and R_{Mt} is a measure of average price change during time period t for 425 industrial NYSE firms. Both variables were defined earlier. The residual,

[20] See p. 75.

[21] William F. Sharpe, "A Simplified Model for Portfolio Analysis," *Management Science*, IX (January, 1963), 277–93.

u_{it}, represents that portion of the individual security's price change that cannot be accounted for by the effects of market-wide events as reflected in R_{Mt}.

The Sharpe model has been investigated by Fama *et al.* and by Scholes and was helpful in abstracting from the influence of market-wide factors. King's study of monthly price changes found that, on the average, 31 per cent of the variation in an individual security's price change can be explained by market-wide factors as reflected in a market-wide index of price change.[22] For these reasons, a price change analysis, unadjusted for the influence of market-wide factors, was not conducted. The evidence will later indicate that if such an analysis had been conducted, the results would be essentially the same as those reported here.

Since the direction of the price change cannot be specified, a knowledge of the investors' expectation model(s), some transformation of u_{it} that abstracts from its sign, is needed. One such transformation is the square of the residual (i.e., u_{it}^2). If earnings reports possess information content, u_{it}^2 should be greater during week 0 than during the nonreport period. The mean of u_{it}^2 during the nonreport period is simply the variance of that variable (s_i^2).[23]

The relationship between the squared residual in week 0 and the average squared residual during the nonreport period can be expressed in the form of the ratio, U_{it}, where the numerator is u_{it}^2 and the denominator is s_i^2. If the ratio is greater than one, the residual price change is larger than normal, and conversely for a ratio of less than one. The prediction is the mean of U (averaging across announcements) will be greater than one during week 0, if earnings reports possess information content.

Analysis of Nonreport Period. Estimates of a_i, b_i, and s_i^2 were obtained from regressions based upon the nonreport period. The observations from the report period (i.e., the 17 weeks surrounding each announcement) were deleted from the regression because if earnings have information content, the assumptions of the classical regression model are violated during the report period (e.g., the variance of the residuals during the report period is not equal to the variance during the nonreport period).

Some summary statistics relating to the regressions appear in Table 5. The mean price changes tend to be lower for the sample firms than for the market index. Since the R_{it} can also be interpreted as a rate of return, the lower returns for the sample firms would suggest that they are less risky

[22] Fama, *et al.*, *op. cit.*; Myron Scholes, "The Effects of Secondary Distributions upon the Market Price" (paper presented at the November, 1967 session of the Conference for the Study of Security Prices held at the Graduate School of Business, University of Chicago); and King, *op. cit.* The percentage refers to the period August, 1952 through December, 1960.

[23] The variance $\sigma_i^2 = E[u_{it} - E(u_{it})]^2$. s_i^2 is the estimate of σ_i^2, computed from sample data. $s_i^2 = [\sum_{t=1}^{T}(u_{it})^2]/T$, where T = number of weekly observations for the nonreport period for security i.

than the firms comprising the index. An inspection of the distribution of b_i also lends support to that contention. Sharpe states that b_i can be viewed as an operational measure of a security's riskiness, with larger values of b_i implying greater riskiness.[24] A b_i of one denotes a security of "average" riskiness. The average b_i for the sample firms is less than one (.89), which suggests that the sample firms are less risky. However, the discussion in the section on definition of variables indicated that the definition of R_{Mt} based upon the S & P index may be subject to measurement error. An errors-in-variables model suggests that measurement error in the independent variable, even if it has a zero expectation, will induce a downward bias in the estimates of the regression coefficient associated with the independent variable (i.e., b_i).[25] Efforts were undertaken to assess the extent of the downward bias by computing b_i for the sample firms, using monthly data and Fisher's Link Relative as a definition of R_{Mt}. The median b_i was .993, suggesting the sample firms are of average riskiness relative to NYSE firms (i.e., the firms that comprise the Fisher Index).

On the average, the association between R_{it} and R_{Mt} was low. Only 6 per cent of the variation in R_{it} can be explained by the variation in R_{Mt}, as measured by the square of the average correlation coefficient. The implication is two-fold: (1) Removing the influence of R_{Mt} should have little effect upon the results, relative to what would have been obtained if R_{it}^2 were analyzed rather than u_{it}^2. (2) The explanatory power is much lower than that obtained by King, suggesting that either weekly data have more noise than monthly data or that R_{Mt} was not properly defined, or both. The presence of either factor will make it more difficult to detect any price effects of the earnings reports.

The distribution of $\bar{U}_t$ (averaging across 143 firms, $t = 2, \cdots, 261$) during the nonreport period is shown in Figure 5. It will be used as a basis for assessing the significance of the $\bar{U}_t$'s observed during the report period.[26]

Price Residual Analysis for Report Period. The residual, u_{jt}, was computed for each week t of the report period and for each of the 506 earnings announcements j in the following manner:

$$u_{jt} = R_{jt} - a_i - b_i R_{Mt} \qquad \begin{aligned} i &= 1, \cdots, 143 \\ j &= 1, \cdots, 506 \\ t &= -8, \cdots, +8. \end{aligned}$$

The residual was then squared and divided by the variance of the residuals for its firm during the nonreport period, as follows:

[24] William F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *Journal of Finance*, XIX (September, 1964), 425–42.

[25] J. Johnston, *Econometric Methods* (New York: McGraw-Hill, 1963), 148ff.

[26] The distribution is skewed to the right. One explanation for this phenomenon is the leptokurtic nature of the underlying u_{it}'s (see Fama, *op. cit.*). The distribution of u_{it}^2 is also skewed in the same direction. Although the mean of u_{it}^2 is one for each security during the nonreport period, only 26 per cent of the observations exceed one.

$$U_{jt} = u_{jt}^2/s_i^2 \qquad \begin{aligned} i &= 1, \cdots, 143 \\ j &= 1, \cdots, 506 \\ t &= -8, \cdots, +8. \end{aligned}$$

$\bar{U}_t$ (averaging across j) was computed for each of the 17 weeks of the report period, and the results appear in Figure 6.

The magnitude of the price changes in week 0 is much larger (67 per cent higher) than the average during the nonreport period. The above normal price activity is what would be expected if changes in equilibrium prices are more likely to occur when earnings reports were released, and hence the evidence is very consistent with earnings reports possessing informational value.

Although the price activity is highest in week 0, the next largest values occur in the weeks immediately contingent to week 0. Price changes are above average in the week immediately prior to the announcement, which may reflect information leakage or the fact that the *Wall Street Journal* was not the first source to report the earnings in some cases. Above normal activity is also present for two weeks after the announcement, during which time the annual reports are released and are evaluated by investors.

The below price activity in weeks -8 through -2 is open to at least two interpretations: (1) There is a below normal amount of information coming onto the market at this time. (2) The below normal price activity is a result of the below normal volume also observed during the same period. More will be said about both (1) and (2) later.

The behavior of the mean residual, $\bar{u}_t$, also indicates greater price activity in week 0 (see Table 6). The mean in week 0 is .00500, which is the largest value observed during the 17 weeks and is four times larger than the average value of R_{it} during the nonreport period (.00125, see Table 5). The means give the impression that serial correlation may be present in the data. However, the average autocorrelation of the price residuals was quite low ($-.08$) during the report period. The low degree of autocorrelation supports the similar findings of Fama and his conclusion that the market moves to new equilibrium positions quickly.[27] Further evidence of this is reflected in the fact that the bulk of the price reaction does occur in week 0 (see Figure 6). The low autocorrelation also suggests that the price changes were permanent in nature and were not reversed in subsequent weeks. In fact, the autocorrelation of the residuals in the weeks immediately after the announcement week was slightly positive.[28]

Two additional comparisons (analogous to those made in the volume analysis) were conducted to see how unusual an $\bar{U}_t$ of 1.67 is. The first comparison examined $\bar{U}_t$ in the nonreport period (see Figure 5). Out of 260 values, only 11 exceeded 1.67. The comparison suggests that the price ac-

[27] Fama, *op. cit.*

[28] The autocorrelation was examined on a week-by-week, cross-sectional basis, i.e., $o_t = [\sum_{j=1}^{506} (e_{jt}e_{jt-1})]/[\sum_{j=1}^{506} (e_{jt})^2]$, $t = -8, \cdots, +8$.

tivity in week 0 is unusually high, in spite of the fact that such a comparison tends to understate how unusual it really is.[29] The second comparison examined the frequency of U_{jt}'s larger than one relative to the frequency that occurred during the nonreport period (see Figure 7). The frequency of values above one is greatest in week 0, with the next highest values occurring in the weeks adjacent to the announcement week. There is an extremely small probability that such a high number (181 in week 0) could have occurred by chance.[30] The interpretation is the same as that of the mean analysis—namely, there is above normal price activity when earnings reports are released. What this analysis reveals that the mean analysis does not is the fact that the abnormally high mean is not caused by a few observations dominating the results but rather by a substantial proportion of the sample data.

In summary, the behavior of the price changes uniformly supports the contention that earnings reports possess information content. Observing a price reaction as well as a volume reaction indicates that not only are expectations of individual investors altered by the earnings report but also the expectations of the market as a whole, as reflected in the changes in equilibrium prices.

Relationship between the Volume and the Price Findings. The previous sentence raises the issue, "how much of the increased price activity can be attributed merely to the fact that there is more 'action' in the security, rather than to changes in equilibrium prices?"

One way to approach this question is to view the price change during a given time period as a sum of price changes on each transaction that occurred during that period. In a world of uncertainty, the price change from each transaction can be treated as an observation from a probability distribution of the investor's assessment of what the price change should be. The price change per period, then, is a sum of random variables. If transactions occur as if they are independent over time (evidence on daily, weekly, and monthly price changes suggest they do), the variance of the weekly price change will increase in direct proportion to the number of transactions that occur during the time period.[31]

[29] The reasons for understatement are similar to those stated in the volume analysis. See p. 77.

[30] The probability is less than 1 chance in 100,000.

[31] The evidence regarding serial correlation of daily and monthly price changes can be found in Fama, *op. cit.* and Fama, *et al.*, *op. cit.*, respectively. The average autocorrelation coefficient for weekly changes in this sample was −.08, which would cause the variance to increase less than proportionately with the number of transactions. Within a given trading day, the autocorrelation may be higher (e.g., because of certain institutional factors, such as clustering of limit orders or stop loss orders). However, the existence of arbitragers should prevent the autocorrelation from being very large. In order for the price activity to be explained entirely by increased transaction activity, the autocorrelation would have to be one. This would be highly unlikely because of the empirical evidence cited and the opportunities for arbitrage.

The issue now is what is the appropriate measure of the number of transactions occurring during a given period. If the volume is used as a measure, then $\bar{U}_t$ in week 0 would be expected to be 1.30 merely because of more action in the security. The remaining portion would be attributed to changes in the equilibrium prices of the securities. However, it is not at all clear that volume (or even number of transactions) is the appropriate measure, because it reflects only the *explicit* transactions that occur.

It could be argued, with considerable support from economic theory, that the expectations of all investors influence the market price, whether or not they engage in a purchase or a sale. If the market acts in this manner, the total number of transactions, explicit and implicit, are the same per time period. Hence all of the above average price activity can be attributed to changes in equilibrium prices.

Additional empirical research is needed before this issue will be resolved. The research would consist of studying increased volume activity due to reasons other than information coming onto the market. An initial analysis of the seasonal variation in volume (V_{Mt}) from 1946 through 1966 revealed that the volume is greatest during the months December and January. The explanation seems to stem from tax considerations rather than an above normal flow of information. Research also indicated that the price variability of R_{Mt} during these months (i.e., $\bar{U}_t$) was only .996, indicating no above average price variability during these months. This finding lends support to the position that none of the price activity in week 0 is due merely to more motion.

Before leaving this topic, note that isolating the volume effects on price changes is of concern only to the extent one wishes to distinguish between information that alters the expectations of the market as a whole from information that alters only the expectations of individual investors. All of the price activity can be attributed to information in the latter sense.

Frequency of Other News Announcements during Report Period

The purpose of this analysis was to discover if there was any clustering of other news announcements around week 0 that might possibly account for the volume and price reactions. As indicated earlier, the sample design excluded any firms that announced dividends in the same week as earnings or any firms that split their stock during the report period. However, it is conceivable that dividends announcements might cluster in weeks immediately prior to and after week 0 or that other types of announcements (e.g., management earnings forecasts) might cluster in week 0. To examine this possibility, the occurrence of other news announcements in the *Wall Street Journal* during the 506 report periods was examined (see Table 7).

By far the most frequent type of announcement was dividends, which exceeded the frequency of all other types of announcements by a factor of

9 to 1. With respect to the purpose of this analysis, there is no clustering of dividend announcements in weeks −1 or +1; in fact the opposite seems to be true. Also there is no clustering of any other type of announcements at any time during the period, including week 0. The volume and price reaction in week 0 does not appear to be attributable to the clustering of other news announcements.[32]

Suggestions for Future Research

The dramatic price and volume reaction indicates that investors do look directly at reported earnings and do not use other variables to the exclusion of reported earnings. The evidence also indicates that news announcements occurring prior to the earnings report do not entirely preempt the information content of reported earnings. Given these findings, one of the first extensions of the study will be to explore the possibility of constructing expectations models that will permit a prediction of the direction and magnitude of the price residual.

The results of a recent study by Ball and Brown in this area are very encouraging.[33] They used an earnings model similar in form to the price and volume models described in this study (e.g., changes in the earnings of an individual security were viewed as a linear function of market-wide index of earnings changes). The sample was divided into two groups: instances where the earnings residual was positive (actual earnings were higher than "expected") and instances where the earnings residual was negative (actual earnings lower than "expected"). The behavior of the price residuals for these two groups was examined, and the findings were: (1) The sign of the cumulative price residual (summed over a 12 month period including the announcement month) was highly associated with the sign of the earnings residual. (2) There was a persistent upward drift in the cumulative mean price residuals for the positive earnings residual group. This drift started 11 months prior to the earnings announcement, and over 90 per cent of the drift had taken place by the beginning of the announcement month. The negative earnings group exhibited an analogous behavior pattern.

The findings indicate that reported earnings are associated with underlying events that are perceived by investors to affect the market price. Because earlier news announcements convey some of the same information as the earnings reports, investors are able to use this information to revise their forecasts of earnings and to adjust the price accordingly. In fact, by the beginning of the announcement month, investors form largely *unbiased* forecasts of reported earnings, even though the reported earnings are above

[32] As measured in terms of number of news announcements per week, the flow of information during the weeks prior to the announcement does not appear to be below normal and hence would not account for the below normal price activity during weeks −2 through −8.

[33] Ray Ball and Philip Brown, "An Empirical Evaluation of Accounting Income Numbers," *Journal of Accounting Research*, 6 (Autumn, 1968), pp. 159–78.

or below normal relative to their historical relationship with market-wide earnings.

Although the forecasts are unbiased, they are not very efficient, for if they were, there would be no volume or price reaction when earnings reports were released.[34] The Ball and Brown findings and the findings presented here are mutually supportive with respect to the information content of earnings reports and also are uniformly consistent with the findings of previous studies in the behavior of security prices. One extension of the research presented here will be to replicate the Ball and Brown study on this sample of non-12/31 firms (the Ball and Brown study dealt exclusively with 12/31 firms) and then to attempt to predict the magnitude, as well as the sign, of the price residual.

A second area of further research is the application of this methodology to other types of news announcements. At an earlier meeting of the Conference, Green and Segall explored the information content of interim reports. An analysis of volume and price changes during the announcement of interim earnings would provide a different approach to this same issue. The information content of dividend announcements is another topic that has received much attention and still is in need of additional empirical investigation. Such research will indicate the importance of annual earnings announcements relative to other kinds of information.

Perhaps the most important extension of this study would be dealing with the normative issue, "Should decision makers perceive earnings reports to possess informational value?" The normative question can be approached by selecting an event of interest to decision makers (preferably as free as possible from the influence of their perceptions) and by investigating the ability of earnings data to predict that event. A few studies of this type have been presented at earlier meetings of the Conference, but much more work is needed in this area.[35] Hopefully, the findings presented here with respect to the positive question will provide greater insight into the normative issue as well.

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[34] The distinction between unbiasedness and efficiency was discussed in footnote 9.

[35] James O. Horrigan, "The Determination of Long-Term Credit Standing with Financial Ratios," *Empirical Research in Accounting: Selected Studies, 1966*, Supplement to Vol. 4, *Journal of Accounting Research*, pp. 44–62, and William Beaver, "Financial Ratios as Predictors of Failure," *ibid*, pp. 71–102.

TABLE 1

Effect of Selection Criteria upon Sample Size

Criteria	No. of firms
Compustat firms (step 1)[a]	896
Less: 12/31 firms	599
Non-12/31 firms (step 2)	297
Less: Non-NYSE firms	55
NYSE and non-12/31 (step 3)	242
Less:	
More than 20 announcements per year	48
Dividends in earnings announcement week	39
Stock split during report period	7
Other[b]	5
	99
Sample size (step 4)	143

[a] Sample criteria were applied sequentially in four stages. The sample size after each stage is denoted by parenthetical comment (e.g., steps 1, etc.).

[b] Miscellaneous reasons such as firm's earnings were not reported in *Wall Street Journal*.

TABLE 2

Distribution of Financial Statement and Announcement Dates

Month	Percentage of firms whose fiscal year ended in each month	Percentage of times earnings reports were announced in each month
January	7.0	7.5
February	6.3	2.3
March	7.8	2.8
April	6.3	5.0
May	1.4	8.7
June	23.8	6.5
July	9.6	6.8
August	7.8	11.3
September	15.3	11.9
October	9.1	13.4
November	5.6	12.3
December	0.0	11.5
Total[a]	100.0	100.0

[a] Total number of firms equals 143, and total number of announcements equals 506.

TABLE 3

Number of Weeks between Fiscal Year-End and Date of Announcement

No. of weeks	Percentage of announcements	Cumulative percentage
Less than 4	1.7	1.7
4	1.5	3.2
5	4.1	7.3
6	11.6	18.9
7	14.0	32.9
8	13.8	46.7
9	11.2	57.9
10	11.0	68.9
11	8.6	77.5
12	8.6	86.1
13	6.9	93.0
14	3.0	96.0
15	2.2	98.2
More than 15	1.8	100.0
Total[a]	100.0	

[a] Total number of announcements is 506.

TABLE 4

Summary of Regression Statistics Volume Analysis

Item	No. of observations per firm in non-report period	Mean of dependent variable $(\overline{V}_i) \times 10^3$	Mean of independent variable $(\overline{V}_i) \times 10^3$	Correlation coefficient	Autocorrelation coefficient of residuals
Fractile					
.10	165	.33	.577	.06	.21
.25	176	.53	.583	.16	.29
.50	193	.88	.588	.28	.39
.75	210	1.56	.595	.39	.50
.90	227	2.36	.608	.46	.62

TABLE 5

Summary of Regression Statistics Price Analysis

Item	No. of observations per firm in non-report period	Mean of dependent variable $(\overline{R}_i) \times 10^3$	Mean of independent variable $(\overline{R}_M) \times 10^3$	Regression coefficient of R_{Mt}	Correlation coefficient
Mean	187	1.25	1.73	.89	.26
Fractile					
.10	165	−2.13	.96	.42	.13
.25	176	−.26	1.25	.62	.22
.50	193	1.51	1.51	.87	.27
.75	210	2.88	2.04	1.13	.32
.90	227	3.98	2.96	1.44	.37

TABLE 6

Analysis of Mean Price Residual

Week	Mean residual ($\Sigma_{i=1}^{506} u_{it}/506$)
−8	.00183
−7	−.00105
−6	−.00029
−5	−.00064
−4	−.00096
−3	.00019
−2	−.00047
−1	.00229
0	.00500
1	.00204
2	.00163
3	.00120
4	.00109
5	.00354
6	−.00040
7	.00257
8	.00343

TABLE 7

Occurrence of Other News Announcements

Week	No. of dividend announcements	No. of all other types of announcements
−4	43	3
−3	39	2
−2	42	4
−1	16	5
0	0	4
1	16	4
2	33	4
3	32	3
4	41	2
Total	262	31

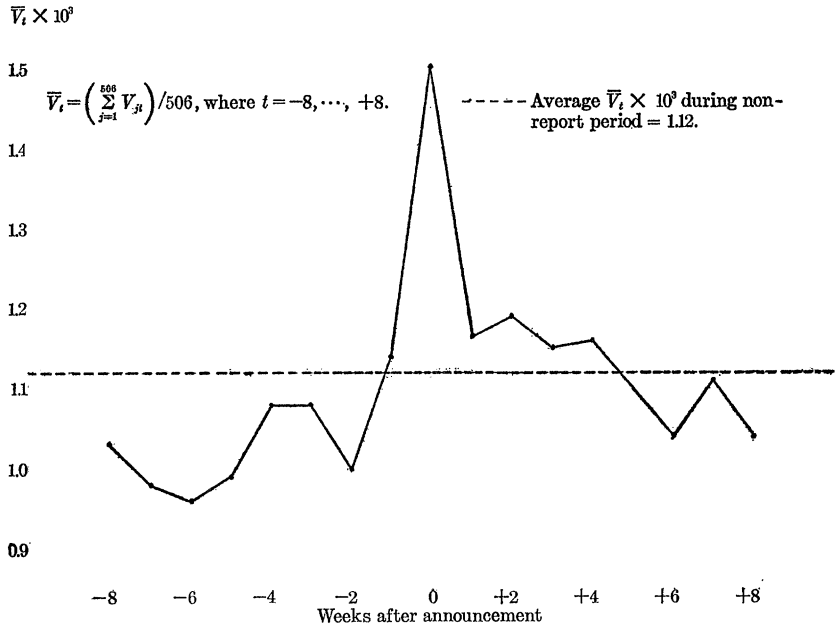

FIG. 1. Volume Analysis

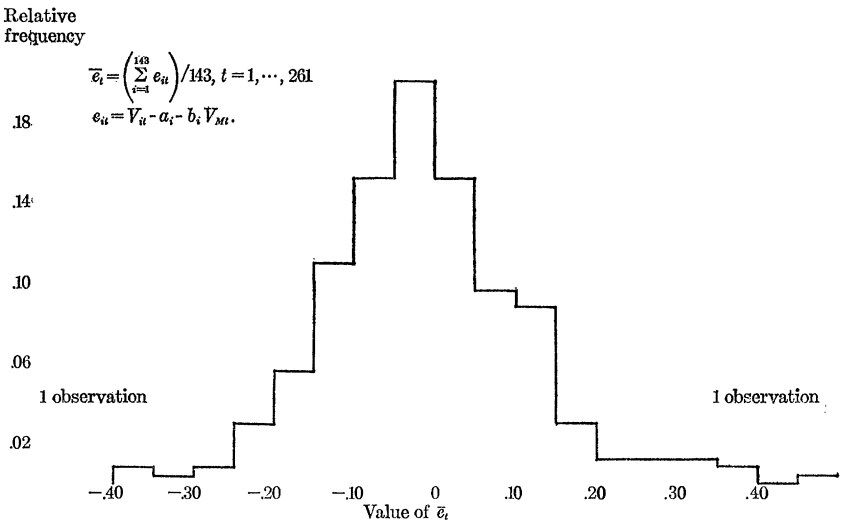

FIG. 2. Distribution of $\bar{e}_t$ in the Nonreport Period

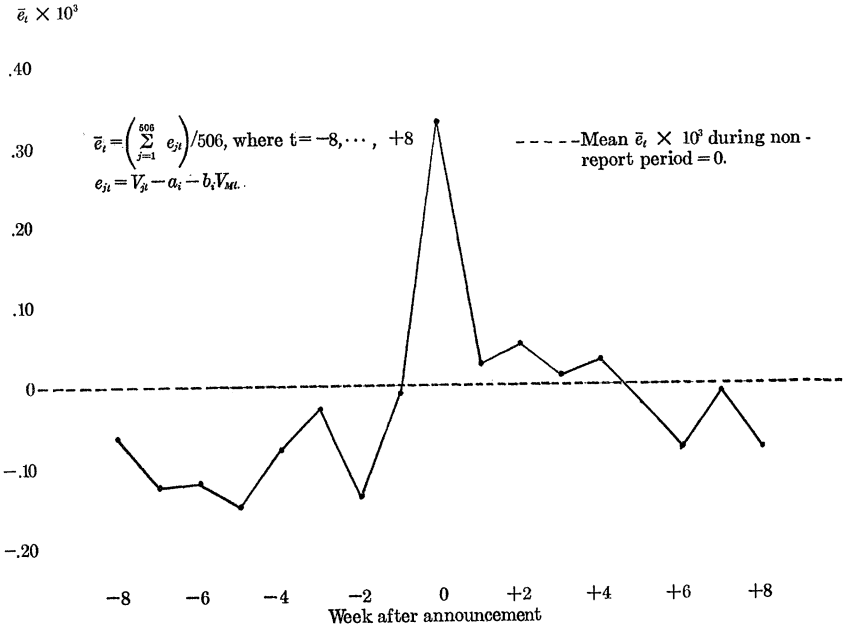

FIG. 3. Residual Volume Analysis

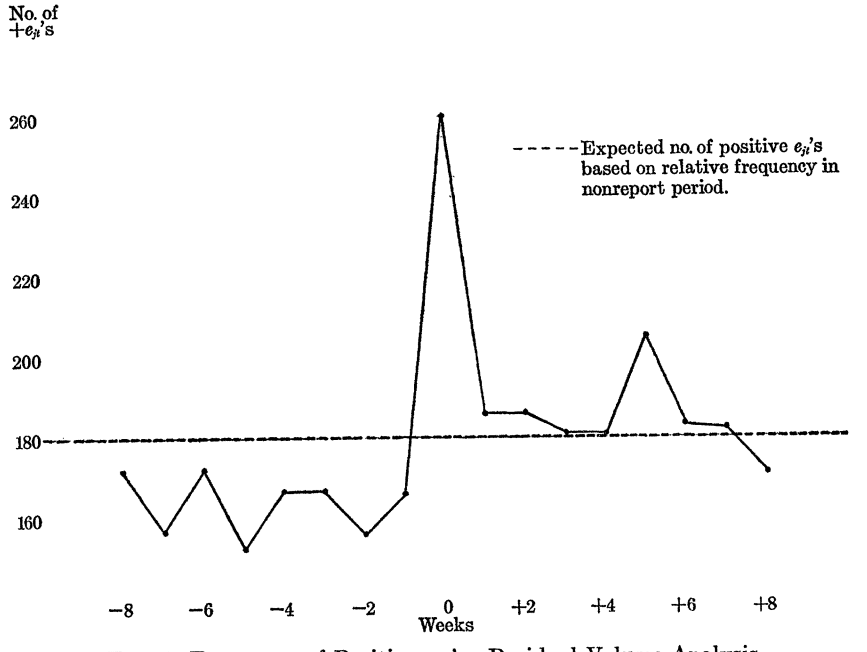

FIG. 4. Frequency of Positive e_{jt}'s—Residual Volume Analysis

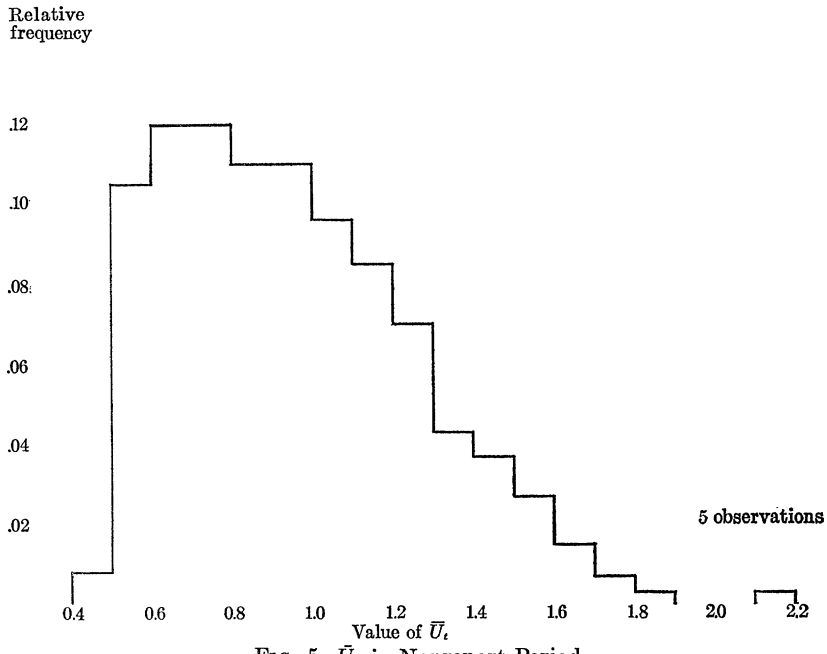

FIG. 5. $\bar{U}_t$ in Nonreport Period

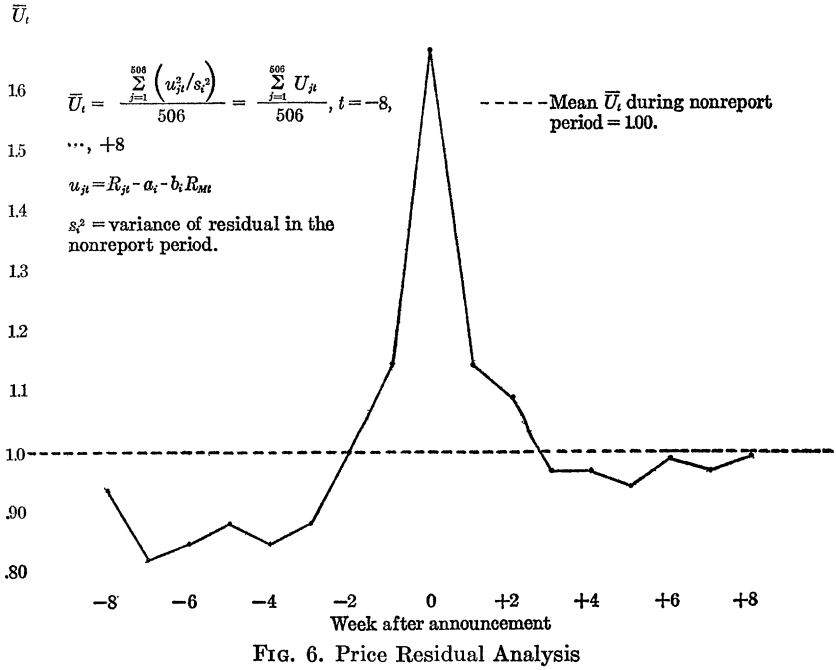

FIG. 6. Price Residual Analysis

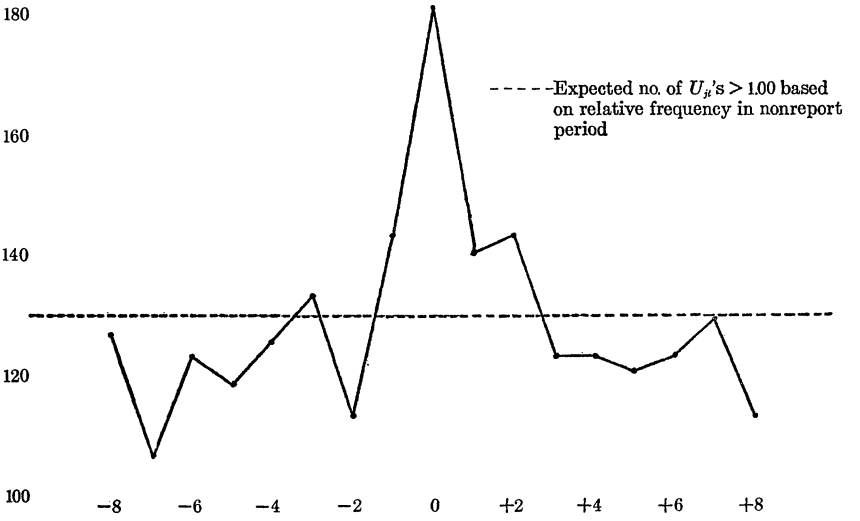

FIG. 7. Frequency of U_{it}'s > 1.00—Residual Price Analysis