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Investor Evaluation of Accounting Information: Some Empirical Evidence†

I. INTRODUCTION

Accounting statements are a principal means for disseminating information about the economic events of corporations. Because accounting reports are utilized for a variety of purposes, a well-defined set of rules has been established to govern methods of reporting. These rules frequently limit the value of accounting reports to some users, but accountants hope that consistent and objective measurement will enable all users to properly interpret and act upon the events being reported.

In recognition, though, of the complexity and diversity of business transactions, generally accepted accounting procedures still permit a firm to have considerable control over the numbers that appear in its published financial statements. The methods of reporting depreciation, inventory valuation, or income and expense recognition are determined by the firm's officers but subject to the approval by its auditors. If a firm can reduce its tax liability by choosing a different method of reporting (e.g., by using accelerated depreciation), a real economic impact can be obtained. But frequently, the method selected will be used only for financial reporting to stockholders and will therefore not affect tax payments. In such a situation, the firm is essentially choosing among different forms of communicating the same information.

The firm and its auditors are responsible for disclosing the accounting conventions used in preparing financial statements. Any change in method that occurs (e.g., a switch in reporting depreciation) should be specifically mentioned at the time that an earnings or financial-position report is issued or, at the very latest, in the annual report for the year in which the accounting change occurred. Sophisticated investors should be able to understand detailed financial statements and properly interpret the accounting conventions used by a company to describe its operations. Thus, the existence of sophisticated traders who are able to correctly "price" a stock should preclude a company being able to influence its stock price through the manipulation of accounting conventions.

However, this view of efficient capital markets, where stock prices

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correctly reflect all information, is not universally held. Almost every week a column in *Barrons,* "Up and Down Wall Street," contains a detailed exposé of the accounting manipulations performed by a company ostensibly attempting to influence its stock price. Since the information used in these exposés is generally obtained by meticulous reading and analysis of footnotes to financial statements, the assumption must be that the investing public is unable to perform these calculations. A number of other articles in *Barrons*[1] have gone to great lengths to explain the accounting manipulations that are possible while still keeping auditors' approval of "generally accepted accounting principles."

Similar articles may be found in professional publications for financial analysts. Two articles in the *Financial Analysts Journal* entitled "Depreciation Manipulation for Fun and Profits"[2] have described in detail how companies have increased their reported profits by switching back from accelerated depreciation to straight-line depreciation. Articles have appeared in accounting journals describing and analyzing companies that have increased reported earnings through changing depreciation methods,[3] using the flow-through method for reporting the investment credit,[4] and accounting for mergers by pooling of interests.[5] A recent dissertation[6] provides an extensive survey of companies that have made accounting changes. The evidence there indicates that companies are most likely to use accounting changes in an attempt to smooth their reported income streams. There are occasional instances of "housecleaning"—implementing accounting changes with an adverse effect on earnings at a time when earnings are already depressed.[7]

Company executives must believe such practices affect securities prices or they would not take the trouble to change accounting pro-

1. E.g., J. S. Seidman, "Pooling Must Go," *Barron's,* July 1, 1968; and Abraham Briloff, "Much-abused Goodwill," *Barron's,* April 28, 1969.

2. John Myers, "Depreciation Manipulation for Fun and Profit," *Financial Analysts Journal* 23 (November-December 1967): 117–23; and 25 (September-October 1969): 47–56.

3. T. Ross Archibald, "The Return to Straight-Line Depreciation: An Analysis of a Change in Accounting Method," *Journal of Accounting Research* 5, suppl. (1967): 164–80; and Francis Bird, "A Note on 'The Return to Straight-Line Depreciation,'" *Journal of Accounting Research* 7 (Autumn 1969): 328–31.

4. Archibald; and M. Gordon, B. Horowitz, and P. Myers, "Accounting Measurements and Normal Growth of the Firm," in Jaedicke, Ijiri, and Nelson, *Research in Accounting Measurement,* ed. R. Jaedicke, Y. Ijiri, and O. Nelson (Iowa City, Iowa: American Accounting Association, 1966).

5. Jean-Marie Gagnon, "Purchase versus Pooling of Interests: The Search for a Predictor," *Journal of Accounting Research* 5, suppl. (1967): 187–204.

6. Barry Cushing, "The Effects of Accounting Policy Decisions on Trends in Reported Corporate Earnings Per Share" (Ph.D. diss., Michigan State University, 1969).

7. For development of the income-smoothing hypothesis, see S. Hepworth, "Smoothing Periodic Income," *Accounting Review* 28 (January 1953): 32–39; Myron Gordon, "Postulates, Principles and Research in Accounting," *Accounting Review* 39 (April 1964): 251–63; Gordon et al.; and Ronald Copeland and Ralph Licastro, "A Note on Income Smoothing," *Accounting Review* 43 (July 1968): 540.

cedures, hinder interperiod and intercompany comparisons, and incur a qualification or supplementary statement in the auditors' report. So far, however, no published evidence is available to support executives' beliefs, and indeed, few systematic studies have been made. Those that are available examine the impact on price-earnings ratios of companies, within a single industry, that implemented accounting methods affecting reported income but not taxable income.[8] They suggest that investors do compensate for accounting changes and do not blindly compute earnings per share without examining the methods used to generate earnings. However, these studies either failed to control for important factors that affect stock prices (e.g., general market movements) or else introduced errors in the measurement of some of the variables (e.g., growth rate, risk).

In this paper, we employ a recently developed technique (see Sec. III) to measure the effect that two widely adopted accounting changes had on stock prices of firms in many different industries. Both changes affected only the financial statements prepared for stockholders and had no effect on taxes, cash, or any other real economic asset or liability of the firm.

The first was the switch, in 1964, to the flow-through method of reporting the investment credit. When the investment credit was first introduced in 1962, the recommended method was to take the tax saving into income over the lifetime of the asset. An alternative method also allowed a company to take 48 percent of the investment credit into income immediately with 52 percent deferred to subsequent accounting periods. In 1964, the accounting treatment was modified to give a company the option of reporting the entire amount of the credit in the year that the asset was purchased. Many companies were quick to adopt this new accounting procedure, and some obtained an even larger earnings jolt in the first year by taking deferred reserves, which had been built up in the first few years of the investment credit, into income too. Of course, many companies continued to use the recommended and more conservative convention of amortizing the credit over the productive life of the asset. The 48–52 method faded from use in 1964 because virtually all the companies that had used it switched to the flow-through method. One might suspect that those companies which were able to increase their reported earnings by

8. See J. L. O'Donnell, "Relationships between Reported Earnings and Stock Prices in the Electric Utility Industry," *Accounting Review* 40 (January 1965): 135–43; and "Further Observation on Reported Earnings and Stock Prices," ibid. 43 (July 1968): 549–53; and F. A. Mlynarczyk, "An Empirical Study of Accounting Methods and Stock Prices," *Journal of Accounting Research* 7, suppl. (1969): 63–81, for studies of the effect of flow-through versus normalization accounting in the electric utility industry. E. E. Comiskey, "Market Response to Changes in Depreciation Accounting," *Accounting Review* 46 (April 1971): 279–85, examines the impact on price-earnings ratios of companies in the steel industry that switched from accelerated to straight-line depreciation for financial reporting.

adopting the flow-through method should have had relatively higher increases in stock prices than those companies which continued to report their earnings conservatively. If the market was dominated by sophisticated investors, however, that portion of a company's earnings which was obtained through the flow-through of the investment credit should have been apparent and discounted properly, thus resulting in no price change.

The second change studied was the switch back from reporting accelerated depreciation to reporting straight-line depreciation. This switch-back has been performed by many companies recently, and there is even an industry effect; for example, paper companies switched back in 1965, steel companies in 1968. Again, since these companies continued to use accelerated depreciation for tax purposes, the change to reporting straight-line depreciation had no effect on the economic position of the firm.

Section II describes the sources and types of accounting data collected for companies that implemented either change in accounting practice since 1962. Section III presents the financial model used to test the impact of changes in accounting practice. Discussion of procedures for statistical inference when the underlying distribution is from the class of symmetric stable distributions also appears in Section III. The findings from estimating and testing the financial model are reported in Section IV. Briefly, they indicate that any price effect from a change in accounting procedure of the type investigated in this paper is temporary. Additional tests and findings are reported in Section V. Summary and conclusions are presented in Section VI.

II. ACCOUNTING DATA

The names of companies that switched to the flow-through method of reporting the investment credit were obtained from the 1965 edition of *Accounting Trends and Techniques*. This publication surveys the annual reports of 600 companies and summarizes the form and terminology used in the financial statements of the companies. It also presents the various treatments of transactions and items that affect the financial statements. The 600 companies are intended to be a cross-section of U.S. industrial firms, and, while most of the largest companies are in the sample, many small companies whose securities are not traded on the New York or American Exchange are also included. No utility companies are in the sample. We are unaware of any bias in selecting companies for inclusion in this publication which would make the results reported in this paper unrepresentative for industrial corporations in general.

The 1965 edition of *Accounting Trends and Techniques* had a detailed section on the investment credit because of the issuance of Opinion No. 4 of the Accounting Principles Board (APB) in March 1964. This opinion granted that "the alternative method of treating the credit as a reduction of Federal income taxes of the year in which the credit arises is also acceptable." There were 302 companies which indicated that they switched to the flow-through method permitted by Opinion No. 4. In contrast to these, sixty-eight companies continued to use the method recommended in APB Opinion No. 2, December 1962, of reflecting the investment credit "in net income over the productive life of the acquired property and not in the year in which it is placed in service." Two companies continued to use the 48–52 method.

The remaining 228 companies either did not make specific reference to the use of the investment credit or else used other accounting variations which were not identified. The identity of the 372 companies which were using either the productive-life or flow-through method was disclosed so that we had both a group of companies that switched their method and a control group of companies that did not switch their accounting treatment of the investment credit. Because of data limitations described in the following section, only companies whose stock was listed on the New York or American Exchange could be analyzed. In addition, tape errors or an insufficient number of stock price observations for some companies limited the sample somewhat further. At this point we had 263 companies which switched to the flow-through method and sixty-nine which retained the productive-life or 48-52 method in 1964. More recent editions of *Accounting Trends and Techniques* were scanned to identify companies that switched methods in later years. This yielded twelve more companies, so that our final sample had 275 companies which switched and fifty-seven companies which retained the productive-life method.

For each of the 332 companies that were in the final sample, the date was obtained when the earnings were announced for the fiscal year in which the investment-credit method switch could have or actually occurred. This was accomplished by finding the first record of a fiscal-year earnings report as published in the *Wall Street Journal*. Such information was readily available by utilizing the *Wall Street Journal Index* in the appropriate year. There was, in general, no specific mention in the *Index* as to whether the investment credit treatment had been disclosed prior to or at the same time as the earnings report. We assumed that this information was generally known at the time of the earnings announcement or shortly thereafter when the annual report appeared. This assumption was tested in another context when we considered companies that switched depreciation methods.

We used the earnings announcement date as the base date for measuring the effect of accounting changes, since previous studies[9] have indicated that this is a time when new information about the company

9. Ray Ball and Philip Brown, "An Empirical Evaluation of Accounting Index Numbers," *Journal of Accounting Research* 6 (Autumn 1968): 159–78; and William Beaver, "The Information Content of Annual Earnings Announcements," *Journal of Accounting Research* 6, suppl. (1968): 67–92.

is disseminated. Significant price adjustments are likely to occur at this point as investors revise their expectations about a company's future prospects. If a company is able to influence its stock price by an accounting change, the principal impact should occur when the announcement is made of the first full year of earnings in which the accounting change was implemented. Certainly, in the first few years after the switch, companies using the flow-through method, and not significantly decreasing their level of investment, will consistently report higher earnings than if they used the productive-life or 48-52 method. However, since the largest change in year-to-year earnings will occur in the first year in which the switch was implemented, this date was used in our analysis.[10]

A similar procedure was used to identify companies that switched from using an accelerated method of depreciation to the straight-line method for financial reporting. As with the investment credit, this switch had the immediate effect of increasing the reported earnings in the first year the change was implemented over what would have been reported had the accounting change not been made. *Accounting Trends and Techniques* again provided a good source of companies that had implemented this change in reporting depreciation, and it was cross-checked against a list compiled by Cushing.[11] The names of additional companies were obtained from studies reported by Myers, Archibald, and Bird.[12] The final sample included seventy-one companies.

For each company, the date of first earnings announcement was recorded from the *Wall Street Journal* for the fiscal year when the change in depreciation method was implemented. In addition to this information, we attempted to identify when the change in depreciation method was first announced. Every mention of a company as indicated in the *Wall Street Journal Index* during the year in which the depreciation change occurred (and shortly thereafter) was checked in the *Journal* itself to see whether it included mention of the accounting change. There is no guarantee that the earliest date so obtained was when the investment community was first informed of the change, but it certainly provided an upper bound and we were not able to obtain a better estimate. For many companies, this date turned out to be the same as for the year-end earnings announcement. However, a number of companies did announce the accounting change prior to this report, and in one instance, a company announced its intentions to change its depreciation method in the annual report for the prior year. Thus, we were able to test whether there was an effect due solely to the announcement, in

10. We observed stock returns for thirty weeks on either side of the announcement date so that an earlier price adjustment, say after a six- or nine-month earnings report which included the effect of the accounting change, would have been detected. In fact, as reported later, the major impact did occur at the year-end announcement date.

11. See n. 6 above.

12. See Myers (n. 2 above) and Archibald and Bird (n. 3 above).

advance, that earnings were going to be increased by an accounting change.

In contrast to the investment-credit switch which was first implemented in most companies in the same year, 1964, the depreciation change occurred throughout the 1960s. Table 1 presents for each year the number of companies in our sample which switched back to reporting straight-line depreciation for that year.

Table 1
Corporations Switching from Accelerated to Straight-Line Depreciation for Financial Reporting

Year	Number of Firms
1962	9
1963	6
1964	3
1965	17
1966	12
1967	3
1968	21
Total	71

III. FINANCIAL DATA AND METHODOLOGY

In attempting to judge the real impact of accounting changes, we are faced with the unfortunate circumstance that many other causes are simultaneously affecting market prices. Whether these are general market movements or changes in dividends, labor contracts, interest rates, or technology, they are all nuisances and must be eliminated in order to clearly perceive the effects of the events under study.

To accomplish this, we employed two techniques: First, by constructing models based on the capital asset pricing theory of Sharpe and Lintner,[13] we intended to eliminate two variables that are broadly related to all securities. These variables were interest rates and general economic conditions, the latter as measured by an index of stock prices. Second, we hoped to purge the effects of many other influences on stock prices by cross-sectional averaging over a large sample of heterogeneous firms. Of course, this technique only eliminated the impact of events that were independent among firms.

The Sharpe-Lintner theory of capital asset pricing is based on the normative risk-avoidance prescription of Markowitz.[14] A diversified

13. William F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk," *Journal of Finance* 19 (September 1964): 425–42; and John Lintner, "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets," *Review of Economics and Statistics* 47 (February 1965): 13–37.

14. Harry M. Markowitz, *Portfolio Selection: Efficient Diversification of Investments* (New York: John Wiley & Sons, 1959).

portfolio of imperfectly correlated securities has a lower expected variance of return than a value-weighted average of the individual security returns. Sharpe was the first to show how capital market equilibrium prices (and expected returns) are formed under pure competition when investors behave as portfolio diversifiers. Although his analysis required several rather unrealistic assumptions,[15] his model has been successfully applied to a variety of capital assets[16] and seems to fit common stocks particularly well.

Sharpe-Lintner equilibrium is characterized by the following expression:

$$\bar{R}_{j,t} = R_{F,t} + \beta_j(\bar{R}_{m,t} - R_{F,t}), \quad (1)$$

where $\bar{R}_{j,t}$ is the expected return on stock j in time t; $R_{F,t}$ is a riskless return; $\bar{R}_{m,t}$ is the average return expected on all risky assets; and β_j is a risk coefficient. In this paper, we followed the common practice of converting (1)[17] to a regression model:

$$R_{j,t} = \gamma_j R_{F,t} + \beta_j R_{m,t} + \epsilon_{j,t}, \quad (2)$$

where $\epsilon_{j,t}$ is a disturbance term whose mean is assumed to be zero. Variables in equation (2) were measured weekly by the quantities given in table 2. For each security, the record of weekly prices begins, at the earliest, on July 5, 1962 and ends, at the latest, on September 25, 1969. To have been included in the sample, at least twelve observations (weeks) must have been available on each side of the accounting change date.

Most securities included here provide a complete record of observations from mid-1962 to the end of 1968, a total of 338 weeks. Some, however, were listed on the New York or American Exchange for less than the full period.[18] Table 3 provides a frequency distribution of weekly observations available for the 364 stocks in the sample.

15. That is, all investors have the same expectations, only two periods are considered, and a riskless asset exists.

16. Eugene Fama, Lawrence Fisher, Michael C. Jensen, and Richard Roll, "The Adjustment of Stock Prices to New Information," *International Economic Review* 10 (February 1969): 1–21; Michael C. Jensen, "Risk, the Pricing of Capital Assets, and the Evaluation of Investment Portfolios," *Journal of Business* 42 (April 1969): 167–247; Marshall E. Blume, "Portfolio Theory: A Step toward Its Practical Application," *Journal of Business* 43 (April 1970): 152–73; Ray Ball and Philip Brown (n. 9 above); and Richard Roll, "Bias in Fitting the Sharpe Model to Time Series Data," *Journal of Financial and Quantitative Analysis* 4 (September 1969): 271–89.

17. This conversion is valid only under specific assumptions about the joint probability distribution of R_j and R_m (see Roll, especially p. 272).

18. Only securities listed on the two major U.S. exchanges are included on the source ISL tapes. Some securities in the sample were listed from the over-the-counter market, were delisted, or merged during the sample period. If a company in the sample merged with a larger company, the record was stopped at the merger time. If the company merged with a smaller concern, the record was continued and calculations were based on the entire period. In the few cases of merger encountered, there was no ambiguity about which firm was larger. For companies that changed depreciation methods in 1968, additional records of prices through September 1969 were collected from the *Wall Street Journal*.

Table 2
Empirical Definitions of Financial Variables

Variable	Definition	Source
$R_{j,t}$	Weekly return,* $\log_e[(P_{j,t}+D_{j,t})/P_{j,t-1}]$	ISL daily historical stock price tapes, Standard Statistics Corporation
$P_{j,t}$	Market price of security j at end of week t adjusted for splits and stock dividends	
$D_{j,t}$	Cash dividend paid to stockholders of record of firm j during week t (also adjusted for splits, etc.)	
$R_{F,t}$	Average rate on short-term government debt obligations at beginning of week t	Standard and Poor's trade statistics
$R_{m,t}$	Market return, $\log_e(I_t/I_{t-1})$	
I_t	Value of Standard and Poor's composite stock price average at end of week t	

* Ordinarily, the time subscript was in increments of one week. In some cases, however, most frequently when a trading day was a holiday, the span was six or eight days. Every return was adjusted to an equivalent per annum return before any calculations were performed. Ordinarily, this was done by simply multiplying the weekly return by 52. If the return was for six or eight days, however, it was multiplied by 364/6 or 364/8, respectively. Naturally, if the security return spanned six or eight days, all explanatory variables spanned the same interval.

Table 3
Distribution of Numbers of Observations (Weeks)

Observations (N)	Securities (N)	Proportion of Securities
$\geqslant$300	265	0.728
200–299	78	0.214
100–199	20	0.055
$\leqslant$100	1	0.003

The market model (2) is of intrinsic interest and has been examined in detail by many others,[19] but we only employed it to remove the influence of extraneous variables (R_F and R_m). We were not searching for either efficient coefficient estimates or optimal functional forms. In searching for maximum explanatory power, however, we checked several alternative specifications. First, regression calculations were performed with and without suppressing the constant term. When a constant term is allowed, the coefficient of R_F becomes much more uncertain. This seems to be due to the extremely low variance of R_F relative to R_m and R_j. The constant term has been suppressed in all reported results.

Second, we checked for temporal nonstationarity by comparing regression coefficients calculated during subperiods. This did not provide any additional explanatory ability. (We could have taken advantage of a systematic nonstationarity in the coefficients.)

19. In particular, see George W. Douglas, "Risk in the Equity Market: An Empirical Appraisal of Market Efficiency," *Yale Economic Essays* 9 (Spring 1969): 3–45; Jensen (n. 16 above); and Blume (n. 16 above).

Third, we checked for excessive serial dependence in regression residuals using the Durbin-Watson test and again found no significant effect.

Regression equation (2) was fitted to the data sample available for each security; but observations thirty weeks before and after the earnings announcement date associated with an accounting change were excluded[20] to avoid another econometric problem: If accounting changes affect stock prices, the disturbance term $\epsilon_{j,t}$ will not have a mean of zero when t is near the earnings announcement date.[21] A summary of regression results from model (2) is presented in table 4.

Table 4
Summary of Regression Results (Applying Eq. [2] to Weekly Observations)

	$\bar{R}_j$	$\hat{\gamma}$	$t_{\hat{\gamma}}$	$\hat{\beta}$	$t_{\hat{\beta}}$	R^2
Investment-credit changes ($N = 332$):						
Mean	16.2	1.52	0.555	1.00	6.44	0.148
Median	15.7	1.43	0.514	0.995	6.40	0.141
Interquartile range	11.7	2.76	1.10	0.442	3.20	0.108
Depreciation changes ($N = 71$):						
Mean	15.0	1.17	0.425	1.07	6.75	0.151
Median	14.5	0.785	0.304	1.05	6.54	0.149
Interquartile range	14.2	2.59	1.05	0.443	2.31	0.083

Using coefficients $\hat{\gamma}_j$ and $\hat{\beta}_j$ estimated from (2) and concurrent values of $R_{j,t}$, $R_{F,t}$, and $R_{m,t}$, we calculated predicted disturbance terms for thirty weeks on each side of the earnings announcement date for each security:

$$u_{j,t} = R_{j,t} - \hat{\gamma}_j R_{F,t} - \hat{\beta}_j R_{m,t}, \qquad t = 1, \ldots, 60. \quad (3)$$

Next, these "abnormal returns," $u_{j,t}$, were averaged cross-sectionally to obtain

$$\bar{u}_t = \frac{1}{N} \sum_{j=1}^{N} u_{j,t}. \quad (4)$$

Emphasis must again be placed on t, a measure of time relative to the earnings announcement date which is generally not the same chronological date for different firms. Thus, for example, $\bar{u}_{31}$ estimates an average historical return, abstracting from market and interest rate effects, that occurred during a week when earnings that had been affected

20. The thirty-week period was chosen a priori as likely to be long enough to contain any discernible price movement caused by the accounting change.

21. This procedure was also followed, for the same reason, in Fama et al. (n. 16 above).

by an accounting change were announced. Generally speaking, $\bar{u}_{31-k}$ measures the average abnormal return in a week ending k weeks before earnings were announced.

Finally, an estimate of the total abnormal return that would have been earned by a holder of shares during the weeks surrounding a change can be more distinctively seen by accumulating $\bar{u}_t$ over time. The next section, therefore, will report

$$U_T = \sum_{t=1}^{T} \bar{u}_t, \qquad T = 1, \ldots, 60. \quad (5)$$

For example, U_{31} is the total abnormal return which would have accrued on the average to stockholders over the thirty weeks preceding, plus the one week containing, an earnings announcement.

The underlying returns, R_j, R_F, and R_m, are, of course, random variables, and true quantities which correspond to estimates $\hat{\gamma}_j$, $\hat{\beta}_j$, $\bar{u}_t$, and U_T are exposed to uncertainty. Since these estimates are all linear functions of the individual abnormal returns, $u_{j,t}$, the sampling distribution of $u_{j,t}$ must be used to derive probability inferences from $\bar{u}_t$ and U_T. This sampling distribution is unknown to begin with, and we were impelled to ease the search problem by restricting the class of contenders. Consequently, we assumed that $u_{j,t}$ had achieved, by virtue of the generalized central limit theorem, a sampling distribution that is a symmetric member of the stable class.

Stable distributions occur as the only possible limiting distributions for sums of independent, identically distributed random variables.[22] The Gaussian (or normal) is a member of this class and undoubtedly owes its wide employment[23] to the normal central limit theorem. But the Gaussian is only a special case that has no prior justification. A more general assumption is both costless and less likely to yield misleading results.

All symmetric stable distributions are described by three parameters: δ, for location (the mode and median and in some cases the mean); s, for scale (in the Gaussian case, s^2 is one-half the variance); and α, the characteristic exponent, which portrays the type.[24] (For the Gaussian, $\alpha = 2$, while for the Cauchy, $\alpha = 1$.) A different probability table is required for each value of α.

All three parameters can be estimated from the order statistics of a sample.[25] The estimators are for δ, a truncated mean; for s, an interfractile range; and for α, a function of the ratio of two interfractile

22. William Feller, *An Introduction to Probability Theory and Its Applications* (New York: John Wiley & Sons, 1966), vol. 2.

23. In empirical work, probability statements are rarely made without the aid of a standard Gaussian probability table.

24. Asymmetric members of the stable class have a fourth parameter.

25. Eugene Fama and Richard Roll, "Some Properties of Symmetric Stable Distributions," *Journal of the American Statistical Association* 63 (September 1968): 817–36; and "Parameter Estimates for Symmetric Stable Distributions," ibid. 66 (June 1971): 331–38.

ranges. Details are given in Appendix A. We shall denote these estimates by $\hat{\delta}(x)$, $\hat{s}(x)$, and $\hat{\alpha}(x)$, where x is the random variable. For example, $\hat{\alpha}(u_{j,t})$ is the estimated characteristic exponent of the cross-sectional distribution of abnormal returns from (3) for week t.

To verify that economic quantities such as $u_{j,t}$ actually *are* sums of random variables and are thus potentially modeled by stable distributions, one only need recall that they represent market quantities and are thus aggregates of many individual transactions. We can offer no additional justification for restricting our analysis to stable distributions, but we can fashion a refuge by comparing it to the much more stringent normality assumption that has been traditionally employed (although usually unstated) in economic data analysis. The data remain as final arbiters of the procedure's validity.

IV. EMPIRICAL RESULTS

Description of Figures and Tables

Stock price changes associated with accounting changes are illustrated in figure 1, Panels *A–C*. Each panel plots these data as functions of time relative to the earnings announcement week, $t = 31$. The numbers used in plotting figure 1 are tabulated in Appendix B.

On each panel, the top chart gives the 80 percent acceptance interval for the mean abnormal return, $\bar{u}_t$, in percentage per week. This interval provides a probability measure of $\bar{u}_t$ and can be interpreted in either of two ways: the probability is .8 that the given interval contains the true value of $\bar{u}_t$; or, given a diffuse prior, the posterior probability is .8 that $\bar{u}_t$ falls within the given interval.[26] Using figure 1, Panel A, as an example, the return from holding a security in a week when a company announces earnings that are increased by a change in investment-credit accounting (week 31) falls in the interval 0.889 to 1.476 percent per week[27] with probability .8; and, of course, this return abstracts from the security's normal responses to movements of interest rates and other stock prices during the same week.

Mean cumulative abnormal returns, U_T, are plotted just below the 80 percent confidence intervals in each panel. Since cumulative returns are sums beginning in week 1, their units are percentage per T weeks. For $T = 52$, the units are percentage per annum; for example, $U_{52} = -0.058$ percent per annum for investment-credit changes.

Confidence bands for the cumulative abnormal average return are

26. Each acceptance interval was derived from probability tables of symmetric stable distributions with characteristic exponent $\alpha = 1.6$. This value of α was chosen because the mean values of $\alpha(_{j,t})$ computed for securities in panels *A*, *B*, and *C* over sixty weeks were $\hat{\alpha}_A = 1.58$, $\hat{\alpha}_B = 1.63$, and $\hat{\alpha}_C = 1.57$. The α's estimated for each week are given in Appendix B, table B1. For details of the derivation of $\alpha(u_{j,t})$, see Appendix A. The 80 percent interval was chosen because it has a lower sensitivity to the choice of α than the 90 or 95 percent intervals.

27. From 46.2 to 76.8 percent per annum!

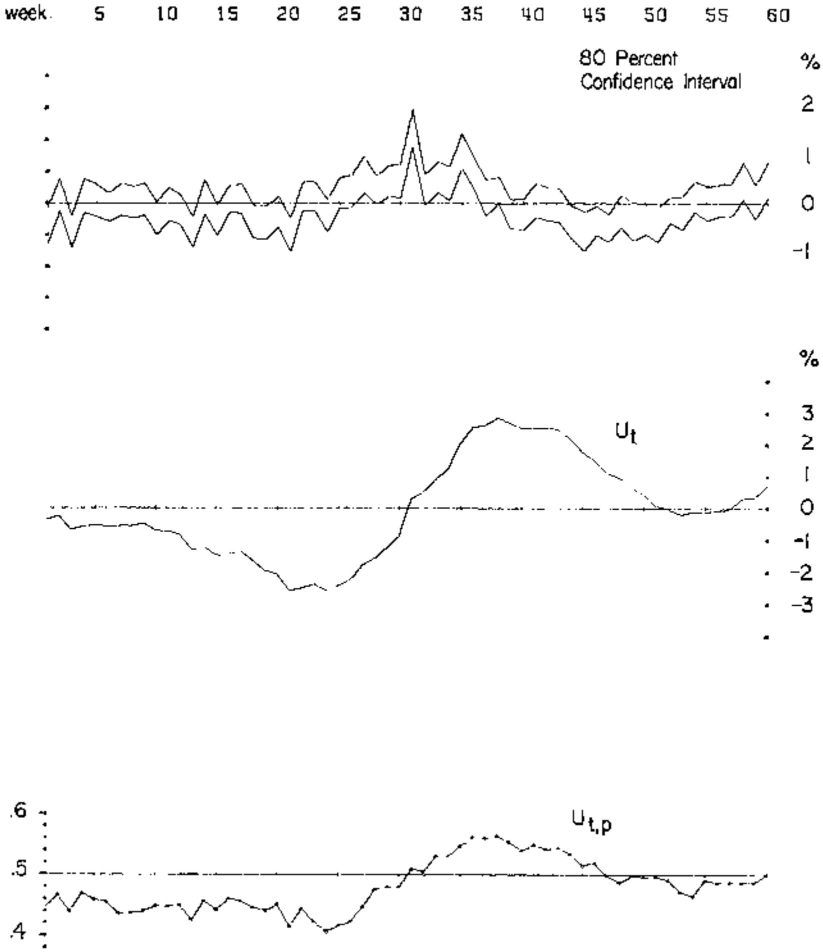

FIG. 1.—Panel *A*.—Investment-credit changes

not reported for every week. As an example, however, table 5 reports the 80 percent confidence interval for U_T for week 52 assuming $\bar{u}_t$ is temporally independent. The table provides intervals for two widely separated values of α (1.3 and 2.0) and also the interval for $\hat{\alpha}$, the arithmetic mean of $\hat{\alpha}$ taken over the sixty weeks around each earnings announcement date.[28]

These results show how sensitive probability statements are to the normality assumption. When normality is assumed, securities in Panels *B* and *C* of figure 1 have highly significant cumulative abnormal returns in week 52 (positive for *B*, negative for *C*); but when more reasonable distributional assumptions are made, the confidence intervals become wider and the results for week 52 agree more with those ob-

28. See n. 26 above.

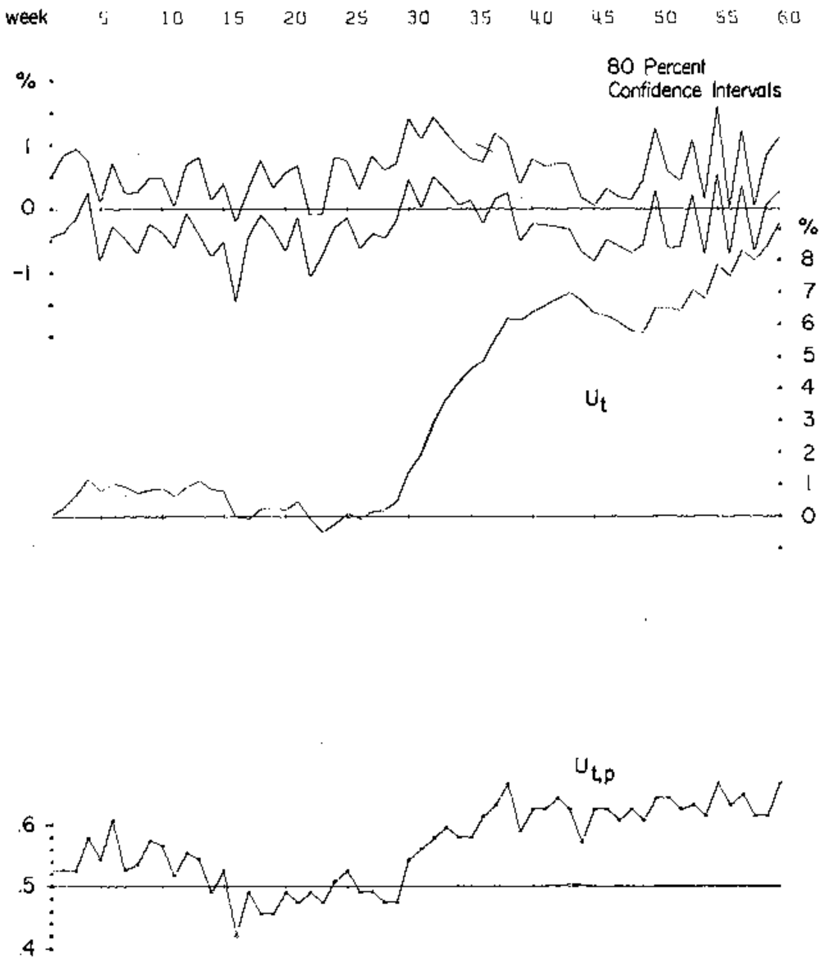

FIG. 1.—Panel *B*.—Investment-credit control group

tained from the nonparametric measure of cumulative return, $U_{t,p}$, discussed below.

A nonparametric measure of cumulative abnormal return is given by $U_{T,p}$ (charted by a ticked curve below U_t). The term $U_{T,p}$ is the proportion of individual securities with positive cumulative abnormal returns in week T; that is, define

$$U_{T,j} \equiv \sum_{t=1}^{T} u_{j,t},$$

where $u_{j,t}$ is the individual abnormal return of stock j in week t given by equation (3). Then

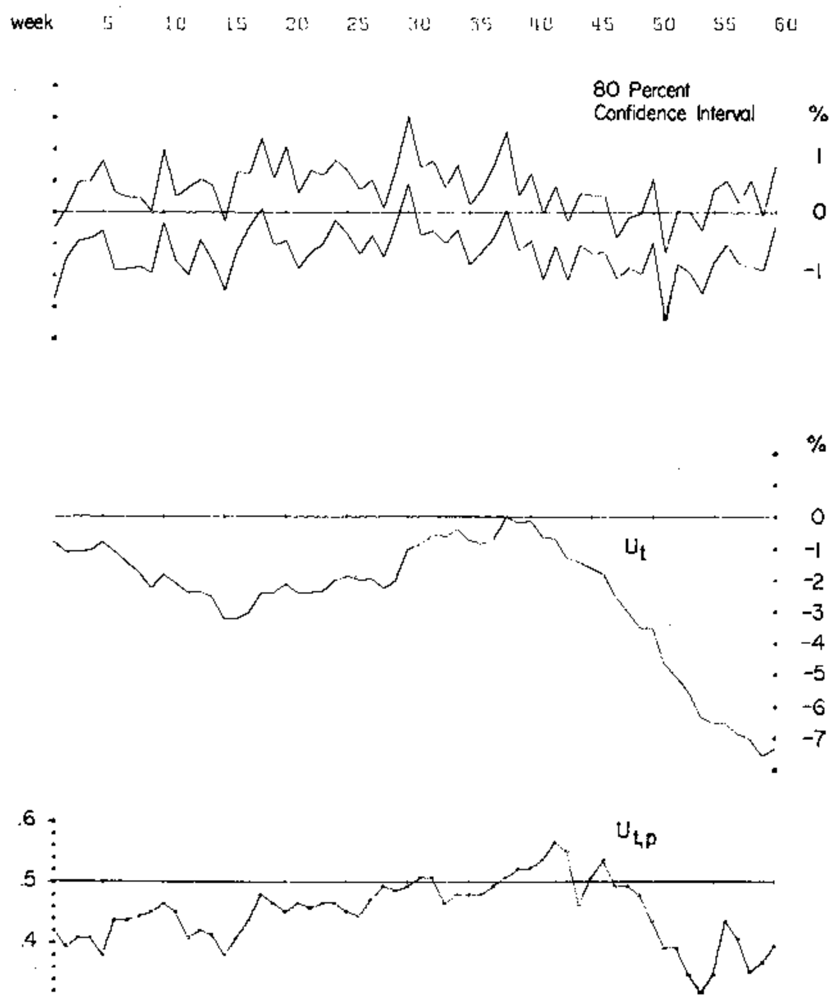

FIG. 1.—Panel *C*.—Depreciation changes

$$U_{T,p} \equiv \frac{1}{N_T} \sum_{j=1}^{N_T} \max(0, \text{sign } U_{T,j}),$$

where N_T is the number of stocks available in week T.

If the u_j's are mutually independent, $N_T U_{T,p}$ has a binomial distribution and the quantity

$$(U_{T,p} - \pi)/\sqrt{\pi(1-\pi)/N_T}$$

is asymptotically normal with mean zero and variance 1 under the null hypothesis: $E(U_{T,p}) = \pi$. We are, of course, interested in the hypothesis $E(U_{T,p}) = \frac{1}{2}$. For example, in figure 1, Panel A, week 31, $N_{31} =$

Table 5
80 Percent Confidence Intervals for Cumulative Abnormal Average Return in Week 52 (Percentage per Annum)

Assumed Type of Distribution	Panel A: Investment-Credit Changes	Panel B: Investment-Credit "Control Group"	Panel C: Depreciation Changes
$\alpha = 2.0$	$-$ 0.935 to $-$0.819	4.44 to 8.40	$-$ 7.19 to $-$2.93
$\alpha = 1.3$	$-$12.9 to 11.7	$-$11.5 to 24.3	$-$25.1 to 14.4
$\alpha = \hat{\alpha}$	$-$ 3.74 to 2.58	1.52 to 11.3	$-$11.9 to 1.75

275 and the 95 percent acceptance interval on $E(U_{31,p}) = \frac{1}{2}$ is approximately $\frac{1}{2} \pm 0.059$. Since $U_{31,p}$ was calculated as 0.509, we cannot reject, at the .05 level of significance, the hypothesis that cumulative abnormal returns are zero $[E(U_{31,p}) = \frac{1}{2}]$ in week 31.

One should note that $U_{T,p}$ is not independent across T.

Interpretation of Investment-Credit Changes

Securities of firms that increased reported earnings by adopting the flow-through method of accounting for the investment credit experienced abnormally good times in the ten weeks surrounding their earnings announcement. This is indicated in figure 1, Panel A, by the uniformly positive average abnormal returns, $\bar{u}_t$, from weeks 25 to 36. These positive returns are responsible for the rapid rise in U_T, the cumulative abnormal return, during the same weeks. The proportion of securities with individually positive cumulative returns rises more than 14 percent from 0.416 in week 25 to 0.562 in week 36.[29] This is a significant movement in security prices, and its coincidence with increased accounting earnings is highly suggestive of a positive relation.

Unfortunately for stockholders, market prices did not remain high. In weeks 39–53, these securities experienced abnormally *bad* times on the average. The proportion of securities with positive cumulative abnormal returns declined to 0.471 in week 53.

It seems prudent to emphasize now that patterns in figure 1 are averages and need bear no resemblance to the patterns of individual prices. Indeed, movements in averages, both up and down, reflect nonsynchronous movements of individual components. For example, in figure 1, Panel A, the movement down in weeks 39–53 must be due to a trickling of information about the true reason for previously reported high earnings. Investors could have learned that earnings had been manipulated by reading the annual report. Its publication occurs sometime after the earnings announcement in the financial press, and part

29. As indicated by positive returns in weeks 26–30, the favorable earnings report seems to have been anticipated by stock prices. However, the largest abnormal average return did not occur until week 31, when the higher earnings were announced. In week 31, the *lower* end of the 80 percent confidence interval was 0.889 percent per week.

of the downtrend after week 39 could be attributed to its receipt and accompanying investor actions. We have no firm estimate of the normal lag in the report's publication, but it seems unlikely to be delayed until week 53, twenty-one weeks after earnings are announced. This fact, plus the sharp downward movement in prices beginning in week 44, suggests another possibility: a reaction to subsequent quarterly reports that began to appear about thirteen weeks after the original earnings announcement date. These later quarterly reports may have indicated that the increased rate of earnings growth anticipated because of the previous investment-credit switch could not be sustained. (No additional earnings manipulations were available.)

Panel *B* of figure 1 portrays the "control group" of firms that were specifically mentioned in the 1965 *Accounting Trends and Techniques* as continuing to reflect the investment credit over their assets' productive lines. These firms voluntarily reported earnings below the potential permitted by accepted accounting practice. Stockholders must not have been too upset, however, because their shares not only increased in value around the earnings announcement date but, in contrast to the companies that switched accounting methods, remained at the higher level. On the average, holders of these shares from weeks 1 to 52 earned 6.42 percent per annum in addition to the normal return associated with interest rates and stock market averages.

You can now appreciate why we enclose "control group" in quotes. The performance reported in figure 1, Panel *B*, strongly suggests the presence of preselection bias in this group of companies, since a random selection should show no abnormal return over an extended time period. A possible explanation is this: Managers of these firms knew that their earnings were going to be higher than anticipated even without the help of an accounting change—so why bother? The change to flow-through of the investment credit could be postponed until a later date when earnings might not be so favorable. (This is consistent with an income-smoothing model for predicting the timing of a firm's accounting changes.)

Interpretation of Depreciation Changes

Firms that switched from accelerated to straight-line depreciation between 1962 and 1968 were, on average, dismal performers. Shareholders from week 1 to week 52 lost 5 percent more than they would have anticipated given interest rate and general stock price movement. In week 60, less than 40 percent of these firms had positive cumulative abnormal returns. These results are only suggestive, however, because none of the performance measures significantly rejects, in the statistical sense, the hypothesis that $E(\bar{u}_t) = 0$, that is, that these firms were unaffected by accounting changes and earnings announcements. Even the low proportion of firms with positive cumulative abnormal returns, $U_{t,n}$, is not significant at the 5 percent level.

But if we rely on the average patterns, the data suggest two conclusions about firms that increase earnings by switching to straight-line depreciation. First, there is a temporary positive effect around the earnings announcement date. This may be due to unexpectedly higher reported earnings which investors accept as valid, not suspecting they resulted from an accounting change. Second, the patterns suggest that firms that increase earnings by changing depreciation reporting are likely to be performing poorly. This is indicated by the general downtrend in cumulative abnormal average return which is only ameliorated in the weeks adjacent to the earnings announcement. This is consistent with the income-smoothing hypothesis of when accounting methods are likely to be changed. We conclude, however, that such practices are unsuccessful in permanently affecting stock prices.

V. ADDITIONAL TESTS AND FINDINGS

Truncating the Sample

When analyzing data from symmetric stable distributions, one can obtain better measures of central tendency by using a truncated sample to estimate the mean.[30] For our purposes, truncation would provide an added benefit by verifying that observed patterns were due to comovements by many stocks rather than by relatively few.

Plots of the cumulative abnormal return, U_t (see the middle plots in fig. 1, Panels *A–C*), were made with both the extreme 5 percent and 25 percent of the residuals deleted in each week. The general shape of U_t remained the same for the truncated and the untruncated samples. This verified that we had been seeing a general movement of prices. However, the level of these returns decreased with the degree of truncation. Subsequent analysis revealed that this downward shift was due to positive skewness in the residuals. The effect of skewness on our probability measures is discussed in Appendix B, where we argue that conclusions in Section IV remain valid, and perhaps are even strengthened. We also believe that skewness makes untruncated sample statistics more reliable measures of accounting change effects.

Advancing the Analysis Forward in Time

In an experiment to verify that observed patterns were significantly related to accounting changes and not due to some artifact, we advanced the analysis forward by thirty weeks for investment-credit changes. The sixty-week period now started at the earnings announcement date for the year that the change occurred and ended slightly more than a year later, so that the announcement date for the following year should have been within the period studied. The shape of the U_t plot for the entire sample of stocks showed a strong positive increase over this period, but

30. See n. 25 above.

this was due to a few extreme observations and was, consequently, not a significant pattern. When the sample was truncated by deleting 5 percent of the extreme observations of either sign in each week, the pattern of U_t reverted, essentially, to random fluctuations. This is important to note, since truncating the sample in the original sixty-week period affected the level of the plot but left the basic shape unchanged.

Treatment of Investment-Credit Reserves

Companies that switched to the flow-through method for the investment credit varied in their treatment of reserves that had been built up in previous years. About half took the previous years' deferred credits directly into current income, thereby inflating earnings for the most recent year even more. A number of companies made no reference to the treatment of this reserve. The remainder continued to amortize the reserve over a period of years, took the reserve into retained earnings,[31] or transferred it to the federal income tax liability account. These remaining firms thus did not try to increase the current year's earnings by the use of credits developed in previous years.

We subdivided investment-credit switchers into three groups according to their treatment of the previous years' reserves, and we made a plot of the mean cumulative abnormal return, U_t, for each group. The mean cumulative returns of the firms that took the reserve directly into current income or did not report their treatment replicated the pattern reported in figure 1, Panel *A*. Firms that took a more conservative treatment of the reserve performed more like the control group in figure 1, Panel *B*. Therefore, the downward trend that is apparent in figure 1, Panel *A*, is due solely to companies that attempted to obtain the maximum impact from earnings manipulation. Firms that were really performing better were less likely to have made an accounting change.

Effect of Prior Announcement of Accounting Change

The sample of companies which switched from accelerated to straight-line depreciation was subdivided according to whether the change was announced prior to or simultaneously with the fiscal-year earnings report. We were trying to determine whether investors respond differently to the fiscal-year earnings report when they had prior knowledge of the accounting change. Because there were only a small number of companies in each group, the results are only suggestive.

Those companies that announced the accounting change prior to the fiscal-year earnings report (in week 31) had an increasing mean cumulative abnormal return, U_t, prior to week 31. As with the investment-credit switchers, a steady decline in U_t started in week 43 and reached zero by week 60.

31. Such as by restating a prior year's income.

Companies which postponed announcement of the accounting change until the year-end report had a declining mean cumulative abnormal return prior to week 30, a greater positive movement in weeks 30–39, but a steady decline thereafter that became significantly negative by week 60. Thus, the companies that were more honest in announcing their intentions in advance fared somewhat better. This could again be due to a selection effect, with firms whose fortunes were on the wane postponing the announcement until the last possible moment in an attempt to get a bigger impact from the increased earnings arranged by a depreciation change.

A final subdivision of the depreciation-switching companies was created by placing all companies that switched in 1968 in one group and all those that switched in prior years in another group. We were trying to determine whether investors had become more perceptive over time, so that smaller transient effects would be observed for companies that switched methods in 1968. In fact, just the opposite result was suggested. The plot of U_t for those companies that switched prior to 1968 was virtually identical to that obtained for the entire sample. (This is not totally surprising, of course, since these companies comprised five-sevenths of the total sample.) The companies that switched in 1968 exhibited a strong positive price movement in advance of the year-end announcement date, and this level was maintained for about twelve weeks. But again, a decline started around week 43 which returned the mean cumulative abnormal return back to its level prior to week 20. This movement, however, could have been a random fluctuation (the sample size was only twenty-one).

Abstracting from Industry Effects

As mentioned before, there were some industries in which several firms switched back from accelerated to straight-line depreciation in the same year. Professor Ray Ball pointed out that such coincidental action might have confounded the results. Since the sample size of the depreciation group is relatively small (seventy-one) and since a small but significant proportion of a security's price variation can be explained by an industry factor,[32] he argued correctly that the ability of cross-sectional averaging to eliminate factors other than the accounting change from the "abnormal return" may have been hampered. To make a rough measure of the possible bias introduced, we recomputed the abnormal returns for the depreciation group after taking out the industry effect for the four most heavily represented industries[33] in the sample. This

32. The first and definitive study of the industry factor was by Benjamin F. King, "Market and Industry Factors in Stock Price Behavior," *Journal of Business* 39, suppl. (January 1966): 139–90.

33. These industries were steels, nine firms; papers, eight firms; cement, four firms; and glass and metal containers, three firms; these comprised a total of twenty-four of the seventy-one firms in the sample. No other industry was represented by more than two firms.

was accomplished by adding a third explanatory variable, the return on an industry index,[34] to regression model (2). Then the abnormal return was calculated net of this industry index return (and net of the total market return and the interest rate, too). The results can scarcely be distinguished from those reported in figure 1, Panel *C*, and in table B1, Panel *C*, for depreciation changes where the effect of heavily represented industries was not eliminated.[35]

VI. SUMMARY

Earnings manipulation may be fun, but its profitability is doubtful. We have had difficulty discerning any statistically significant effect that it has had on security prices. Relying strictly on averages, however, one can conclude that security prices increase around the date when a firm announces earnings inflated by an accounting change. The effect appears to be temporary, and, certainly by the subsequent quarterly report, the price has resumed a level appropriate to the true economic status of the firm. In the present sample, firms that manipulated earnings seem to have been performing poorly. If this is generally true, one would predict that earnings manipulation, once discovered, is likely to have a depressing effect on market price because it conveys an unfavorable management view of a firm's economic condition.

APPENDIX A
ESTIMATORS FOR SYMMETRIC STABLE DISTRIBUTION

Let x be a random variable conforming to a symmetric stable distribution function $dF(x; \alpha, \delta, s)$. Let

$$\hat{x}_1 \leqslant \hat{x}_2 \leqslant \ldots \leqslant \hat{x}_N$$

34. The industry index return was defined by

$$R_{i,t} = \log_e [\text{IND}_{i,t}/\text{IND}_{i,t-1}],$$

where $\text{IND}_{j,t}$ is the Standard and Poor index for industry i at time t. It might have been better to construct an industry index that is orthogonal to the market index (see King, n. 32 above). However, the uniformly significant industry and total market coefficients in all twenty-four cases where the industry factor was included led us to believe that multicollinearity was not a serious problem. In the twenty-four regressions, the lowest t-ratio associated with the industry effect was 1.8 and only three were below 3.0. Among the t-ratios associated with the total market return, nineteen of twenty-four were above 3.0.

35. The patterns are almost identical. The only difference is a small downward shift in the abnormal returns from weeks 10 through 60. For example, the cumulative abnormal returns (U_t's) were previously -5.058 percent in week 52 and -0.31 percent in week 38 (U_t reached a relative peak in week 38). After we abstracted from the four industries, these cumulative abnormal returns were $U_{52} = -6.00$ and $U_{38} = -1.59$ percent. If anything, this strengthens our conclusion that switching back to straight-line depreciation has little permanent effect. In addition, the temporary effect is lowered. Previously, the cumulative abnormal return increased 2.24 percent from week 28 to week 38. After we netted out the industry return; this temporary increase was only 1.85 percent.

be the order statistics of a random sample of size N drawn from $dF(x)$. The parameters are α, the characteristic exponent; δ, the location; and s, the scale. We examine the problem of estimating α, δ, and s from the x's.

An Estimator for s

Any random variable can be standardized by the linear operation

$$Z = \frac{x - \delta(x)}{s(x)},$$

where Z is a standard $[\delta(Z) = 0, s(Z) = 1]$ variable of the same distribution. After choosing two fractiles x_f and x_{1-f} $(0 < f < 1)$, one can write

$$s(x)(Z_f - Z_{1-f}) = x_f - x_{1-f},$$

$$s(x)\, k(\alpha, f) = x_f - x_{1-f},$$

where $k(\alpha, f)$ is generally a function of α, the characteristic exponent. Fama and Roll[36] pointed out that for certain values of f in the neighborhood of 0.72, $k(\alpha, f)$ is almost invariant to α and specifically equal to about 1.654. That is,

$$s(x) \doteq \frac{x_{0.72} - x_{0.28}}{1.654}.$$

Now, when $N+1$ is a multiple of 25, the order statistics $x_{0.72(N+1)}$ and $\hat{x}_{0.28(N+1)}$ are asymptotically unbiased estimators of the fractiles $x_{0.72}$ and $\hat{x}_{0.28}$, and $(\hat{x}_1, \hat{x}_2, \ldots, \hat{x}_N)$ is asymptotically distributed as multivariate normal regardless of the distribution of x.[37] In large samples, therefore,

$$\hat{s}(x) \equiv \frac{\hat{x}_{0.72(N+1)} - \hat{x}_{0.28(N+1)}}{1.654} \qquad \text{(A1)}$$

is normally distributed with mean $s(x)$.[38] Certain problems arise when $0.72(N+1)$ is not an integer [when $(N+1)$ is not evenly divisible by 25]. In this case, however, an accurate estimate of x_f can be obtained by a weighted average of adjacent-order statistics.

An Estmator for α

When f is not near 0.72, $k(\alpha, f)$ is a monotone function of α. (When $f >> 0.72$, it is monotonically increasing.) Since these distributions are symmetric,

$$k(\alpha, f) = \frac{x_f - x_{1-f}}{2s(x)}$$

is the f fractile of the *standardized* distribution and

$$\hat{k}(\alpha, f) = \frac{\hat{x}_{f(N+1)} - \hat{x}_{(1-f)(N+1)}}{2\hat{s}(x)} \qquad \text{(A2)}$$

36. See n. 25 above.

37. Harold Cramèr, *Mathematical Methods of Statistics* (Princeton, N.J.: Princeton University Press, 1945), pp. 367–70.

38. The term $k(\alpha, 0.72)$ is not exactly invariant to α. This induces a small bias in $s(\hat{x})$. Its maximum is about 0.3 percent.

is an estimator of this fractile [$s(x)$ is obtained from (A1)]. Since k is a monotone regular function, an estimator of α is

$$\hat{\alpha}(x) = k^{-1}\left[\frac{\hat{x}_{f(N+1} - \hat{x}_{(1-f)(N+1)}}{2s(x)}, f\right]. \qquad \text{(A3)}$$

Sampling properties of $\hat{\alpha}$, studied in Fama and Roll,[39] indicate that f in the neighborhood of $f = 0.95$ provides a relatively low dispersion of $\hat{\alpha}$. Unfortunately, neither $\hat{k}(\hat{\alpha}, f)$ nor $\hat{\alpha}$ follow a familiar sampling distribution.

Estimating δ with the Sample Mean

The most commonly employed estimator of location is, of course, the sample mean

$$\hat{x} = \sum_{j=1}^{N} x_j/N.$$

For any member of the stable class, the sample mean has a stable distribution with the same α as its components but with

$$s(\hat{x}) = s(x)\, N^{(1/\alpha)-1}. \qquad \text{(A4)}$$

An estimator of the sample mean's dispersion is therefore

$$\hat{s}(\hat{x}) = s(x) N^{1/[\hat{\alpha}(x)]-1}, \qquad \text{(A5)}$$

where $s(x)$ and $\hat{\alpha}(x)$ come from (A1) and (A3). This enables one to make probability statements about $\hat{x}$. For example, suppose one obtains from a sample of size 299 the order statistics

$$\hat{x}_{216} = 5.31; \hat{x}_{84} = 2.00$$

and

$$\hat{x}_{285} = 9.76; \hat{x}_{15} = -2.45$$

and the sample mean $\hat{x} = 3.70$.

From (A1), $\hat{s} \doteq 2$, and from (A2),

$$k(\alpha, 0.95) = \frac{12.21}{4} = 3.05,$$

which is approximately the 0.95 fractile of a symmetric stable distribution with $\alpha = 1.5$. Thus,

$$\hat{s}(\hat{x}) = 2 \cdot 299^{(1/1.5)-1} \doteq 0.0446.$$

By looking in a probability table for $\alpha = 1.5$ (in Fama and Roll),[40] one can obtain confidence intervals of $\hat{x}$. For example, the 99 percent interval is 3.70 ± 0.346.

39. See n. 25 above.
40. See n. 25 above.

APPENDIX B
FURTHER EMPIRICAL ANALYSIS OF THE EARNINGS ANNOUNCEMENT EFFECT

Table B1 presents the abnormal return statistics plotted in figures 1–3. In addition, the characteristic exponent $\hat{\alpha}(u_t)$ estimated each week from the cross-sectional distribution of abnormal returns is tabulated along with the sample size.

In this table, the 80 percent confidence interval is based on a characteristic exponent, $\alpha = 1.6$. As was mentioned in the text, 1.6 is close to the mean values of $\alpha(u_t)$ in the three parts of table B1; these means are, for each part, $\hat{\alpha}_A = 1.57$, $\hat{\alpha}_B = 1.63$, and $\hat{\alpha}_C = 1.58$. Of course, an estimated confidence interval is sensitive to the choice of α (see table 5), and the reader who likes a different α may calculate his own confidence intervals (and obtain his own conclusions) by using table B2. In this table, the scale parameter, $\hat{s}(u_{j,t})$, for the cross-sectional distribution of abnormal returns is given each week. This scale parameter and the sample size (given in table B1) can be used to obtain a confidence band for any value of α (see Appendix A).

All our probability measures have been based on the assumption of symmetry for the cross-sectional distribution of abnormal returns, but others[41] have found asymmetry in common stock returns. It is therefore crucial to examine the validity of the symmetry assumption and to appraise the impact, if any, that asymmetry in the sample may have had on our inferences. Table B3 provides some information on this point. The median abnormal return, $u_{\text{med},t}$, is given for each week and is cumulated over time just as the mean abnormal return was cumulated according to equation (5). The patterns that emerge in cumulated medians are quantitatively much different from those obtained for cumulated means. This seems to be due to significant rightward skewness in the sampling distribution of $u_{j,t}$, a fact emphasized by a measure of skewness,

$$SK = \frac{\bar{u}_t - u_{\text{med},t}}{\hat{s}(u_{j,t})},$$

which is also given in table B3. In table B3, Panel *A*, where investment-credit changes are tabulated, fifty-nine out of sixty weeks evidence rightward skewness (positive values of *SK*)! The smaller sample sizes of Panels *B* and *C* of table B3 (for the investment-credit control group and the depreciation-change group) show more frequent negative values of *SK*. But in Panel *B*, forty-four out of sixty weeks have positive *SK*s, and in Panel *C*, thirty-five out of sixty are positive. These still indicate significant skewness.

The primary problem now is to ascertain whether the invalid assumption of symmetry affected our inferences, and if so, in what directions. We have concluded that its main effect was to widen the confidence bands reported in table B1 and plotted in figure 1. It may have also shifted them downward slightly, but we are less sure of this.

41. See Merton H. Miller and Myron Scholes, "Rates of Return in Relation to Risk: A Reexamination of Some Recent Findings," in *Studies in the Theory of Capital Markets*, ed. Michael C. Jensen (New York: Frederick A. Praeger, Inc., 1971).

TABLE B-1

Panel A. Investment Credit Changes

t	$\bar{u}_t$	80 percent conf. int.		$U_{t,p}$	U_t	$\hat{\alpha}$	N	t	$\bar{u}_t$	80 percent conf. int.		$U_{t,p}$	U_t	$\hat{\alpha}$	N
1	-0.371	-0.666	-0.076	0.447	-0.371	1.79	266	31	1.183	0.889	1.476	0.509	0.323	1.51	275
2	0.130	-0.127	0.387	0.466	-0.240	1.56	268	32	0.215	-0.026	0.457	0.505	0.538	1.47	275
3	-0.452	-0.690	-0.214	0.439	-0.692	1.46	269	33	0.412	0.173	0.651	0.531	0.950	1.56	275
4	0.106	-0.158	0.371	0.469	-0.587	1.74	271	34	0.304	0.035	0.573	0.531	1.256	1.60	275
5	0.035	-0.222	0.292	0.458	-0.552	1.60	271	35	0.825	0.559	1.091	0.547	2.077	1.59	274
6	-0.069	-0.292	0.153	0.454	-0.621	1.39	269	36	0.473	0.223	0.723	0.562	2.558	1.64	274
7	0.051	-0.199	0.301	0.435	-0.569	1.59	271	37	0.083	-0.199	0.365	0.560	2.635	1.79	275
8	0.007	-0.240	0.255	0.436	-0.562	1.55	273	38	0.217	0.013	0.422	0.564	2.846	1.33	275
9	0.065	-0.186	0.316	0.439	-0.498	1.45	264	39	-0.176	-0.407	0.055	0.553	2.673	1.49	275
10	-0.240	-0.499	0.018	0.448	-0.737	1.78	261	40	-0.181	-0.419	0.057	0.540	2.500	1.50	274
11	-0.018	-0.275	0.238	0.447	-0.756	1.63	266	41	0.044	-0.222	0.310	0.549	2.538	1.61	273
12	-0.115	-0.351	0.120	0.449	-0.871	1.42	267	42	-0.014	-0.275	0.247	0.542	2.519	1.60	273
13	-0.456	-0.693	-0.218	0.425	-1.327	1.59	273	43	-0.040	-0.309	0.228	0.544	2.481	1.80	274
14	0.095	-0.177	0.367	0.456	-1.233	1.59	274	44	-0.306	-0.561	-0.050	0.533	2.173	1.62	274
15	-0.273	-0.514	-0.032	0.442	-1.504	1.61	274	45	-0.444	-0.750	-0.139	0.515	1.735	2.00	274
16	0.070	-0.139	0.279	0.460	-1.435	1.36	274	46	-0.273	-0.500	-0.046	0.518	1.463	1.54	274
17	0.070	-0.172	0.312	0.456	-1.363	1.54	274	47	-0.394	-0.610	-0.178	0.498	1.069	1.48	273
18	-0.304	-0.564	-0.044	0.445	-1.667	1.75	274	48	-0.123	-0.376	0.129	0.487	0.946	1.47	273
19	-0.304	-0.561	-0.047	0.440	-1.981	1.67	275	49	-0.290	-0.588	0.007	0.498	0.654	2.00	273
20	-0.132	-0.370	0.105	0.451	-2.096	1.56	275	50	-0.256	-0.484	-0.028	0.496	0.398	1.52	272
21	-0.502	-0.764	-0.239	0.415	-2.596	1.60	275	51	-0.348	-0.612	-0.085	0.496	0.049	1.85	272
22	0.114	-0.112	0.339	0.444	-2.500	1.48	275	52	-0.107	-0.312	0.098	0.491	-0.058	1.43	273
23	0.102	-0.125	0.329	0.422	-2.385	1.48	275	53	-0.156	-0.418	0.105	0.471	-0.213	1.57	272
24	-0.198	-0.451	0.055	0.407	-2.596	1.51	275	54	0.104	-0.138	0.347	0.465	-0.110	1.60	273
25	0.167	-0.069	0.404	0.416	-2.423	1.53	274	55	-0.005	-0.271	0.262	0.491	-0.114	1.69	273
26	0.198	-0.054	0.451	0.423	-2.231	1.50	274	56	0.049	-0.201	0.299	0.487	-0.065	1.66	273
27	0.452	0.163	0.741	0.447	-1.769	1.64	275	57	0.044	-0.216	0.304	0.487	-0.021	1.54	273
28	0.212	-0.014	0.437	0.476	-1.560	1.47	275	58	0.352	0.060	0.644	0.487	0.331	1.65	273
29	0.350	0.111	0.589	0.480	-1.210	1.51	275	59	0.020	-0.249	0.290	0.487	0.350	1.46	273
30	0.350	0.072	0.628	0.480	-0.860	1.67	275	60	0.365	0.089	0.641	0.500	0.715	1.50	256

TABLE B-1

Panel B. Investment Credit Control Group

t	$\bar{u}_t$	80 percent conf. int.		$U_{t,p}$	U_t	$\hat{\alpha}$	N	t	$\bar{u}_t$	80 percent conf. int.		$U_{t,p}$	U_t	$\hat{\alpha}$	N
1	0.038	-0.433	0.510	0.526	0.038	1.76	57	31	0.554	0.020	1.088	0.561	1.962	2.00	57
2	0.238	-0.366	0.843	0.526	0.277	2.00	57	32	0.969	0.504	1.434	0.579	2.923	1.46	57
3	0.398	-0.150	0.946	0.526	0.675	1.81	57	33	0.746	0.306	1.187	0.596	3.673	1.64	57
4	0.498	0.254	0.742	0.579	1.173	1.22	57	34	0.506	0.064	0.948	0.579	4.173	1.39	57
5	-0.356	-0.808	0.097	0.544	0.817	1.55	57	35	0.462	0.142	0.781	0.579	4.635	1.33	57
6	0.221	-0.274	0.716	0.607	1.038	1.58	56	36	0.246	-0.229	0.721	0.614	4.885	1.55	57
7	-0.111	-0.465	0.242	0.527	0.927	1.38	55	37	0.660	0.160	1.179	0.632	5.558	2.00	57
8	-0.212	-0.691	0.268	0.536	0.715	1.63	56	38	0.629	0.256	1.002	0.667	6.192	1.26	57
9	0.127	-0.236	0.489	0.574	0.842	1.29	54	39	-0.055	-0.500	0.391	0.589	6.135	1.47	56
10	0.061	-0.364	0.486	0.566	0.904	1.42	53	40	0.265	-0.241	0.772	0.625	6.404	1.74	56
11	-0.285	-0.604	0.035	0.518	0.619	1.49	56	41	0.198	-0.264	0.660	0.625	6.596	1.62	56
12	0.321	-0.062	0.704	0.554	0.940	1.18	56	42	0.213	-0.286	0.713	0.643	6.808	1.92	56
13	0.206	-0.401	0.813	0.544	1.146	2.00	57	43	0.186	-0.321	0.693	0.625	7.000	1.79	56
14	-0.300	-0.739	0.139	0.491	0.846	1.94	57	44	-0.254	-0.670	0.163	0.571	6.731	1.66	56
15	-0.049	-0.501	0.403	0.526	0.798	1.66	57	45	-0.385	-0.822	0.053	0.625	6.346	1.42	56
16	-0.821	-1.438	-0.204	0.421	-0.023	2.00	57	46	-0.088	-0.485	0.310	0.625	6.269	1.75	56
17	-0.062	-0.424	0.301	0.491	-0.085	1.35	57	47	-0.204	-0.588	0.180	0.607	6.058	1.60	56
18	0.333	-0.093	0.759	0.456	0.248	1.47	57	48	-0.275	-0.687	0.137	0.625	5.788	1.60	56
19	0.007	-0.317	0.332	0.456	0.254	1.22	57	49	-0.041	-0.545	0.463	0.607	5.750	1.97	56
20	-0.043	-0.657	0.570	0.491	0.212	1.99	57	50	0.767	0.283	1.252	0.643	6.519	1.36	56
21	0.277	-0.119	0.673	0.474	0.488	1.58	57	51	-0.015	-0.610	0.581	0.643	6.500	2.00	56
22	-0.577	-1.053	-0.101	0.491	-0.087	1.79	57	52	-0.077	-0.580	0.427	0.625	6.423	1.68	56
23	-0.398	-0.718	-0.078	0.474	-0.485	1.36	57	53	0.648	0.215	1.081	0.632	7.077	1.63	57
24	0.262	-0.279	0.802	0.509	-0.223	2.00	57	54	-0.283	-0.712	0.146	0.614	6.788	1.94	57
25	0.304	-0.134	0.742	0.526	0.081	1.72	57	55	1.077	0.548	1.606	0.667	7.865	1.40	57
26	-0.157	-0.614	0.299	0.491	-0.076	1.72	57	56	-0.356	-0.721	0.009	0.632	7.500	1.58	57
27	0.215	-0.392	0.823	0.491	0.140	1.91	57	57	0.796	0.367	1.226	0.649	8.308	1.41	57
28	0.072	-0.461	0.606	0.474	0.212	2.00	57	58	-0.312	-0.664	0.041	0.614	8.000	1.41	57
29	0.265	-0.180	0.711	0.474	0.479	1.68	57	59	0.471	0.083	0.859	0.614	8.462	1.26	57
30	0.925	0.450	1.400	0.544	1.402	2.00	57	60	0.698	0.278	1.118	0.667	9.173	1.56	57

TABLE B-1

Panel C. Depreciation Changes

t	$\bar{u}_t$	80 percent conf. int.		$U_{t,p}$	U_t	$\hat{\alpha}$	N	t	$\bar{u}_t$	80 percent conf. int.		$U_{t,p}$	U_t	$\hat{\alpha}$	N
1	-0.817	-1.394	-0.240	0.420	-0.817	1.91	69	31	0.181	-0.356	0.717	0.507	-0.846	1.78	71
2	-0.331	-0.720	0.059	0.394	-1.148	1.43	71	32	0.260	-0.296	0.815	0.507	-0.587	1.54	71
3	0.018	-0.441	0.476	0.408	-1.131	1.58	71	33	-0.048	-0.489	0.393	0.465	-0.635	1.29	71
4	0.047	-0.410	0.505	0.408	-1.083	1.26	71	34	0.233	-0.281	0.746	0.479	-0.402	1.45	71
5	0.265	-0.291	0.822	0.380	-0.817	1.99	71	35	-0.350	-0.825	0.125	0.479	-0.754	1.59	71
6	-0.312	-0.925	0.302	0.437	-1.129	1.63	71	36	-0.113	-0.608	0.382	0.479	-0.865	1.37	71
7	-0.335	-0.896	0.227	0.437	-1.463	2.00	71	37	0.182	-0.392	0.756	0.493	-0.685	1.81	71
8	-0.315	-0.865	0.234	0.443	-1.779	1.63	70	38	0.654	0.033	1.275	0.507	-0.031	1.61	71
9	-0.481	-0.971	0.010	0.451	-2.269	1.61	71	39	-0.172	-0.607	0.262	0.521	-0.204	1.41	71
10	0.406	-0.163	0.974	0.464	-1.854	2.00	69	40	0.084	-0.450	0.618	0.522	-0.119	2.00	69
11	-0.267	-0.782	0.248	0.451	-2.115	1.62	71	41	-0.537	-1.057	-0.016	0.536	-0.656	1.81	69
12	-0.294	-0.990	0.401	0.409	-2.423	2.00	66	42	-0.058	-0.532	0.416	0.565	-0.713	1.51	69
13	0.038	-0.445	0.521	0.420	-2.385	1.58	69	43	-0.612	-1.072	-0.152	0.551	-1.327	1.40	69
14	-0.185	-0.779	0.408	0.412	-2.558	1.75	68	44	-0.116	-0.525	0.293	0.464	-1.442	1.29	69
15	-0.687	-1.226	-0.147	0.380	-3.250	1.48	71	45	-0.200	-0.656	0.256	0.507	-1.642	1.61	69
16	0.022	-0.599	0.643	0.408	-3.231	1.90	71	46	-0.174	-0.618	0.269	0.536	-1.817	1.45	69
17	0.194	-0.218	0.606	0.437	-3.038	1.52	71	47	-0.723	-1.041	-0.405	0.493	-2.538	1.29	69
18	0.608	0.053	1.163	0.479	-2.423	1.61	71	48	-0.475	-0.876	-0.074	0.493	-3.019	1.71	69
19	0.009	-0.516	0.534	0.465	-2.423	1.39	71	49	-0.502	-0.987	-0.016	0.478	-3.519	1.54	69
20	0.290	-0.451	1.032	0.451	-2.135	2.00	71	50	0.025	-0.480	0.530	0.435	-3.500	1.39	69
21	-0.287	-0.884	0.311	0.465	-2.423	1.59	71	51	-1.165	-1.696	-0.635	0.391	-4.654	1.35	70
22	0.012	-0.628	0.653	0.457	-2.404	1.54	70	52	-0.398	-0.827	0.031	0.391	-5.058	1.33	70
23	0.041	-0.501	0.582	0.465	-2.365	1.59	71	53	-0.483	-0.960	-0.005	0.348	-5.539	1.29	69
24	0.340	-0.136	0.817	0.465	-2.019	1.49	71	54	-0.788	-1.283	-0.294	0.319	-6.327	1.31	69
25	0.152	-0.351	0.655	0.451	-1.869	1.51	71	55	-0.202	-0.773	0.370	0.348	-6.538	1.62	69
26	-0.154	-0.664	0.356	0.443	-2.019	1.35	70	56	-0.002	-0.509	0.505	0.435	-6.538	1.38	69
27	0.071	-0.375	0.516	0.471	-1.962	1.30	70	57	-0.337	-0.818	0.145	0.406	-6.865	1.34	69
28	-0.321	-0.707	0.065	0.493	-2.269	1.35	71	58	-0.179	-0.866	0.509	0.353	-7.058	2.00	68
29	0.260	-0.181	0.700	0.486	-2.019	1.49	70	59	-0.500	-0.933	-0.067	0.368	-7.558	1.53	68
30	0.987	0.459	1.514	0.493	-1.027	1.31	71	60	0.248	-0.229	0.725	0.394	-7.308	1.54	66

Table B-2. Estimated Scale Parameters

Cross-sectional Distribution of Abnormal Returns

t	investment credit changes	investment credit control group	depreciation changes	t	investment credit changes	investment credit control group	depreciation changes
1	1.960	1.756	2.308	31	1.971	1.988	2.171
2	1.710	2.250	1.575	32	1.621	1.731	2.246
3	1.587	2.040	1.854	33	1.600	1.640	1.783
4	1.765	0.908	1.850	34	1.810	1.646	2.077
5	1.717	1.685	2.252	35	1.783	1.190	1.921
6	1.481	1.831	2.481	36	1.677	1.769	2.002
7	1.671	1.298	2.271	37	1.896	1.898	2.321
8	1.658	1.773	2.212	38	1.375	1.388	2.512
9	1.662	1.323	1.983	39	1.554	1.648	1.758
10	1.702	1.540	2.275	40	1.596	1.873	2.135
11	1.704	1.183	2.083	41	1.783	1.710	2.083
12	1.567	1.417	2.737	42	1.748	1.848	1.896
13	1.592	2.262	1.931	43	1.800	1.875	1.840
14	1.825	1.637	2.362	44	1.713	1.540	1.637
15	1.615	1.683	2.183	45	2.050	1.617	1.825
16	1.404	2.298	2.510	46	1.525	1.471	1.775
17	1.625	1.350	1.665	47	1.446	1.421	1.273
18	1.744	1.587	2.244	48	1.690	1.523	1.606
19	1.729	1.210	2.121	49	1.992	1.863	1.942
20	1.596	2.285	2.998	50	1.527	1.792	2.021
21	1.763	1.475	2.417	51	1.763	2.202	2.133
22	1.515	1.773	2.575	52	1.375	1.863	1.725
23	1.525	1.192	2.188	53	1.750	1.613	1.912
24	1.698	2.013	1.927	54	1.625	1.598	1.979
25	1.588	1.631	2.035	55	1.788	1.969	2.287
26	1.604	1.700	2.052	56	1.675	1.360	2.029
27	1.944	2.263	1.792	57	1.744	1.600	1.927
28	1.517	1.988	1.562	58	1.958	1.312	2.735
29	1.606	1.658	1.771	59	1.806	1.446	1.723
30	1.871	1.767	2.133	60	1.806	1.563	1.877

Table B-3. Medians and Skewness Statistics

Panel A. Investment Credit Changes

t	median	cumulative median	(mean-median)/scale	t	median	cumulative median	(mean-median)/scale
1	-0.434	-0.434	0.032	31	0.654	-6.803	0.268
2	-0.050	-0.485	0.106	32	-0.042	-6.845	0.159
3	-0.592	-1.077	0.089	33	0.156	-6.689	0.159
4	-0.149	-1.226	0.144	34	0.168	-6.522	0.075
5	-0.024	-1.249	0.034	35	0.471	-6.051	0.199
6	-0.351	-1.601	0.190	36	0.154	-5.897	0.190
7	-0.168	-1.769	0.131	37	-0.057	-5.954	0.074
8	-0.108	-1.877	0.070	38	0.031	-5.923	0.136
9	-0.052	-1.930	0.070	39	-0.237	-6.160	0.039
10	-0.499	-2.429	0.152	40	-0.419	-6.579	0.150
11	-0.280	-2.709	0.154	41	-0.226	-6.806	0.151
12	-0.238	-2.947	0.078	42	-0.261	-7.066	0.141
13	-0.513	-3.460	0.036	43	-0.076	-7.142	0.020
14	-0.248	-3.708	0.188	44	-0.540	-7.682	0.136
15	-0.327	-4.035	0.033	45	-0.577	-8.259	0.065
16	0.020	-4.015	0.036	46	-0.504	-8.763	0.152
17	0.044	-3.972	0.016	47	-0.420	-9.183	0.018
18	-0.440	-4.412	0.078	48	-0.330	-9.514	0.122
19	-0.599	-5.011	0.171	49	-0.523	-10.036	0.117
20	-0.308	-5.319	0.110	50	-0.384	-10.420	0.084
21	-0.589	-5.908	0.049	51	-0.334	-10.755	-0.008
22	-0.309	-6.217	0.279	52	-0.358	-11.113	0.183
23	-0.197	-6.414	0.196	53	-0.357	-11.470	0.115
24	-0.529	-6.943	0.195	54	-0.145	-11.615	0.153
25	-0.130	-7.074	0.188	55	-0.175	-11.790	0.095
26	-0.134	-7.208	0.196	56	-0.097	-11.888	0.087
27	0.001	-7.207	0.232	57	-0.049	-11.937	0.053
28	0.008	-7.200	0.134	58	-0.162	-12.099	0.263
29	0.032	-7.168	0.198	59	-0.312	-12.411	0.184
30	-0.289	-7.457	0.341	60	-0.018	-12.429	0.213

Table B-3. Medians and Skewness Statistics

Panel B. Investment Credit Control Group

t	median	cumulative median	(mean-median)/scale	t	median	cumulative median	(mean-median)/scale
1	0.144	0.144	-0.061	31	0.310	-0.472	0.123
2	-0.203	-0.059	0.196	32	0.773	0.302	0.113
3	0.181	0.122	0.106	33	0.709	1.011	0.023
4	0.774	0.896	-0.304	34	-0.249	0.762	0.459
5	-0.396	0.500	0.024	35	0.327	1.089	0.113
6	-0.010	0.490	0.126	36	-0.138	0.951	0.217
7	-0.227	0.263	0.089	37	0.582	1.533	0.046
8	-0.363	-0.100	0.086	38	0.537	2.070	0.066
9	-0.171	-0.272	0.225	39	-0.327	1.744	0.165
10	0.080	-0.191	-0.013	40	0.139	1.883	0.067
11	0.070	-0.121	-0.300	41	-0.048	1.834	0.144
12	-0.185	-0.305	0.357	42	0.038	1.872	0.095
13	0.021	-0.284	0.082	43	-0.225	1.647	0.219
14	-0.771	-1.055	0.288	44	-0.378	1.269	0.081
15	-0.047	-1.102	-0.001	45	-0.793	0.476	0.253
16	-0.061	-1.163	-0.331	46	-0.221	0.255	0.090
17	-0.153	-1.316	0.068	47	0.288	0.543	-0.346
18	0.293	-1.023	0.025	48	0.120	0.663	-0.260
19	-0.395	-1.418	0.332	49	0.335	0.998	-0.202
20	0.047	-1.370	-0.040	50	0.386	1.384	0.213
21	0.136	-1.234	0.095	51	-0.207	1.177	0.087
22	-0.563	-1.797	-0.008	52	-0.212	0.965	0.073
23	-0.100	-1.896	-0.250	53	0.592	1.557	0.035
24	0.348	-1.548	-0.043	54	-0.433	1.123	0.094
25	0.159	-1.390	0.089	55	0.970	2.093	0.054
26	-0.506	-1.895	0.205	56	-0.582	1.512	0.166
27	0.306	-1.589	-0.040	57	0.556	2.068	0.150
28	-0.386	-1.976	0.231	58	-0.437	1.630	0.096
29	-0.238	-2.213	0.304	59	0.535	2.166	-0.044
30	1.432	-0.781	-0.287	60	0.312	2.477	0.247

Table 8-3. Medians and Skewness Statistics

Panel C. Depreciation Changes

t	median	cumulative median	(mean-median)/scale	t	median	cumulative median	(mean-median)/scale
1	-0.784	-0.784	-0.014	31	0.164	-3.787	0.008
2	-0.612	-1.396	0.178	32	-0.294	-4.080	0.246
3	0.024	-1.372	-0.004	33	-0.342	-4.422	0.165
4	-0.254	-1.626	0.163	34	-0.601	-5.024	0.402
5	-0.475	-2.101	0.329	35	-0.542	-5.565	0.100
6	-0.561	-2.662	0.101	36	-0.565	-6.130	0.226
7	-0.597	-3.259	0.115	37	0.015	-6.115	0.072
8	-0.215	-3.474	-0.045	38	-0.116	-6.232	0.307
9	-0.291	-3.765	-0.096	39	-0.259	-6.491	0.050
10	0.667	-3.098	-0.115	40	-0.211	-6.702	0.138
11	-0.148	-3.246	-0.057	41	-0.637	-7.338	0.048
12	0.155	-3.091	-0.164	42	-0.472	-7.810	0.218
13	-0.253	-3.343	0.151	43	-0.240	-8.050	-0.202
14	0.084	-3.259	-0.114	44	-0.509	-8.559	0.240
15	-1.006	-4.265	0.146	45	-0.115	-8.674	-0.046
16	-0.179	-4.445	0.080	46	0.201	-8.474	-0.211
17	0.291	-4.154	-0.058	47	-0.539	-9.013	-0.144
18	0.577	-3.577	0.014	48	-0.430	-9.443	-0.028
19	-0.437	-4.014	0.210	49	-0.783	-10.226	0.145
20	-0.333	-4.347	0.208	50	-0.080	-10.306	0.052
21	-0.197	-4.544	-0.037	51	-0.461	-10.767	-0.330
22	0.251	-4.293	-0.093	52	-0.053	-10.820	-0.200
23	-0.156	-4.450	0.090	53	-0.685	-11.505	0.106
24	0.111	-4.338	0.119	54	-0.738	-12.242	-0.026
25	0.223	-4.116	-0.035	55	-0.347	-12.589	0.063
26	-0.099	-4.215	-0.027	56	-0.523	-13.112	0.257
27	-0.011	-4.226	0.046	57	-0.728	-13.840	0.203
28	-0.160	-4.387	-0.103	58	0.232	-13.608	-0.150
29	-0.248	-4.634	0.287	59	-0.228	-13.836	-0.158
30	0.684	-3.950	0.142	60	0.440	-13.396	-0.102

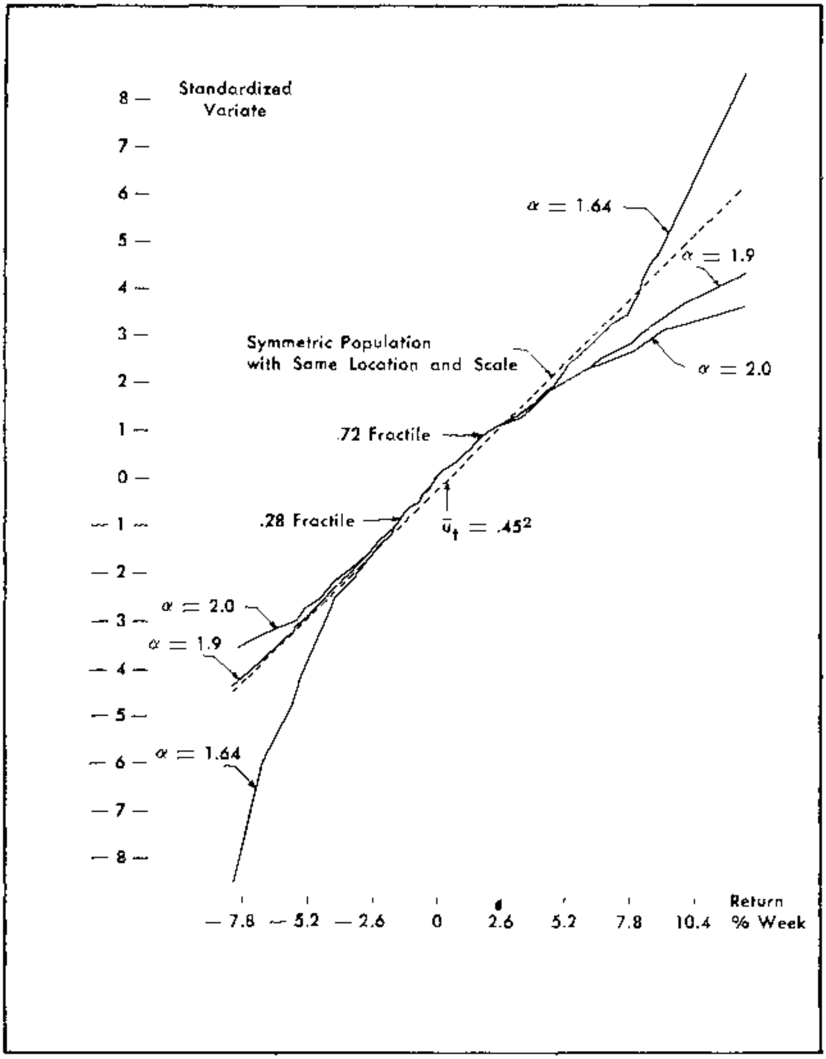

FIG. B1.—Sample distribution of investment-credit abnormal returns in week 27.

The widened confidence bands occur through a rather complex chain of events that can be understood more easily by referring to figure B1. As an example, this figure plots the sample distribution of $u_{j,27}$, for investment-credit changes in week 27, on probability paper. The three curves shown are actually the same sample points plotted on three different kinds of probability paper. On normal probability paper, the sample looks like the curve labeled $\alpha = 2.0$. On probability paper of a symmetric stable distribution with characteristic exponent equal to the actual value estimated from the sample itself using the method of Appendix A, the sample appears as the curve labeled $\alpha = 1.64$. After observing the first two plots, we also plotted the sample on paper for $\alpha = 1.9$. Our reason for examining the sample in this way was to determine whether *any* symmetric stable distribution paper would result in the graph of a reasonably straight line.[42] The answer is that none will. For $\alpha = 2.0$, the sample's too-thick tails appear as the familiar S shape. For $\alpha = 1.64$, the tails are too thin. For $\alpha = 1.9$, the tails are fine but the curve is concave downward, a definite indication of positive skewness.

This skewness clearly biases downward our estimate of scale, which is proportional to the difference between the 0.72 and 0.28 fractiles. The difference between wider fractiles is not biased as much because all stable distributions of different skewness but the same characteristic exponent come together as the fractiles increase. Thus, our estimate for α is biased downward, too, and this results in biased-wide confidence bands.

Because of rightward asymmetry, the confidence bands are probably also shifted downward by a small amount.

42. The dotted straight line portrays a symmetric stable population with location parameter equal to the sample mean and scale parameter equal to the value estimated from the sample.