Relationship Between Accounting Changes and Stock Prices: Problems of Measurement and Some Empirical Evidence

SHYAM SUNDER*

Part I

1. INTRODUCTION

Generally accepted accounting principles allow alternative treatments of several types of accounting events. Financial accounting policy-making bodies such as the Accounting Principles Board and the Securities and Exchange Commission rule on the admissibility of various accounting procedures and on changes from one procedure to another. For this purpose, they need information about the effect of accounting procedures and changes in accounting procedures on the interests of various economic agents in society. Admissibility of alternative procedures implies that corporate managers must select one of the available procedures for their use. For making such selections, managers need information about the relationship of accounting procedures with corporate objectives. In making their investment decisions, investors too need information not only about the meaning of various accounting procedures but also about the relationship of these procedures with stock prices. In this paper, I report on a study of the relationship between alternative inventory cost flow assumptions (Lifo and Fifo) with the behavior of stock prices. The belief that an understanding of this relationship is relevant to the three classes of decision makers mentioned above provides the justification for the study.

* Carnegie-Mellon University.

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This paper comprises three parts. In Part I various approaches to the study of accounting changes and investor behavior are briefly reviewed, effects of accounting changes involving Lifo on earnings, cash flows and tax liability are analyzed and the data used for empirical analysis in Parts II and III are described. In Part II, the relationship between changes in accounting for inventory costing and stock price behavior is analyzed by estimating the abnormal stock price change associated with the accounting change. The abnormal price change framework of study was proposed by Fama, Fisher, Jensen and Roll (1969) and has been widely used in accounting research. An important assumption of this research design is that risk of firms relative to the market remains unchanged over time. Recently the propriety of this assumption has been questioned. Part III of this paper discusses the possibility, hypotheses and evidence of risk-changes for firms that changed their method of costing inventories. Existence of risk changes has important implications for the measurement of relationship between accounting events and stock prices. These implications also are discussed in Part III. Brief mention is made of further work now in progress which measures (a) the association between accounting and risk-changes and (b) the association between accounting and abnormal price changes after allowing for the risk-changes. Tentative conclusions from the study are given in the last section. Final conclusions, however, must await the completion of this study.

2. DECISION MAKERS

The relationship between various accounting changes and investment behavior is of direct interest to the financial accounting policy makers, corporate management, and investors.

Though financial reporting is supposed to fulfill the information needs of a variety of economic agents in society, the needs of the owners and creditors of business enterprises are given special consideration in the Accounting Principles Board's statement of objectives of financial accounting and financial statements: "The basic purpose of financial accounting and financial statements is to provide quantitative information about a business enterprise that is useful to statement users, particularly owners and creditors, in making economic decisions."[1] Since financial accounting is so strongly oriented towards the needs of investors, understanding of the relationship between investor behavior and accounting changes is important for improving standards of financial reporting.

Given the corporate objective of maximizing shareholders' wealth, the management is interested in maximizing the market value of the firm's stock. Accounting procedures, especially those which have direct economic impact on the firm due to a tax advantage, such as the Lifo method, can be used by the management to this end. A better understanding of the re-

lationship between accounting changes and investor behavior can be useful to the management in this respect. For example, it is well recognized that given rising prices and stable or increasing inventory, the Lifo method of inventory costing leads to deferment of tax payments and consequently to an increase in the economic value of the firm. One possible explanation of the failure of most firms to adopt this method is that corporate managers are wary of reporting lower earnings, which result from nonrealization of inventory holding gains under Lifo, for the fear of an adverse effect on stock price. If a study of the relationship between stock prices and accounting changes involving Lifo were to indicate that such adverse effect does not occur, managers would have little reason to hesitate in adopting Lifo on this ground.

A third group of decision makers interested in the relationship between accounting changes and investor behavior are the investors themselves. Judged by the unusual stock market activity associated with their release, accounting statements are an important source of information for the investor community.[2] Accounting changes may reduce the intertemporal comparability among financial statements. If a change represents a deviation from the general industry practice, it also reduces the interfirm comparability of such statements. Investors generally take a dim view of changes in accounting for reporting purposes not only because they reduce comparability of financial statements but also because they are often suspicious about the motives that may lie behind the management's decision to bring about such a change. Several recent studies have looked into the managerial motives for accounting changes.[3] Income smoothing, housecleaning, rationalization, diversification and decentralization are some of the suggested motives for accounting changes. However, an accounting change justified on economic grounds does not trouble the investors as does the possibility that the management may use a change to manipulate the financial statements and misrepresent the financial position of the firm. A study of the relationship between accounting changes and stock price behavior is therefore of interest to investors.

3. APPROACHES

The relationship between various accounting changes and behavior of investors has been the subject of many studies in recent years. Investment behavior has been empirically analyzed at both the individual and the market levels. In the following paragraphs this literature is briefly reviewed.[4]

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[2] For evidence of unusual trading volume and price variability associated with the release of financial statements, see Beaver (1968).

[3] For example, Cushing (1969), Gordon, Horwitz and Meyer (1966), Copeland (1968) and Gagnon (1967).

[4] No attempt is made here to survey the literature which is fairly large. Hakansson

Experimental studies to examine investor behavior at the individual level have been conducted by Jensen (1966) and Dyckman (1966). Jensen designed an experimental field study of security evaluation by professional security analysts by supplying them data generated from different accounting procedures. He concluded that accounting differences did affect the analysts' evaluation of securities, primarily through their impact on earnings per share. Dyckman (1966) found that individual participants of his experiment reacted differently to data generated from different accounting procedures for inventory costing.

A major advantage of studying individual investment behavior in an experimental setting is the possibility of testing hypotheses about the existence of manipulative causality[5] between accounting procedures and investor behavior. However, the results from this approach are difficult to generalize for reasons such as subject selection, reward structure and experimental learning. A special objection to the generalization of results is the absence of a competitive market and competitive sources of information in the experimental environment. In a real market, accounting statements are only one of the many channels from which an investor receives information. The other channels include the price, the insiders and the fellow investors. In experimental situations other channels of information are difficult to incorporate. The value of financial information evaluated in isolation from other sources of information may have very little meaning in competitive markets.

Studies of investor behavior with respect to accounting changes at the market level have used two approaches, one based on valuation theory and the other on the capital market equilibrium theory. Studies by O'Donnell, Summers, Mlynarczyk, Gonedes and Comiskey can be placed in the former class, while Kaplan and Roll, Ball, Archibald and Beaver and Dukes' studies are in the latter class. O'Donnell's first study (1965) compared mean price earning ratios and trends of these means over time for three groups of electric utilities which had used different accounting methods for depreciation. O'Donnell concluded that investors viewed the extra earnings reported as a result of accounting change as real earnings. O'Donnell's second study (1968) confirmed these conclusions. Summers' (1968) study of alternative accounting methods for investment tax credit and interperiod tax allocation concluded that investors were indifferent to the alternative accounting practices. This finding was in conflict with O'Donnell's. Mlynarczyk (1969) constructed another valuation model with security price as

[5] See Rapoport (1953). He distinguishes manipulative causality from observational and postulational causality. The notion of manipulative causality between A and B implies "Make A occur and you will observe B" or "Prevent A from occurring and B will not occur." While it is possible to control the occurrence of A in experimental situations, it is not easy to do so in market level studies where the best that can be obtained is observational causality which implies "Watch for the occurrence of A and you will observe the occurrence of B."

a function of accounting earnings, expected growth, revenues, debt equity ratio, and two dummy variables—one for listing on the New York Stock Exchange and the other for the use of flow through or deferred tax liability method by the firm. Of the five years for which Mlynarczyk analyzed data, he concluded that accounting treatments made a significant difference to stock price during the last three years only. Mlynarczyk's results supported O'Donnell's conclusions. Gonedes (1969) also examined the relationship of alternative treatments of interperiod tax allocation using a security price model based on Gordon's (1962) dividend capitalization model. His results "do not invariably discredit the null hypothesis—may support alternative interpretations."

There are two main objections to the use of valuation approach to measure the relationship between accounting events and stock prices. First, these models are formulated in terms of levels of earnings and other variables, and are dominated by the scale factor. Accounting researchers, however, are basically concerned with the association between accounting *changes* and *changes* in stock price behavior, and high correlation in levels does not imply high correlation in changes. Second, these models consider the pricing of each stock as an isolated problem and ignore the cross sectional association that is known to exist among stock price changes.

The approach based on capital market equilibrium model was first used by Fama, Fisher, Jensen and Roll (1969) in their study of the relationship between stock splits and stock prices. This approach and its justification are discussed in Section 6. Kaplan and Roll (1972) used this model to study the relationship between stock price changes and accounting changes with respect to investment credit and depreciation. They also proposed and applied tests of significance on estimated association after taking the recent findings about distribution of stock prices into account. They did not find a statistically significant relationship between these accounting changes and stock price changes. Their results are, however, suggestive of a small rise in stock price following a financial statement in which earnings have been boosted by making an accounting change. Archibald's (1972) study of 65 firms which changed their method of accounting for depreciation from accelerated to straight-line method used a methodology quite similar to Kaplan and Roll's and he concluded that "the (depreciation) switchback announcement and resultant improvement apparently had no immediate substantial effect on stock market performance."

Ball (1972) analyzed the relationship between stock prices and a variety of accounting changes by various firms over a period of 14 years. Unlike the other studies cited above, he used Black's (1972) two-factor model of market equilibrium and did not assume that relative risk of firms is an unchanging parameter. Use of a two-factor model, the descriptive validity of which is still controversial, for such measurements is discussed in Section 6. Treatment of risk changes is the subject matter of Part III of this paper.

Beaver and Dukes (1972) analyzed a sample of firms which used deferred tax liability method and computed the reported earnings which would have been reported if the deferred tax liability had not been recognized. They compared the association of these two earning figures and cash flow with the changes in market price of stocks and concluded that "deferral earnings are most consistent with the information set used in setting security prices, while cash flow is least consistent." Note that no accounting change had actually been made by the firms analyzed and that the results are dependent on the earnings expectation model used in the analysis. Beaver and Dukes used several expectation models but the descriptive validity of these models remains untested.

The capital market equilibrium based approach to the study of accounting events and stock price behavior also has its weaknesses. Validity of the capital asset pricing model and the market model has been questioned recently.[6] Controversy on the efficiency of the capital markets continues. Gonedes (1972) and Beaver (1972) give representative expositions of the implications of the efficient market hypothesis for accounting issues. A review of the theoretical arguments and interpretation of considerable empirical work in support of the efficient markets hypothesis is given by Fama (1970). Downes and Dyckman (1973) review the available empirical evidence against an absolutist view of market efficiency. They also mention that market based studies in accounting have largely ignored the heterogeneity of individual investor expectations which has important implications for policy on accounting information.

Capital market efficiency implies quick and unbiased incorporation in prices of all information as soon as it becomes available. Market efficiency can at best be used as an assumption in studies whose objective is to measure the relationship (or lack of it) between accounting information and market prices. Besides drawing an inference about the relationship between stock prices and certain types of accounting information, some studies[7] have stated that their evidence *supports* the market efficiency hypothesis. This has caused some confusion. In order to test a hypothesis about efficiency of the market with respect to a given piece of information, an assumption about the effect of such information on prices must be made. If this effect is not known, an assumption about efficiency of the market with respect to such information is required in order to test a hypothesis about the effect of the information on prices. Hypotheses about market efficiency and the effect of a piece of information cannot be tested simultaneously. For example, if we *know* that the effect of an increase in income is an increase in stock price, data can be analyzed to examine if (a) such an increase in the stock price occurs and (b) whether it occurs immediately after the time information becomes available, and thus test the efficiency

[6] See Black (1972), Miller and Scholes (1972) and Black, Jensen and Scholes (1972).

[7] Ball (1972) and Beaver and Dukes (1972).

of the market with respect to the information about increases in income. On the other hand, if we do not know the effect of an increase in income on stock price and this effect is the object of investigation, efficiency of the market with respect to information on income must be assumed. This assumption implies that whatever the effect of increase in income on stock price, it will be observed *immediately* and *unbiasedly*. Given the efficiency assumption, price changes *immediately after* the time information becomes available can be examined. An observed increase in price then implies that the effect of increased income is increased stock price. If no price change is observed, the implication is that the income change does not affect the stock price. Without prior knowledge of the efficiency of the market with respect to certain information or of the effect of such information on the market, neither hypothesis can be tested on the data. In this study, I *assume* that the market is efficient with respect to the information about accounting changes and test hypotheses about the association between accounting changes and stock prices. No attempt is made to test the efficiency of the market. The conclusions drawn from this study are dependent on the propriety of this assumption.

An important assumption of the market based research design has been that risk of firms is stable over time. Ball (1972) proposed a modification to the research design to drop this assumption. Part III of this paper examines his methodology and the evidence on the existence of risk changes and their effect on measurement of association between accounting changes and stock price changes. Continuing research to develop alternative methodology is briefly mentioned.

4. LAST-IN, FIRST-OUT

I selected this accounting change for study for two reasons: (a) the existence of a fairly substantial and controversial body of accounting literature about the change and (b) a uniqueness conferred upon Lifo method by the tax law.[8] Firms using Lifo for tax purposes must use it for reporting purposes; but firms which use Lifo for reporting purposes can use some other method for tax purposes.

The necessity of making cost flow assumptions in inventory accounting arises from price changes. During the 32-year period since 1939 when the Internal Revenue Act of 1938 first permitted the use of Lifo for tax purposes, commodity prices in the U.S.[9] have risen at an average annual rate of 3.43%. In only 5 of these 32 years were the prices lower than in the previous years. Thus it is reasonable to assume that American busi-

[8] "In American tax regulations, booking is required only in connection with the use of Last-in-first-out (Lifo) inventory methods," Davidson (1965). Booking is the practice of using the same method of accounting for reporting as for tax purposes.

[9] Wholesale Price Index of the Bureau of Labor Statistics.

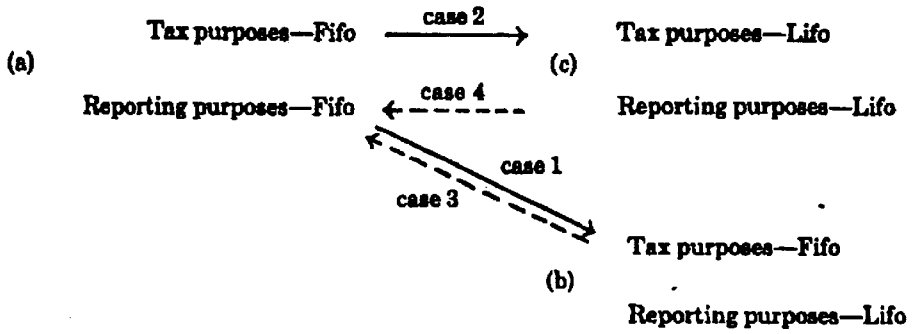

FIG. 1.

FIG. 1.—Possible Changes Between Lifo and Fifo.

nesses have operated in an inflationary environment during this period.[10] This assumption underlies the following analysis.

Accounting changes can occur between any two of the following three states:

(a) Fifo used for both reporting and tax purposes

(b) Fifo used for tax and Lifo for reporting purposes

(c) Lifo used for both tax and reporting purposes.

A total of six different transitions from any one of the three to the remaining two can occur among these three states. The transitions between states (b) and (c) do not involve a change in accounting for reporting purposes and information about such transitions does not become available to the market through the financial statements. The remaining four transitions shown in Figure 1 where arrows to the right in firm line indicate transitions towards adoption of Lifo and arrows to the left in broken line show the transitions involving abandonment of Lifo. The effect of each of these transitions on reported earnings, tax liability, and economic value of the firm can be analyzed under a set of assumptions.[11] In addition to the above mentioned assumption about an inflationary environment, these are:

(a) Accounting changes are not accompanied by a change in the internal decision process of the firm which may systematically alter the reported earnings or value of the firm. Some evidence to support this assumption is provided by Dyckman (1964).

(b) Marginal tax rate of the firm is positive.

(c) Discounted net cash flow concept of valuation of firm is used. Miller

[10] While true of the economy in general and for most of the firms in the sample of this study, it may not be true for each individual firm by virtue of the price behavior of the particular commodities each firm deals with. This need not be of much concern since cross-sectional analysis over a wide variety of firms should bring out the overwhelmingly inflationary trend experienced by the economy.

[11] See e.g., Cerf (1956) for a detailed analysis of the effect of the Lifo method on earnings etc. and Most (1967).

and Modigliani (1961) have shown that other major approaches to valuation (current earnings plus future investment opportunities, stream of dividends and stream of earnings) are essentially equivalent under perfect capital markets.

(d) Reported earnings in the following discussion include the inventory holding gains realized at the time of accounting change even if such gains were directly added to the retained earnings or shown as extraordinary items.[12]

(e) Firms using Lifo maintain stable or increasing year-end inventory in order to prevent realization of inventory holding gains.

The effect of the four transitions discussed above on reported earnings, tax liability and the economic value of the firm can be analyzed as follows:

Case 1. Adopting or extending the use of Lifo for reporting purposes only. This represents a transition from state (a) in which Lifo is not used to state (b) in which Lifo is used for reporting purposes only. Since there is no change in tax liabilities, both present and future net cash flows and therefore the value of the firm remains unchanged. Adoption of Lifo for reporting purposes prevents the realization of inventory holding gains and their inclusion in the reported earnings. Thus the current and future reported earnings are lower to the extent of the inventory holding gains which would have been realized under Fifo.

Case 2. Adopting or extending the use of Lifo for both tax and reporting. This represents a transition from state (a) to state (c). Nonrealization of inventory holding gains under Lifo results in lower taxable and reported earnings. If marginal tax rate of the firm is positive, the tax liability of the firm is also lower. Even if inventory holding gains are realized in a subsequent period, tax payments on these gains are postponed until such time. This amounts to an interest-free loan to the firm from the tax authority. The value of the firm increases because the present value of net cash flows to the firm is higher. Thus reported earnings and the economic value of the firm change in opposite directions.

Case 3. Wholly or partially abandoning Lifo used for reporting only. This represents a transition from state (b) to state (a). As in Case 1, no change is involved for tax purposes with the result that the tax liability and current and future net cash flows remain unchanged. Since previously unreported inventory holding gains are realized, current and future reported earnings are higher than they would have been if the accounting procedure had not changed. (See assumption (d) and footnote 12 above.)

Case. 4. Wholly or partially abandoning Lifo for both tax and reporting. This represents a transition from state (c) to state (a). Realization of

[12] Accounting Principles Board Opinion No. 20 which came into effect on August 1, 1971 calls for much more explicit disclosure for accounting changes from Lifo to other methods. The data for this study are taken from the period 1946 to 1966 when these rules were not applicable.

inventory holding gains results in higher reported as well as taxable earnings in the current and future accounting periods. (See assumption (d) and footnote 12.) Increased tax liability on realized inventory holding gains reduces the economic value of the firm. Thus the economic value and reported earnings change in opposite directions.

These results are summarized in Table 1. For Cases 1 and 2 (transitions towards Lifo) the change in reported earnings is negative while the change in the value of the firm as a result of the accounting change is zero or positive. For Cases 3 and 4 (transitions away from Lifo) the effect of the accounting change on reported earnings is always positive but the effect on the economic value is zero or negative. For a study of the relationship between these accounting changes and the behavior of the stock prices, Cases 1 and 2 have been placed together in Group A and Cases 3 and 4 in Group B.

This analysis indicates that if investors' expectations in the stock market are formed primarily on the basis of reported earnings, the market price of the firms in Group A should decline and the market price of the firms in Group B should increase when the accounting change is made. On the other hand if these expectations are formed on the basis of the economic value of the firm, the market value of the firms in Group A should increase or remain unchanged; the market value of the firms in Group B should decline or remain unchanged.

If stock price changes associated with accounting changes can be measured, the following two hypotheses about their relationship can be tested:

Hypothesis 1. Market's expectations about a firm are formed on the basis of the real economic value of the firm. Market price reflects this value and accounting changes which increase the economic value are associated with increase in the market price.

Hypothesis 2. Market's expectations about a firm are formed on the basis of reported earnings. If an accounting change causes a change in the reported earnings, market price will be affected accordingly even if the effect of the accounting change on the economic value of the firm is zero or in the opposite direction.

If accounting changes in Group A are found to be associated with an increase in the market price, such evidence would support Hypothesis 1.

TABLE 1

Group	Case	Cash outflows	Tax liability	Reported earnings	Economic value
A	1	Unchanged	Unchanged	Lower	Unchanged
	2	Lower	Lower	Lower	Higher
B	3	Unchanged	Unchanged	Higher	Unchanged
	4	Higher	Higher	Higher	Lower

If accounting changes in Group B are found to be associated with a decline in the market price, this would also support Hypothesis 1. On the other hand, if accounting changes in Group A and Group B are found to be associated with negative and positive market price changes respectively, such evidence would support Hypothesis 2.

The data used for empirical testing of these and other hypotheses are described in the next section. The research design to measure the association between accounting changes and stock price is described in Section 6.

5. DATA

Three kinds of data are needed for this study: the identity of firms which changed their accounting procedure, the date of change and stock price relatives for the years surrounding the date of accounting change. Sources, collection procedures and certain characteristics of the data are given below.

Identity of firms. Names of the firms which adopted, extended or abandoned the use of Lifo method of inventory costing were obtained from the 1946 to 1966 editions of *Accounting Trends and Techniques* (published by the American Institute of Certified Public Accountants). The initial sample had 199 firms (Group A—165; Group B—34) including multiple counts for the firms which changed their accounting method more than once during the period 1946–1966. A total of 44 firms (Group A—36; Group B—8) were dropped from the sample for the following reasons:

(a) They could not be identified by name.

(b) Rather than adopting Lifo, they had merely acquired a subsidiary using this method.

(c) They were not listed on the New York Stock Exchange and their stock price data was not available on the Center for Research and Security Prices Monthly Price Relative File of the University of Chicago.

Various parts of this study require different amounts of data for analysis. These data requirements further reduce the sample size and such reductions are indicated at appropriate places in this study. In effect, 155 is the maximum sample size (Group A—129; Group B—26) for any part of this study. The names of these 155 firms are given in Appendix A.

The selection criteria used above may have introduced the familiar C.R.S.P. bias to this sample. Though the firms listed on the New York Stock Exchange are not representative of all business firms, they are fairly representative of a major sector of the economy to which this study is directed. This bias is therefore not of serious concern here.

Industry Profiles and Multiple Counts Profile of the sample of firms are given in Tables 2a and 2b respectively.

Date of change. It is difficult to know precisely when the information about the accounting change became available to the market. Some pre-

TABLE 2a

Industry Profile of the Sample

SIC Code	Industry	Group A	Group B	Total
100	Mining	3		3
200	Food Products	13	3	16
211	Tobacco	1		1
220	Textiles	3	7	10
260	Paper	9		9
270	Printing and Publishing	3		3
280	Chemicals	5	1	6
291	Petroleum	7		7
301	Rubber and Plastics	4	2	6
314	Leather and Shoe	1		1
320	Clay, Glass and Roofing Materials	7	1	8
331	Steel and Iron	23	1	24
333	Non-Ferrous Metals	5	1	6
340	Fabricated Metal Products	8	2	10
350	Machinery except Electrical	9	1	10
360	Electrical Equipment	8	1	9
370	Transportation Equipment	4		4
380	Instruments	3	1	4
390	Jewelry	3		3
500	Retail Stores	10	5	15
	Total	129	26	155

TABLE 2b

*Multiple Counts Profile of the Sample**

	No. of firms	No. of counts in	
		Group A	Group B
Single change in Group A	81	81	
Single change in Group B	9		9
Two changes (both in Group A)	10	20	
Two changes (both in Group B)	1		2
Two changes (one in each group)	7	7	7
Three changes (all in Group A)	2	6	
Three changes (2 in Group A, 1 in Group B)	2	4	2
Three changes (1 in Group A, 2 in Group B)	1	1	2
Total	113	119	22

* Some firms changed their accounting method more than once during the period 1946–66. This table gives details of such occurrences.

TABLE 2c

*Distribution of Dates of Accounting Change**

Group	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
A	Dec. 48	Jan. 49	Dec. 50	Dec. 50	Oct. 51	Dec. 51	Dec. 52	Dec. 55	Dec. 57	Dec. 62
B	Dec. 52	Dec. 54	Jan. 57	Dec. 58	Dec. 59	July 60	Dec. 62	Dec. 63	Dec. 65	Dec. 66
Total	Dec. 48	Oct. 50	Dec. 50	May 51	Dec. 51	Dec. 52	Dec. 55	Dec. 57	Dec. 59	Dec. 66

* Dates before which the given percent of firms in the sample made the accounting change.

vious studies[13] have justified the date of formal announcement of earnings for this purpose. The *Wall Street Journal Index*, the principal source of such information, is not available for 1940's and early 1950's when most firms in this sample changed their accounting procedure. The last day of the fiscal year during which the change was brought about is used as the base date for accounting change and for cross sectional alignment of data. The exact date of earnings announcement is unlikely to make a substantial difference to the results of this study. Most earnings announcements come within one or two months after the end of the fiscal year and any effect is likely to be captured in the monthly price return data used in this study. In light of the following remarks by Davidson (1968), end of the fiscal year might actually be a better measure of the availability of information to the market than the date of formal announcement of earnings:

> Effective earnings announcements are often made prior to the date that the announcement formally appears in the *Wall Street Journal*. Under pressure from stockholders or financial analysts, a company may release hard, preliminary estimates of annual earnings in the 4–8 week period about the end of the fiscal year. Further, leaks on actual earnings are known to occur. Earnings are usually known roughly within a company by 15 days after fiscal year-end—when the books are closed. Within 25 days after fiscal year-end, audit fieldwork will usually be sufficiently completed that the final figure is known. While there are no formal statistics on leaks and their timing, a company is able to leak information at an early date. The effect of such leaks is, of course, to diminish the effect observed on the WSJ date.

The last date of the fiscal year of each firm was obtained from *Moody's Industrial Manual*. The date of change profile of the sample is given in Table 2c.

Stock price relatives.[14] Monthly price returns were taken from the University of Chicago's Center for Research in Security Prices Monthly Price Relative File. Fisher's Arithmetic Index[15] is used for price relatives on the market portfolio.[16]

[13] Benston (1967) and Kaplan and Roll (1972) used earnings announcement dates from the *Wall Street Journal Index*. Ball (1972) assumed that the changes become known three months after the end of the accounting period for the firms whose date of publication of annual reports was not available.

[14] See Section 6 for definition.

[15] Fisher (1966).

Part II

6. RESEARCH DESIGN

Changes in the price of individual stocks may be associated with a number of economic events and actions of various investors in the competitive market. In order to isolate that component of price changes which might be associated with a specific event (change in accounting procedure in this study), a research design based on the theory of capital market equilibrium has been proposed by Fama, Fisher, Jensen and Roll (1969). This methodology has been used, among others, by Ball and Brown (1968), Kaplan and Roll (1972) and Archibald (1972) to study various accounting events. A brief description of this research design is presented in this section.

Events that affect the stock price of a firm in a competitive market can be placed into two classes: (1) those which affect the price of all the securities in the market[17] and (2) those which are unique to the firm. Sensitivity of the price changes of a given stock to the price changes for the market as a whole, is called risk coefficient of the stock. By measuring the market-wide price movements and the sensitivity of a given stock to the market movements, the individualistic component of the changes in the price of the stock, caused by events unique to the firm can be isolated. King (1966) has shown that a common (market) factor accounts for about one half of the price change variance of individual stocks on average. Model (1), usually referred to as the market model, related R_{jt}, the observed return[18] on stock j in period t to R_{mt}, the observed market factor in period t and the unobserved individualistic factor u_{jt} through a simple linear relationship.

$$R_{jt} = \alpha_j + \beta_j R_{mt} + u_{jt} \tag{1}$$

where α_j is a constant and β_j is the sensitivity of stock j to the market factor.

This model is closely related to, but not identical with, the capital asset pricing model (2) of Sharpe (1964), Lintner (1965) and Mossin (1966) which specifies the conditions of the capital market equilibrium in terms of the first two moments of the probability distribution of stock price returns.

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[17] Operational definition of the market has been limited to the New York Stock Exchange in empirical analysis, primarily because of the unavailability of data in readily usable form for other stock markets.

[18] Return on a security j in period t is defined as the total relative change in the price of the stock after adjustment for cash and stock dividends and splits. If P_{jt} is the price of stock j at the end of period t, adjusted for splits, and D_{jt} is the dividend distributed during this period, return R_{jt} is equal to $((P_{jt} + D_{jt})/(P_{jt-1}) - 1)$. To transform this finite period return to continuously compounded basis, log. $((P_{jt} +$

$$E(\tilde{R}_{jt}) = R_{ft} + (E\tilde{R}_{mt} - R_{ft}) \times \frac{\text{Cov}\,(\tilde{R}_{jt}\tilde{R}_{mt})}{\text{Var}\,(\tilde{R}_{mt})} \tag{2}$$

where

E is the expected value operator
$\sim$ indicates random variables
R_{jt} is the return on security j in period t
R_{ft} is the risk free rate of return in period t
R_{mt} is the return on the market portfolio.

Unlike the market model which specifies a relationship between realized values, the capital asset pricing model is formulated in terms of the expectation and the variance of the return distributions. While model (1) is a specification of the stochastic generating process for stock price changes, model (2) is an equilibrium condition on expected price changes. By using

$$\lambda_{jt} = \frac{\text{Cov}\,(\tilde{R}_{jt}\tilde{R}_{mt})}{\text{Var}\,(\tilde{R}_{mt})} \tag{3}$$

model (2) can be rewritten as,

$$E(\tilde{R}_{jt}) = (1 - \lambda_{jt})R_{ft} + \lambda_{jt}E(\tilde{R}_{mt}). \tag{4}$$

β_j in model (1) and λ_{jt} in model (4) can be approximately equal if (a) variance of the market factor R_{mt} is equal to the variance of the return on market portfolio $\tilde{R}_{mt}$, (b) no security represents a very large fraction of the market portfolio, (c) variance of the individualistic factor u_{jt} is not much larger than the variance of the return on the market portfolio and (d) sensitivity β_j of stock j to market factor and λ_{jt} are unchanged over time. King (1966) and Blume (1968) have indicated that the first three assumptions are not unreasonable. Evidence on the last assumption is not so strong. Most studies [except Ball (1972)] have made this assumption in measuring the relationship of various accounting events to stock price changes. Analysis in this part of the paper is conducted on this assumption. Issues, evidence and implications related to this assumption are the subject matter of Part III. An additional assumption that the risk free interest rate R_{ft} is constant will imply that α_j, the intercept of model (1), is approximately equal to $(1 - \lambda_{jt})R_{ft}$. Bogue (1972) found that assuming that the risk-less rate is constant makes very little difference to the estimates of α_j and β_j.

The above discussion implies that sensitivity β_j in model (1) is equal to the relative risk λ_{jt} of stock j in the market portfolio and market factor in (1) can be replaced by the return on the market portfolio. Thus equation (1) is a simple regression of R_{jt}, the ex-post return on stock j in period t on R_{mt}, the ex-post return on the market portfolio in period t. Since monthly price data is used in this study, each period corresponds to a month. The month during which the change occurred is given time index zero ($t = 0$) for each accounting change in the sample. Thus month t for all accounting

Estimates of α_j and β_j are obtained from ordinary least square regression for each stock by using a minimum of 24 to a maximum of 120 months of data within six years before and six years after the date of accounting change. Twelve months of data on either side of the accounting change (this period corresponds to the interval between the previous and following annual reports) are excluded from the regression because of the suspicion that residuals during this period may have nonzero expectations which may bias the parameter estimates. Let $\hat{\alpha}_j$ and $\hat{\beta}_j$ be the ordinary least squares estimates of α_j and β_j respectively from the model,

$$R_{jt} = \alpha_j + \beta_j R_{mt} + u_{jt}, \qquad t = -71, \cdots -12, 13, \cdots 72. \quad (5)$$

Note that the 24 month period ($t = -11, \cdots 12$) is excluded from the regression. For each of these 24 months, the residual price change $\hat{u}_{jt}$ which represents the component of price change specific to stock j is computed.

$$\hat{u}_{jt} = R_{jt} - \hat{\alpha}_j - \hat{\beta}_j R_{mt}, \qquad t = -11, \cdots 12. \quad (6)$$

Now define $\bar{u}_t$, the average residual for month t.

$$\bar{u}_t = \frac{1}{N} \sum_{j=1}^{N} \hat{u}_{jt}, \qquad t = -11, \cdots 12 \quad (7)$$

where N is the number of stocks, $\bar{u}_t$ is also referred to as abnormal return in period t because this is the return obtained on an equally weighted portfolio of the N stocks under study over and above the market return after adjustment for risk. The cumulative abnormal return on this portfolio starting month -11 up to month t is

$$U_t = \sum_{i=-11}^{t} \bar{u}_i, \qquad t = -11, -10, \cdots, 12. \quad (8)$$

If it is assumed that the market reacts immediately and unbiasedly to new information, that is, the market is efficient, $\bar{u}_t$ can be viewed as an unbiased estimate of market reaction to the information that became available to the market in the tth month from the date of accounting change. The expected values of both $\bar{u}_t$ and U_t are zero and any significant deviations can be interpreted to be associated with the change in the accounting method.

The purpose of examining the abnormal returns in the year preceding the accounting change is to detect the leakage of information to the market through channels other than the financial statements. The information about the accounting change is almost certainly available to the market after the earnings announcement, but possibility of earlier leakages through other channels cannot be denied. Since the flow of information in these channels is hard to observe directly, it cannot be included in this model formally. This failure leads to difficulties (discussed in Section 8) in the interpretation of results from this research design.

sented, a few comments on a modified version of this model suggested by Ball (1972) seem appropriate.

An alternative methodology. Black (1972) has proposed a modification to the Sharpe-Lintner capital asset pricing model given by equation (2). Black does not assume that a risk-less asset exists. His model, referred to as a "two-factor model," can be written as:

$$E(\tilde{R}_{jt}) = E(\tilde{R}_{zt}) + \lambda_{jt}(E(\tilde{R}_{mt}) - E(\tilde{R}_{zt})) \qquad (9)$$

where R_{zt} is the return in period t on that minimum variance portfolio whose covariance with the market portfolio is zero. Other terms in (9) have the same definitions as in (2).

Ball uses the two-factor model to estimate $\hat{u}_{jt}$ to study the relationship between several types of accounting changes and the behavior of stock prices. Since the validity of model (9) is still controversial, it is not a clearly preferred alternative to the single factor model (1) for the purpose of measurement in this thesis. Empirically, Black, Jensen and Scholes (1972) and Fama and MacBeth (1973) provide some evidence that the data are not always compatible with model (1). But the compatibility of the data with the two-factor model has not been shown either. At the theoretical level, Stone (1972) questions the validity of the derivation of the model (9) for two reasons: (a) market clearing conditions are not imposed, and (b) more conditions are placed on the individual investor's personal equilibrium than the number of available variables. Stone also argues that the empirical results obtained by Black, Jensen and Scholes (1972) can be interpreted to reject the two-factor model. Blume and Friend (1973) "cast serious doubt on the validity of the market-line theory in either its resolved, we have preferred to use model (1) for measurement in this study. In the next section, results from the application of the methodology described in this section to the data are presented.

7. RESULTS

Firms changing to Lifo (Group A). Average cumulative residuals, U_t, for each of the 12 months before and after the date of change to Lifo are shown in Figure 2 and Table 3. Out of a possible 129, 119 firms are included in this analysis. Ten firms were dropped because the stock price data available for them on the C.R.S.P. File did not fulfill the minimum data requirements specified in Section 6.

The average price of these stocks rose 5.3% higher than the market index (after adjusting for relative risk) during the 12 months preceding the accounting change. Apparently, these stocks enjoyed exceptionally good times during this year. It is highly unlikely that this pattern of price increases could have occurred by random chance since twelve consecutive residuals preceding the date of changes are positive and the binomial

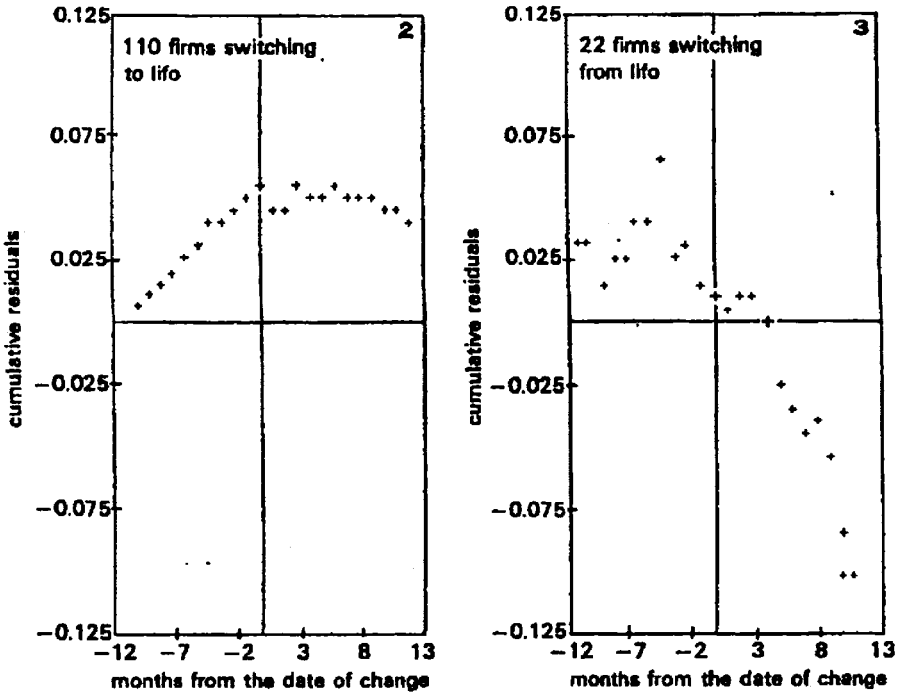

FIG. 2.—Group A. Cumulative Residuals for 24 Months Around the Date of Accounting Change.

FIG. 3.—Group B. Cumulative Residuals for 24 Months Around the Date of Accounting Change.

During the year following the accounting change, average abnormal price change was −1.3%. There seems no clear trend in price of these stocks in this period.

In order to check on homogeneity of Group A, i.e. to examine if the estimated residuals represent a general tendency of the firms in this group or an extreme behavior of a few firms, Group A was subdivided into five subgroups A1, A2, A3, A4 and A5. After arranging all firms of Group A in order of increasing C.R.S.P. identification number, the first, sixth, eleventh etc. were assigned to Subgroup A1; second, seventh, twelfth etc. to Subgroup A2 and so on.[19] Subgroup A1 through A4 had 24 firms each and A5 had 23.

Patterns of average cumulative residuals U_t for each of these five subgroups are given in Figure 4. Patterns for all except one (A1) subgroups show strong similarity with the pattern obtained for Group A in Figure 4 in the sense that the average abnormal change in the price of these stocks was positive before the accounting change and about zero afterwards. This analysis supports the view that the results for Group A are fairly representative of a tendency of firms in that group.

[19] There is no a priori reason for a systematic bias in the results reported here due to this ordering procedure.

TABLE 3

Analysis of Residuals in 24 Months Surrounding the Date of Accounting Change to Lifo. Group A

Sample size / Month (1)	Group A all firms 119 $\bar{u}_t$ (2)	Group A all firms 119 U_t (3)	Group A without steel firms 97 $\bar{u}_t$ (4)	Group A without steel firms 97 U_t (5)	Steel firms of Group A only 22 $\bar{u}_t$ (6)	Steel firms of Group A only 22 U_t (7)
−11	0.000	0.000	−0.003	−0.003	0.012	0.012
−10	0.005	0.005	0.008	0.005	−0.004	0.008
−9	0.006	0.011	0.006	0.010	0.009	0.017
−8	0.005	0.016	0.001	0.011	0.020	0.037
−7	0.002	0.019	0.003	0.014	0.001	0.038
−6	0.006	0.025	0.004	0.018	0.018	0.055
−5	0.007	0.032	−0.002	0.016	0.047	0.102
−4	0.007	0.039	0.003	0.019	0.023	0.126
−3	0.000	0.039	−0.003	0.015	0.017	0.142
−2	0.007	0.047	0.003	0.018	0.026	0.168
−1	0.006	0.052	0.004	0.022	0.013	0.181
0	0.001	0.053	0.000	0.023	0.004	0.185
1	−0.008	0.045	−0.010	0.012	0.000	0.186
2	−0.002	0.044	0.004	0.017	−0.027	0.159
3	0.011	0.055	0.011	0.027	0.014	0.173
4	−0.004	0.051	−0.002	0.025	−0.010	0.163
5	−0.001	0.051	0.001	0.027	−0.009	0.154
6	0.004	0.054	−0.001	0.026	0.024	0.178
7	−0.006	0.049	−0.008	0.018	0.003	0.181
8	0.001	0.050	0.000	0.018	0.008	0.188
9	0.001	0.051	0.001	0.019	0.001	0.189
10	−0.008	0.043	−0.011	0.008	0.006	0.195
11	−0.000	0.043	0.004	0.012	−0.018	0.177
12	−0.001	0.042	0.002	0.014	−0.015	0.161

$\bar{u}_t$ is average residual; see equation (7) for definition.
U_t is cumulative residual; see equation (8) for definition.
Due to round off errors, average residuals may not sum to cumulative residuals.

Firms changing to Fifo (Group B). Twenty-two firms in this group satisfied the minimum data requirements. The average and the average cumulative residuals for this group of stocks are given in Table 4 and the latter are also plotted in Figure 3. Compared to Figure 2, this pattern has more noise because the sample is smaller (22 in Group B versus 119 in Group A). It also suggests that for a few months before and for a year after the accounting change, these stocks fared rather poorly but this cannot be supported by statistical inference. As can be seen later from results of the control group, such patterns can be obtained entirely by chance in sample sizes of 20–25.

Control Group C. Before drawing any conclusions from these results, it will be useful to examine the nature and extent of randomness in the average and cumulative residuals. A random sample of 120 stocks, called

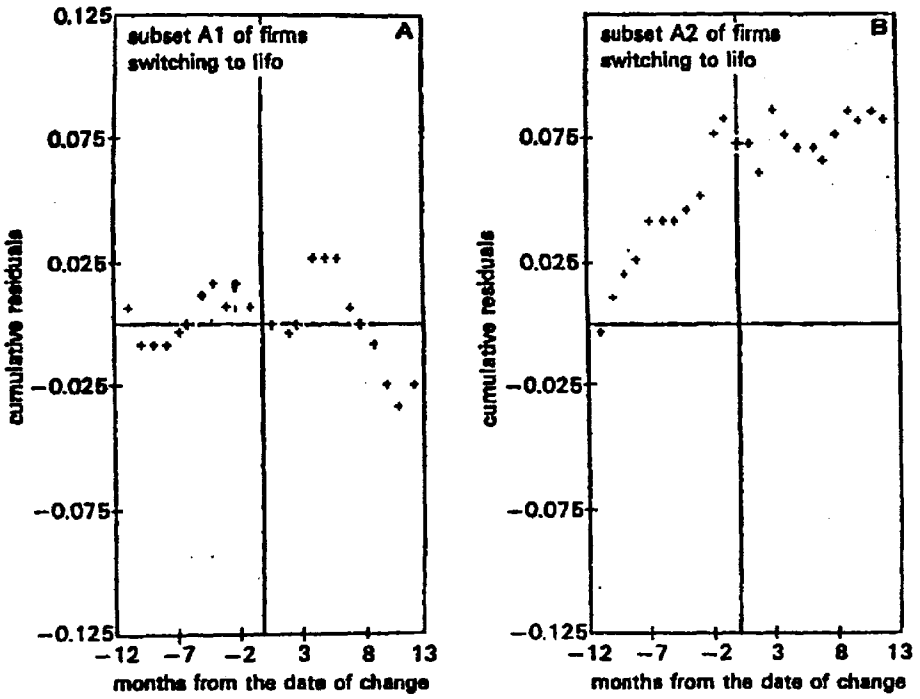

FIG. 4a. Cumulative Residuals for 24 Months Around the Date of Accounting Change
FIG. 4b. Cumulative Residuals for 24 Months Around the Date of Accounting Change

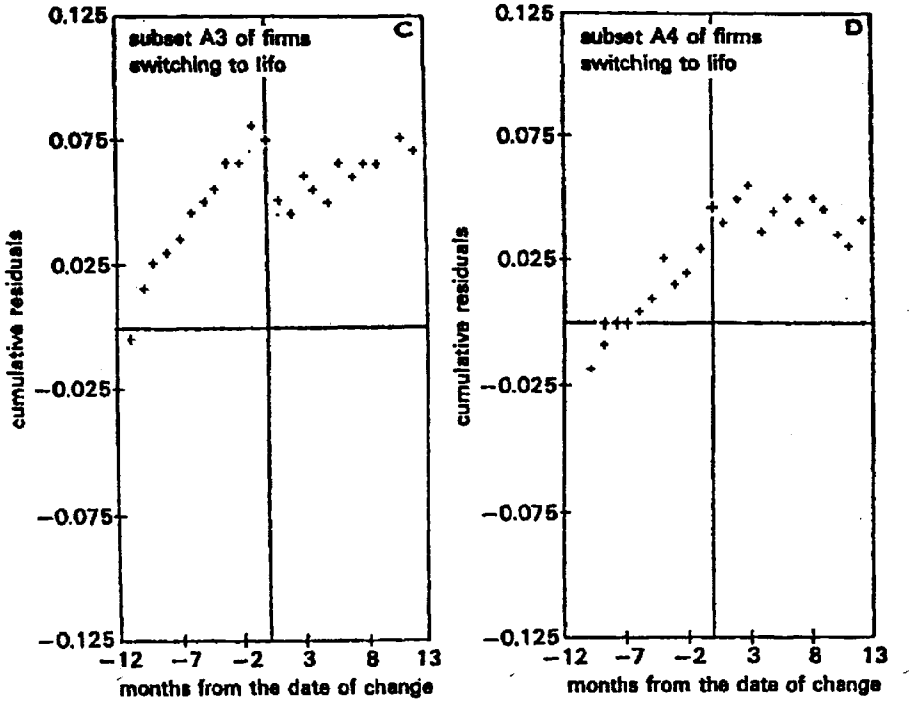

FIG. 4c. Cumulative Residuals for 24 Months Around the Date of Accounting Change
FIG. 4d. Cumulative Residuals for 24 Months Around the Date of Accounting Change

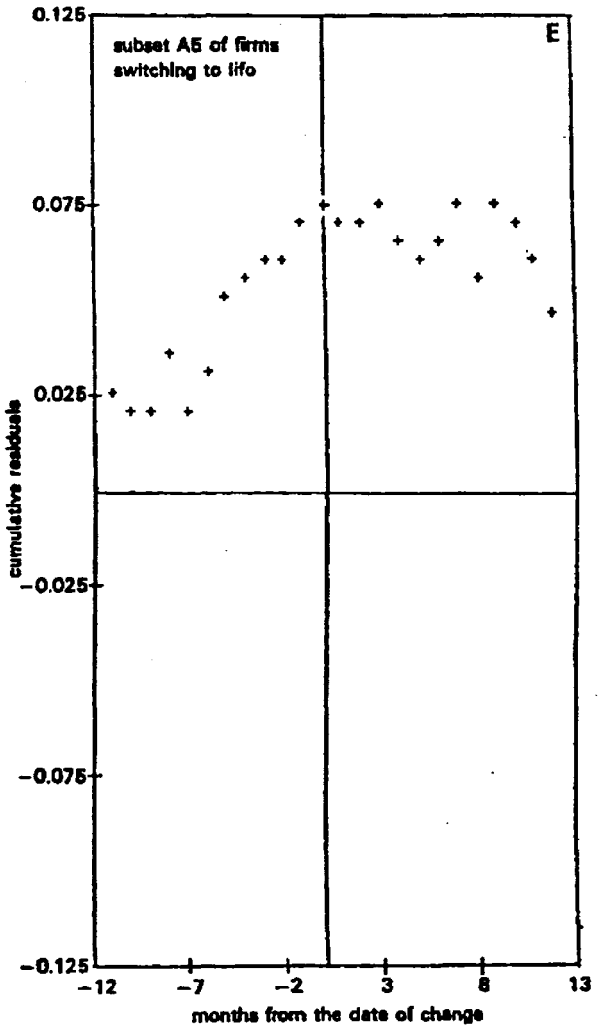

FIG. 4c. Cumulative Residuals for 24 Months Around the Date of Accounting Change

Group C hereafter, is drawn from the C.R.S.P. File.[20] Stock price data o these firms is analyzed by the same procedure as used above for Groups A and B. Average and average cumulative residuals for these 120 stocks fo 24 months around a hypothetical date of accounting change are presente in Table 5. Average cumulative residuals are also plotted in Figure 5a.

The pattern of cumulative residuals for Group C is in strong contrast t the pattern for Group A, though the two sample sizes are approximatel equal. During the 12 prechange months, the average abnormal price chang

[20] The following procedure was used to draw this sample from the C.R.S.P. File: (1 Look for first stock for which at least 48 months of data are available. Include it in th sample. (2) Skip 3 stocks. (3) Stop if 120 stocks have been selected. Otherwise go t Step 1.

The middle point of available time series for each stock included in this sample wa taken to be the hypothetical date of accounting change for the purpose of this analysis

TABLE 4

Analysis of Residuals in 24 Months Surrounding the Date of Accounting Change to Fifo: Group B

Sample size Month (1)	Group B all firms 22		Group B without textile industry 17		Group B without retail industry 17	
	$\bar{u}_t$ (2)	U_t (3)	$\bar{u}_t$ (4)	U_t (5)	$\bar{u}_t$ (6)	U_t (7)
−11	0.028	0.028	0.029	0.029	0.026	0.026
−10	0.000	0.029	0.002	0.031	0.005	0.031
−9	−0.015	0.013	−0.010	0.021	−0.024	0.007
−8	0.012	0.025	−0.015	0.006	0.022	0.030
−7	0.000	0.026	0.003	0.008	0.001	0.030
−6	0.012	0.038	−0.008	0.001	0.022	0.052
−5	0.004	0.042	−0.017	−0.017	0.010	0.062
−4	0.024	0.066	0.003	−0.014	0.032	0.095
−3	−0.040	0.027	−0.013	−0.027	−0.051	0.044
−2	0.002	0.029	0.001	−0.026	0.006	0.050
−1	−0.014	0.015	−0.013	−0.038	−0.010	0.040
0	−0.007	0.008	−0.001	−0.040	−0.003	0.037
1	−0.003	0.005	−0.005	−0.044	−0.009	0.028
2	0.006	0.012	0.010	−0.034	0.012	0.039
3	−0.001	0.011	0.006	−0.028	−0.003	0.036
4	−0.009	0.002	0.001	−0.027	−0.012	0.024
5	−0.027	−0.025	−0.010	−0.037	−0.036	−0.012
6	−0.012	−0.037	−0.006	−0.042	−0.010	−0.022
7	−0.010	−0.047	−0.018	−0.061	−0.010	−0.032
8	0.008	−0.040	−0.002	−0.063	0.010	−0.022
9	−0.015	−0.055	−0.008	−0.071	−0.024	−0.046
10	−0.029	−0.084	0.011	−0.060	−0.029	−0.075
11	−0.023	−0.107	−0.009	−0.069	−0.029	−0.104
12	0.002	−0.106	0.019	−0.050	−0.006	−0.110

$\bar{u}_t$ is average residual; see equation (7) for definition.
U_t is cumulative residual; see equation (8) for definition.
Due to round off errors, average residuals may not sum to cumulative residuals.

of stocks in Group C was higher by only 2.3% compared to 5.3% for Group A. During 12 months after the change, abnormal price change for Group C was −1.3%.

To provide a standard of comparison for Group B and subgroups of A, Group C was divided into five subgroups C1 through C5 of 24 stocks each by the same procedure as used for subdividing Group A. Patterns of average cumulative residuals for these five subgroups are shown in Figures 5b through 5f. The average residuals and average cumulative residuals are presented in the last ten columns of Table 5. As expected, no dominant pattern of price changes is observed in these figures. Note that Figures 5b and 5e for random samples C1 and C4 are quite similar to Figure 3 for Group B. This result supports the view that (a) the pattern of residuals observed for Group B can be obtained for a random group of stocks and is

TABLE 5

Analysis of Residuals in 24 Months Surrounding a Hypothetical Accounting Change for Group C

Sample size / Month (1)	Group C 120 $\bar{u}_t$ (2)	Group C 120 U_t (3)	Subgroup C1 24 $\bar{u}_t$ (4)	Subgroup C1 24 U_t (5)	Subgroup C2 24 $\bar{u}_t$ (6)	Subgroup C2 24 U_t (7)	Subgroup C3 24 $\bar{u}_t$ (8)	Subgroup C3 24 U_t (9)	Subgroup C4 24 $\bar{u}_t$ (10)	Subgroup C4 24 U_t (11)	Subgroup C5 24 $\bar{u}_t$ (12)	Subgroup C5 24 U_t (13)
−11	0.005	0.005	0.008	0.008	0.009	0.009	0.006	0.006	−0.010	−0.010	−0.006	−0.006
−10	0.009	0.014	0.023	0.031	−0.026	−0.017	0.003	0.009	−0.015	−0.025	0.012	0.006
−9	0.000	0.014	−0.004	0.027	0.004	−0.013	0.008	0.017	−0.024	−0.049	−0.002	0.004
−8	−0.008	0.006	−0.017	0.010	−0.012	−0.025	−0.034	−0.017	0.031	−0.019	0.032	0.036
−7	0.006	0.012	0.003	0.013	0.013	−0.012	−0.006	−0.023	0.001	−0.018	0.003	0.039
−6	−0.005	0.007	0.005	0.018	0.002	−0.010	0.000	−0.023	−0.028	−0.046	0.000	0.039
−5	0.003	0.010	−0.001	0.017	0.008	−0.002	0.003	−0.020	0.001	−0.035	0.004	0.043
−4	0.008	0.018	0.010	0.027	−0.002	−0.004	0.002	−0.018	−0.011	−0.047	0.017	0.060
−3	−0.008	0.010	0.008	0.035	−0.004	−0.008	−0.034	−0.052	−0.021	−0.067	−0.014	−0.046
−2	−0.009	0.001	−0.007	0.028	−0.008	−0.016	−0.024	−0.076	−0.019	−0.086	0.003	0.049
−1	0.017	0.018	−0.012	0.016	−0.006	−0.022	0.079	0.003	−0.018	−0.014	0.016	0.065
0	0.005	0.023	0.019	0.035	−0.008	−0.030	−0.006	−0.003	−0.042	−0.148	0.005	0.070
1	−0.008	0.015	0.009	0.044	−0.018	−0.048	−0.022	0.025	0.002	−0.144	0.009	0.079
2	0.003	0.018	0.005	0.049	0.017	−0.031	0.009	−0.016	0.007	−0.137	0.002	0.081
3	−0.001	0.017	−0.007	0.042	0.003	−0.028	−0.010	−0.026	0.033	−0.104	0.017	0.098
4	0.003	0.020	−0.021	0.021	0.000	−0.028	0.006	−0.020	−0.005	−0.110	0.027	0.125
5	0.008	0.028	0.001	0.022	0.000	−0.028	0.003	−0.017	−0.008	−0.117	0.022	0.147
6	0.000	0.028	−0.005	0.017	−0.014	−0.042	0.030	0.013	0.019	−0.098	−0.001	0.146
7	−0.009	0.019	−0.020	−0.003	−0.007	−0.049	−0.017	−0.004	−0.034	−0.132	0.014	0.160
8	−0.019	0.000	−0.014	−0.017	−0.012	−0.061	−0.022	−0.026	0.002	−0.130	−0.024	0.136
9	0.009	0.009	0.001	−0.016	0.000	−0.061	0.010	−0.016	0.012	−0.118	0.008	0.144
10	0.006	0.015	−0.001	−0.017	0.015	−0.046	0.005	−0.011	0.005	−0.113	0.002	0.146
11	−0.003	0.012	−0.020	−0.037	−0.010	−0.056	0.014	0.003	−0.011	−0.124	0.004	0.150
12	−0.002	0.010	−0.014	−0.050	0.010	−0.046	0.010	0.013	0.006	−0.118	−0.003	0.147

$\bar{u}_t$ is average residual; see equation (7) for definition.

U_t is cumulative residual; see equation (8) for definition.

Due to round off errors, cumulative residuals may not be exactly equal to sum of average residuals.

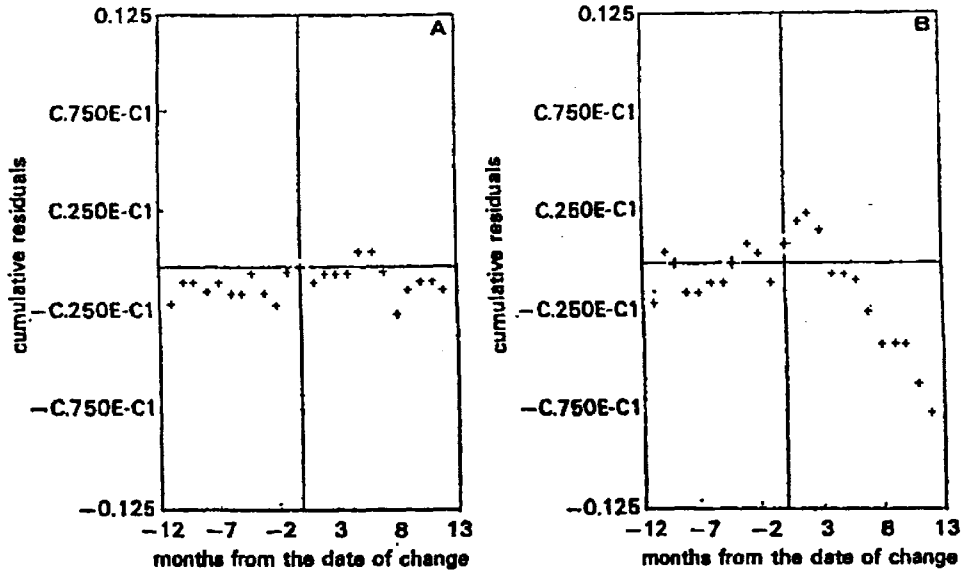

FIG. 5a. Cumulative Residuals for 24 Months Around the Date of a Hypothetical Accounting Change.

FIG. 5b. Cumulative Residuals for 24 Months Around the Date of a Hypothetical Accounting Change.

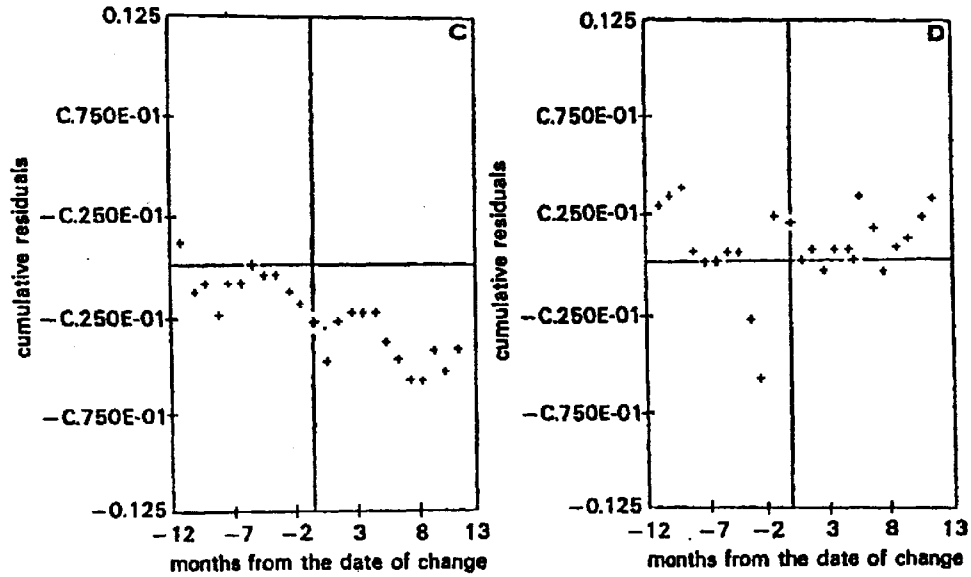

FIG. 5c. Cumulative Residuals for 24 Months Around the Date of a Hypothetical Accounting Change.

FIG. 5d. Cumulative Residuals for 24 Months Around the Date of a Hypothetical Accounting Change.

not statistically significant, (b) the sample size of Group B and subgroups A1 through A5 is too small to yield useful results and (c) the difference in the pattern of residuals obtained for Subgroup A1 from other subgroups of A need not be of much concern.

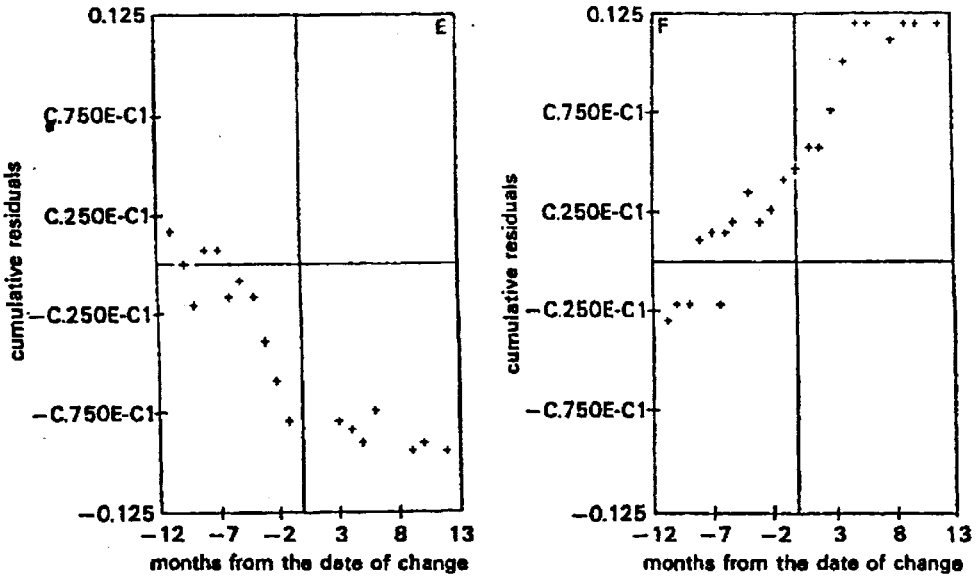

FIG. 5e. Cumulative Residuals for 24 Months Around the Date of a Hypothetical Accounting Change.

FIG. 5f. Cumulative Residuals for 24 Months Around the Date of a Hypothetical Accounting Change.

Industry effects. The analysis given above does not control for the industry effects. Since industry effects account for a relatively small fraction of the rate of return variance,[21] this would not be a serious problem if the industry wide distribution of firms in the sample was proportionate to the distribution of firms in the population.[22] As can be seen from the industry profiles given in Table 2a, this is not the case. Eighteen percent of all firms in Group A are from the steel industry. Textile and retail store industries account for 27 and 19 percent respectively of all firms in Group B. These proportions are much higher than the share of these industries in the population. This calls for appropriate control of industry effects before the results are interpreted.

One approach to control for industry effects is to include a rate of return index for the appropriate industry as a second explanatory variable in the regression equation (5). Estimated residuals thus obtained would be orthogonal to both the market and the industry indices. This procedure would be acceptable if the accounting changes in a given industry did not occur simultaneously. If all or most firms in an industry make an accounting change at the same time, any relationship which might exist between the accounting change and stock price behavior will be included in the

[21] King (1966) showed that the industry factor explains about 10 percent of the variation of stock returns on average.

[22] The population of firms from which the sample is drawn is the intersection of the firms listed on the New York Stock Exchange and the firms surveyed by the American Institute of CPAs for reporting in *Accounting Trends and Techniques*.

industry index and excluded from the estimated residuals. Since it is proposed to draw the inference from this relationship on the basis of estimated residuals, the inclusion of the industry indexes in the regression is not likely to be of much help in the presence of industry wide accounting changes. Unfortunately, in industries such as steel, which are heavily represented in the sample, accounting changes were fairly widespread and simultaneous.

Alternatively, each sample can be analyzed by excluding one overrepresented industry at a time. By comparing the results for such truncated samples with the results from the whole samples, an estimate of the importance of industry effect can be obtained. Columns 4 and 5 in Table 3 show the average and average cumulative residuals for 97 nonsteel firms of Group A. The average abnormal price change of nonsteel stocks in Group A was 2.3% during the 12 months immediately preceding the accounting change and −0.9% during the following 12 months. A comparison of these numbers with the corresponding numbers for all stocks of Group A in columns 2 and 3 of Table 3 indicates that the tendency towards an increase in price during the first 12 months is common to both the steel and the nonsteel stocks, though it is considerably stronger in the former and weaker in the latter. A separate analysis of 22 steel stocks in Group A indicates that their prices rose by 18.6% above the market during the first 12 months and fell by 2.5% in the next 12 months.

The sample size of Group B, which was already quite small, was further reduced by the exclusion of overrepresented industries. Results of analysis after excluding the textile and the retail store industries from the sample are given in columns 4 through 7 of Table 4 with the results for the whole sample in columns 2 and 3.

8. INTERPRETATION OF RESULTS

Group A. Average stock price of the firms which switched to Lifo experienced a steady abnormal increase over and above the expected covariation of these stocks with the market factor during the year preceding the accounting change. This increase was unlikely to have occurred by random noise in a sample of this size. During the 12 months following the accounting change there was no distinguishable abnormal price change.

For reasons explained in Section 5 the last date of the fiscal year during which the accounting change took effect has been used as the date of accounting change. Thus month 0 in the tables and figures represents the last month of the fiscal year of accounting change. The observed price behavior of Group A can be given more than one interpretation:

(a) If it is held that the information about the accounting change did not become available to the market before month 1, it can be inferred that the announcement of the accounting change, and associated tax deferment and understatement of earnings, did not have any effect on the market

prices on average. No abnormal price trend is observable in the 12 months following the end of the fiscal year.

(b) Though no data are available on the explicit public announcement of the firm's decision to make an accounting change to Lifo, it is possible that such decisions were taken sometime during the fiscal year and this information had leaked to the market. Abnormal price increases can thus be interpreted as the market's favorable response to the increase in the economic value of the firm arising out of tax deferment. This interpretation supports Hypothesis 1 given in Section 4.

(c) A third interpretation of the observed results can be given in terms of a selection bias in the sample of firms which changed to Lifo and in terms of the managements' motives to effect an accounting change. No attempt has been made in this study to examine the conditions and motives that may lie behind a management's decision to make a change in the method of inventory costing. Several studies have been made of management's motives. Income smoothing, housecleaning, rationalization, diversification and decentralization are a few of the suggested motives. Moore (1973) has suggested that accounting changes may be associated with changes in management. If income smoothing is the motive, management may decide to adopt Lifo at a time when earnings are increasing and to abandon it when the earnings are decreasing.[23] A housecleaning motive will lead to the opposite policy.

It is possible that the increase in stock prices during the first 12 months occurred because of good business prospects for these firms and an income smoothing motive led their managements to make a change to Lifo. Thus the association of stock price increase with accounting change may be spurious. The improved earnings of the firm caused a rise in stock price on the one hand and caused the management to make the accounting change on the other. Therefore, it is possible that Group A may contain a sample biased towards the firms with better earning prospects.

Ball and Brown (1968) have shown that changes in earnings of firms are anticipated by the market prices. If we had information about the dollar effect of accounting changes on earnings, we could have calculated the earnings that would have been reported had the accounting change not been made (adjusted earnings). Ball and Brown's effect associated with these adjusted earnings could then be subtracted from the observed abnormal price change of Section 7 to obtain the price change associated with the accounting change. Unfortunately, most firms in the sample did not disclose the dollar effect of their accounting change and this procedure could

[23] Since the Internal Revenue Service does not permit arbitrary changes in accounting for tax purposes, this policy instrument is not available for more than one application. However, in the sample of this study, 10 firms did have reversals. It could not be ascertained from the available information if these reversals were effective for tax purposes.

not be used to isolate the income effect from the effect of accounting change in this study.

Group B. The analysis yielded no significant stock price movements associated with accounting switches from Lifo to Fifo.

Implications for corporate decisions. It is well recognized that given inflation and stable or rising inventory the Lifo method of inventory costing leads to deferment of tax payments and therefore to an increase in the economic value of the firm. Two reasons have been advanced to explain why, given this advantage, most corporations have not adopted this method of accounting: (a) Since the Lifo method precludes the realization of inventory holding gains, the reported earnings under Lifo are generally lower than under Fifo or moving-average cost methods. Corporate managers are believed to be wary of reporting lower income because of its possible effect on the market price of their stock and consequently on their own job security and remuneration. (b) A second explanation has been that ex-post rate of inflation does not always reflect the expectation of inflation. Many corporations would have adopted Lifo had they expected that the prices would continue to rise after World War II. During the decade following the War, many businessmen expected price deflation and did not want to be left holding inflated inventory if the prices declined. Since the tax law provided that the users of Lifo could not use the "lower of cost or market" rule, such corporations would have been paying heavy taxes on extra income generated by the inflated inventories in times of price level decline.

Results of this study lend *no support* to the view that the market reacts adversely to the reduced earnings caused by adoption of Lifo. In fact the stock price of the corporations which adopted Lifo increased by about 5% over and above the market during the year in which the switch was made. It cannot be claimed that this price rise was *caused* by the accounting change because it is possible that the firms which made the accounting change might have been those which saw exceptionally good business prospects for themselves and therefore were not concerned about the adverse effect of the accounting change on their earnings. The observed results are consistent with both of the following hypotheses:

(a) Stock price of the firms which adopt Lifo increases on average because of the accompanying tax advantage.

(b) Managers of the firms whose business prospects look good are more likely to adopt Lifo than the others. Therefore the adoption of Lifo was accompanied by a rise in stock price of such firms. Change to Lifo was not the cause but a related effect of the same factors which led to the price rise.

In all likelihood both these hypotheses account for some part of the observed price changes. Kaplan and Roll (1972) in their study of investment credit and depreciation changes found that the firms which had not changed to the flow-through method of accounting for investment credit were doing better than the market on average. They also argued that the

firms which are doing well are less likely to switch back than those which are not doing so well. In any case there seems to be little reason why the managers should hesitate to adopt Lifo for fear of adversely affecting their stock price.

This study does not bear upon the second reason given above for the corporate reluctance to adopt Lifo—the prospects of deflation.

Implications for the financial reporting standards and investors. Determination of financial reporting standards is a much more complex issue than the corporate problem discussed above because the interests of a much larger and diverse set of groups must be considered in making such decisions. Investors, the interest group with which this study has been concerned, are only one, albeit important, of these groups. Other interested groups include the customers, suppliers, employees, government bodies and regulatory agencies and the general public. The study of investor behavior in this paper has been limited to the aggregate level, and the distribution of wealth effect of the accounting policy, if any, has been ignored. A sound recommendation on reporting practices will have to consider these other aspects of the problem. This study has the following implications which may be relevant to the policy on financial reporting:

(a) At the aggregate level at least, publication of an annual report which includes announcement of an accounting change to Lifo is not followed by an observable price movement on average. It is worth emphasizing that this statement applies only to the average price changes for a large number of firms and does not imply that the price of each firm moved in step with the market. It is also worth noting that the results observed refer to the market price as observed through completed transactions and no implications can be drawn from this study about the behavior of or effects on the individual investors. Whether some individuals are misled by a financial statement involving an accounting change is an important consideration for the policy makers and is not addressed in this study.

(b) Accounting change to Lifo is on average associated with an increase in the market price of stock of the firm and this increase precedes the end of the fiscal year during which the change occurred. This price rise can be given two different interpretations discussed in the previous section: (1) the price rise in the market and accounting change by management are two manifestations of a single cause—good health of the firm, and (2) the price rise is caused by a change to Lifo through the tax advantage accruing to the firm. If the second of these interpretations is true, a change to Lifo represents inside information until it is disclosed to the market and can be used by the insiders for private benefit. It is possible, and quite likely, that the decisions about the accounting change are not announced to the market immediately after they are made. The profit that can be made from such inside information is relatively small and is realized only on average in a large portfolio of such stocks.

Part III

9. ASSOCIATION BETWEEN ACCOUNTING CHANGES AND RELATIVE RISK CHANGES

In measuring the association between accounting changes and stock prices in Sections 6 and 7, it was assumed that the relative risk of the stocks under study remained unchanged over the period from which data were used; or at least that there were no significant changes as far as this measurement is concerned. There is little a priori reason or empirical evidence to support this assumption. In fact, some studies on tests of stability of relative risk indicate that it may be a changing parameter.[24] I shall exclude the general problem of changes in risk of stocks from the scope of this paper and concentrate on risk changes which might be systematically associated with changes in accounting procedures for inventory costing. The remainder of this paper is concerned with the possible reasons for the presence of such an association, its detection and measurement of its effect on the results given in Section 7. It is shown that in the presence of risk changes, results from the research design of Section 6 can be quite misleading.

From the investors' point of view risk of a stock relative to the market is its basic characteristic. Changes in the market's assessment of the risk of a stock may occur due to (a) change in the economic status of the firm represented by the stock with respect to its environment or (b) changes in the information system relating the firm to the investors. Ijiri, Jaedicke and Knight (1966) have specified conditions under which decision makers may change their decisions due to alterations in the information system. Beaver (1972) argued that each information system implies a set of equilibrium stock prices conditional upon the information system relating the business firms to the capital market. Financial statements, however, are only a part of this information system and it is difficult to argue that if the investors want to have certain types of information which the financial statements do not supply, they would not be able to obtain it through other sources. Therefore, I shall ignore changes in the information system per se as a cause of change in risk and concentrate on analyzing the economic impact of Lifo and its association with risk changes.

Effect of Lifo on relative risk of the firm. As discussed in Section 4, inflation results in higher realized inventory holding gains and tax liability for the firms using Fifo. These firms have to pay taxes on a part of their liquidated equity. Firms using Lifo (relative to other firms) will benefit from higher rates of inflation because higher amounts of their inventory profits will not be realized and go untaxed. Compared to Fifo, the real return on the capital of a firm when it is using Lifo is higher in inflationary times, and other things being equal, this difference is greater for higher

[24] Fisher (1971), Bogue (1972).

rates of inflation. On this basis, it can be argued that compared to other business firms, the firms using Lifo have higher returns on their capital under inflation.

The effect of unexpected inflation on businesses has been controversial.[25] These effects are ascribed to the lag of costs and wages behind the price of a firm's products and the debtor-creditor status of the firm. If wage changes lag behind price-level changes, unexpected inflation would bring extra profits to business firms. The evidence for the wage lag hypothesis from various empirical studies has not been conclusive. But it is generally accepted that a wealth transfer from creditors to debtors takes place during unexpected inflation.

Given that the New York Stock Exchange firms are net debtors and therefore get higher returns in times of unexpected inflation and that the firms which use Lifo have an extra edge over those which do not, covariability of returns on stocks of firms with the market index will be higher when firms use Lifo as compared to when they use Fifo. Since the ratio of covariance with the market factor to the variance of the market factor is defined as relative risk of a firm, a change to Lifo will be accompanied by an increase in the relative risk. Similarly, a decrease in relative risk will accompany a change from Lifo to Fifo.

Debt equity ratio. As discussed in Section 4, a change in the method of accounting for inventory may cause a change in the stock price of the firm. Empirical measurements in Section 7 indicated that the changes to Lifo were accompanied by an increase in the market value of the owners' equity and the changes to Fifo were accompanied by a decrease in this value. Since the book values of debts and other liabilities specified in nominal terms remain unchanged during inflation, accounting changes will be accompanied by changes in debt equity ratio of the firms. This ratio will decrease with a change to Lifo and increase with a change to Fifo. Since relative risk is a linear function of debt equity ratio, we should expect the relative risk of the firms changing to Lifo to decrease and to increase for the firms changing to Fifo.

Speculatory inventory policies. It has been assumed so far that management policies remain unaffected by the accounting change. This assumption may not hold in certain circumstances. The Lifo method is usually applied to year-end inventories. Since very low year-end inventories may lead to loss of a low-priced Lifo base, realization of substantial inventory profits and creation of additional tax liability on these profits, firms with a very old Lifo base may attempt to maintain level year-end inventories. In certain industries in which inventory prices are subject to seasonal or speculative changes, these accounting changes are almost certain to affect the inventory policies, primarily because of their tax implications. Such changes in the management policy may affect the riskiness of the firm but

the direction and extent of this effect are hard to specify from prior consideration alone.

Measurement of changes in average relative risk. To measure changes in relative risk at the time of the accounting changes, relative risk of each stock in the sample is estimated before and after the accounting change. Twelve months of data from either side of the accounting change are excluded from these estimates because the expectation of abnormal residuals during this period is likely to bias the estimates. Prechange estimates of the relative risk of each stock are made from OLS regression (1):

$$R_{jt} = \alpha_j + \beta_j R_{mt} + u_{jt}, \qquad t = -71, \cdots -12 \quad (1)$$

where all terms are the same as defined earlier in Section 6 and $t = 0$ is the month of accounting change for jth firm. Up to 60 months of data are used in these regressions. Firms for which at least 24 months of data are not available are excluded from the analysis. Summary statistics of these estimates for each group are given in Table 6 under column heading Regression 2. Corresponding summary statistics from estimates computed in Section 6 from pooled data before and after the accounting change are given under the heading Regression 1.

A similar set of estimates of relative risk is made from 60 months of post-change data, i.e. $(12 < t \leqslant 72)$ is the range of data used. Summary statistics for this set of estimates are given under Regression 3 in Table 6. The last part of this table shows the differences between pre- and post-change estimates. Since only those firms are included in this analysis for which at least 24 months of data are available, for both regression sets 2 and 3, the sample size is reduced to 115 for Group A and 14 for Group B. Control Group C comprises 120 firms randomly selected from C.R.S.P. tape. A description of the selection procedure is given in Section 6.

Table 6 indicates that the cross-sectional mean of relative risk of Group A firms (which made an accounting change to Lifo) increased by 0.102 between prechange and postchange periods. The t-statistic of this change is 4.1 which appears to be quite significant.[26] The cross-sectional median of relative risk of Group A firms also increased by a comparable amount of 0.13. Cross-sectional median of changes in relative risk of individual firms between these periods was 0.11. These order statistics support the view that the observed increase in the relative risk of Group A firms represents

[26] Though this statistic is being called a t-statistic because it is a ratio of an estimate to its estimated standard error, it may not have a Student t distribution and a measure of care is called for in its interpretation for two reasons: (a) stock price returns are believed to have non-gaussian fat-tailed distributions; the ratio of estimated coefficient to its standard error of estimation in a linear model has a Student t distribution only when the error terms are gaussian, (b) the standard error of estimation is biased downwards when coefficients are not stationary. If the risk coefficient is changing, as has been suggested in this chapter and tested in Chapter VI, the t-statistic is

TABLE 6

Changes in Risk Coefficients after the Accounting Change

	Regression 1[a]			Regression 2[b]			Regression 3[c]			Difference between regressions 2 and 3				
	$\bar{\beta}$	$\sigma_{\bar{\beta}}$	$\hat{\beta}_m$	$\bar{\beta}$	$\hat{\sigma}_{\bar{\beta}}$	$\hat{\beta}_m$	$\bar{\beta}$	$\hat{\sigma}_{\bar{\beta}}$	$\hat{\beta}_m$	$\Delta\bar{\beta}$	$\hat{\sigma}_{\Delta\bar{\beta}}$	T	$\Delta\hat{\beta}_m$	$(\Delta\hat{\beta})_m$
Group A	1.030	.0017	1.05	1.012	.015	0.99	1.114	.020	1.12	+.102	.025	4.1	+.13	+.11
Group B	.901	.0385	.865	.971	.0518	.965	.839	.0615	.75	−.132	.0804	−1.64	−.215	−.045
Control Group C	.987	.019	.99	.959	.034	.92	.99	.026	.93	+.03	.043	0.7	+.01	−.01

12 months on either side of change excluded from all regressions

$\bar{\beta}$ = cross sectional mean of individually estimated $\hat{\beta}$

$\hat{\sigma}_{\bar{\beta}} = \frac{1}{N}\left[\sum_{\text{Group A or B}} (\hat{\sigma}_{\hat{\beta}_j}^2)\right]^{1/2}$, N = number of companies in the group

$\hat{\beta}_m$ = median of individually estimated $\hat{\beta}$

$\Delta\bar{\beta} = (\bar{\beta})_2 - (\bar{\beta})_1$

$\hat{\sigma}_{\Delta\bar{\beta}} = \hat{\sigma}_{\bar{\beta}_1}^2 + \hat{\sigma}_{\bar{\beta}_2}^2$

$T = \Delta\bar{\beta}/\hat{\sigma}_{\Delta\bar{\beta}}$

$\Delta\hat{\beta}_m = (\hat{\beta}_m)_2 - (\hat{\beta}_m)_1$ = change in median of $\hat{\beta}$

$(\Delta\hat{\beta})_m$ = median of changes in risk coefficients of individual stocks.

[a] Regression 1 used 120 months of data (60 months on either side of change date).

[b] Regression 2 used 60 months of data before the change.

[c] Regression 3 used 60 months of data after the change.

a general tendency of the sample and does not arise from a few large changes.

For Group B firms (which made an accounting change to Fifo) changes in cross-sectional mean and median of estimated relative risk were −0.132 and −0.215 respectively. The t-statistic of mean change was −1.64. Though this change is less significant than the change for Group A firms, it is worth noting that the risk of these firms decreased after the accounting change. The median of changes in relative risk of individual firms was −0.045. For Group B as for Group A, order statistics confirm that changes in mean reflect the general tendencies of the respective samples.

The summary statistics for Group C are strikingly different from those for Groups A and B. Even though the sample size of Group C is comparable to the sample size of Group A, the average change in risk of these firms is only 0.03 with t-statistic of 0.7. The change in cross-sectional median and cross-sectional median of individual changes in relative risk of these firms are +0.01 and −0.01 respectively. The lack of significance of these changes lends further support to the view that the accounting changes to and from Lifo were accompanied by changes in the relative risk of the firms in Groups A and B.

Table 7 shows the results of the application of the χ^2 test on pre- and post-change distributions of estimated relative risk of Group A firms. The χ^2 statistic with 11 degrees of freedom is 23.8. Since $\chi^2_{11,0.95} = 19.67$ and $\chi^2_{11,0.90} = 24.72$, there appears to be a significant shift to the right in the distribution of relative risk of firms in this group. There is less than 5% chance that χ^2 statistic could be so large when in fact there was no difference in the distribution of the two populations. Though about one-half of the magnitude of this χ^2 statistic arises out of the last of the 12 intervals of Table 7, it is noteworthy that the frequency changes on each of the first six intervals are nonpositive followed by nonnegative frequency changes in each of the

TABLE 7

Comparison of Distribution of Risk Coefficients before and after the Accounting Change: Group A

$\bar{\beta}$ range (less than)	.51	.65	.75	.86	.95	1.01	1.09	1.17	1.28	1.39	1.58	2.27	Total
f_1 Frequency before change-regression 2	10	10	10	10	10	10	10	10	10	10	10	5	115
f_2 Frequency after change-regression 3	10	6	5	6	7	7	13	13	11	10	14	13	115
$f_2 - f_1$ Difference in frequencies	0	−4	−5	−4	−3	−3	+3	+3	+1	0	+4	+8	0

$$\sum \frac{(f_2 - f_1)^2}{f_1} = 23.8.$$

last six intervals. This observation further supports the inference of a rightward shift in the distribution of relative risk. The sample size of Group B is too small to conduct a similar test of significance on changes in relative risk.

10. EFFECT OF CHANGES IN RELATIVE RISK ON MEASUREMENT OF ABNORMAL PRICE CHANGES

The tests conducted in Section 9 create a reasonable doubt about the appropriateness of the assumption that the accounting changes under study here are not accompanied by changes in relative risk. The research design used in Section 7 does not allow for the possibility of such changes. It can be shown that the estimates of abnormal price changes can be quite misleading if changes in relative risk are large enough and are not accounted for in the model.

Let β_{j1} and β_{j2} be the relative risk of a firm before and after change to the Lifo method respectively. Let $\hat{\beta}_j$ be the ordinary least square estimate of risk coefficient from T observations before and T observations after the accounting change. The market model can be written as

$$R_{jt} = \alpha_j + \beta_j R_{mt} + u_{jt}, \qquad t = -T + 1, \cdots T \quad (1)$$

where

$$\beta_j = \begin{cases} \beta_{j1} & \text{for } t \leq 0 \\ \beta_{j2} & \text{for } t > 0. \end{cases}$$

The expected value of estimate $\hat{\beta}_j$ lies between β_{j1} and β_{j2}. Abnormal price changes or residuals are estimated from equation (2):

$$\hat{u}_{jt} = R_{jt} - \hat{\alpha}_j - \hat{\beta}_j R_{mt}. \quad (2)$$

Since estimated risk $\hat{\beta}_j$ is not an unbiased estimate of the relative risk of the firm either before or after the accounting change, estimated residuals $\hat{u}_{jt}$ also are biased.

$$E(\hat{u}_{jt}) = \begin{cases} R_{mt}(\beta_1 - E\hat{\beta}_j) & \text{for } t \leq 0 \\ R_{mt}(\beta_2 - E\hat{\beta}_j) & \text{for } t > 0. \end{cases} \quad (3)$$

Expected value of estimated residuals is nonzero for nonzero values of the market factor R_{mt}. When R_{mt} is positive, the prechange residuals are positively biased if $\beta_{j1} > \beta_{j2}$ and negatively biased if $\beta_{j1} < \beta_{j2}$. The opposite is true for postchange residuals. Since the mean value of the market factor R_{mt} is positive, the above statements about the residual bias for positive values of R_{mt} are also true for all values of R_{mt} on average. If an accounting change is accompanied by a discrete shift in relative risk and if no abnormal residuals actually exist, data analysis by the research design given in Section 6 will result in a pattern of cumulative residuals shown in figure 6. Some serious deficiencies of this research design can now be pointed out:

(a) Such analysis may indicate abnormal price changes when in fact none exist.

(b) Even when abnormal price changes are present, this analysis may not be able to detect them due to the presence of changes in relative risk.

(c) In the presence of risk changes, estimated abnormal returns on stocks are dependent on the time series data used for estimation of relative risk; and to the extent that this choice is made arbitrarily, estimated abnormal performance also is arbitrary. The extent of changes in the abnormal performance estimated in Section 7 due to arbitrary selection of time series is shown in the following analysis.

The cumulative residuals estimated from three different sets of regressions for Groups A and B are shown in Table 8. Rows a, b and c of this table give the cumulative residuals estimated from pooled, prechange and postchange regression estimates respectively. Starting 12 months before the accounting change, columns 2 and 3 show the cumulative residuals at the month of change and 12 months after the change respectively. Average abnormal price change for Group A stocks during the 12 months immediately preceding the accounting change is 5.3% from pooled regression estimates. This changes to 7.5% if the prechange estimates of relative risk

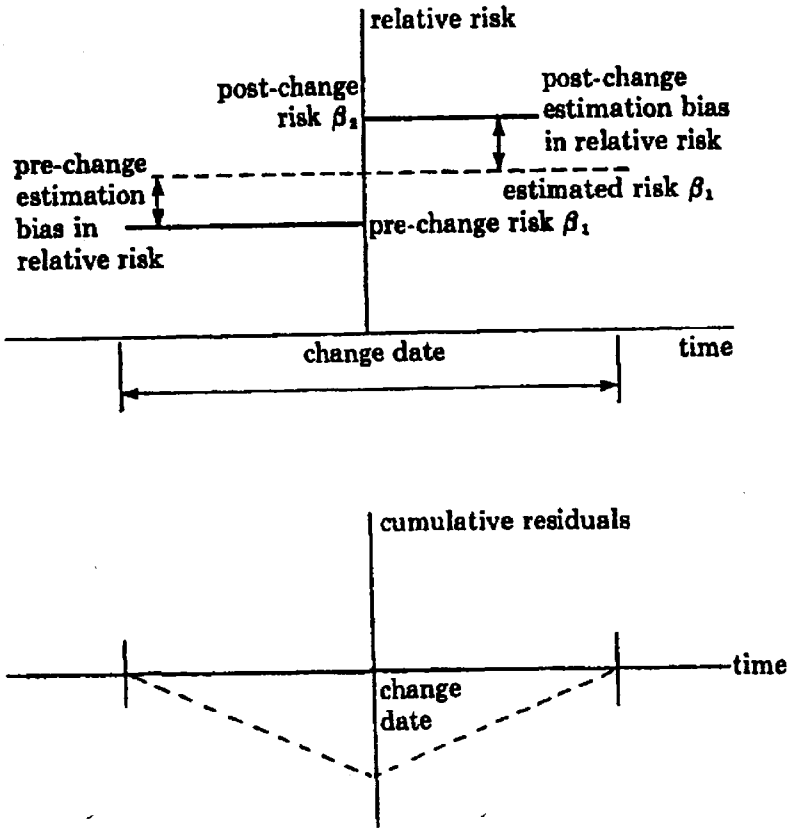

FIG. 6. Estimation Bias in Relative Risk and Residuals when Accounting Change is Accompanied by a Change in Relative Risk.

TABLE 8

Cumulative Residuals Using Different Estimates of Risk

		12 months before change	0 months before change	12 months after change
Group A	a	0.00	0.053	0.042
	b	0.00	0.075	0.082
	c	0.00	0.033	0.010
	d	0.00	0.075	0.052
Group B	a	0.00	0.008	−0.105
	b	0.00	−.005	−.147
	c	0.00	.025	.038
	d	0.00	−.005	.008

a = pooled estimates of risk
b = prechange risk estimates
c = postchange risk estimates
d = prechange estimate used for prechange residuals and postchange estimate used for postchange residuals.

are used and to 3.3% if the postchange estimates are used. Estimates of abnormal price change during the two-year period ending 12 months after the accounting change also show similar dependence on the choice of data from which relative risk is estimated. The second part of the table for Group B also shows heavy dependence of cumulative residuals on the choice of regression set.

It can be argued that in the presence of risk changes, the abnormal performance should be measured by using prechange estimates of risk for prechange residuals and postchange estimates for postchange residuals. The cumulative residuals computed by this method are given in row d of table 8 for both groups. For Group A stocks, there was an abnormal price increase of 7.5% during the 12 months immediately preceding the accounting change followed by a decline of 2.3% during the next 12 months. For Group B stocks, a 0.5% abnormal decline in prices during the 12 prechange months was followed by a 1.3% rise in the 12 postchange months on an average.

It can be seen from these results that the estimates of abnormal price changes are quite sensitive to the estimates of relative risk which may differ considerably over different periods of time even for a large portfolio of 115 stocks. Thus the estimates of abnormal price changes are dependent on time series data used for estimation of relative risk. In the absence of an understanding of the relationship between accounting changes and risk changes, selection of time series data for estimation of risk is quite arbitrary and results obtained from such a research design are of doubtful value.

These findings imply that further research is needed in the following areas:

(a) A statistical test to detect changes in relative risk

(b) Estimators of relative risk in an unstable environment

(c) A research design in which measurement of abnormal price changes takes into account the possibility of risk changes

(d) A research design to study the association between accounting changes and changes in relative risk of firms.

I shall briefly outline the research now in progress in these areas.[27]

(a) Ordinary least squares estimates of relative risk over adjacent segments of time series have been used in the literature (and in Section 9 of this paper) for testing the stability of this parameter. Since OLS estimates are inefficient in the presence of parameter instability, such tests are inadequate. Random coefficient models are being used for directly testing the hypotheses of parameter stability. These procedures do not need an estimate of relative risk to conduct the tests.

(b) Ball (1972) recognized the problem of instability of relative risk and used OLS regression estimates over a moving time series for each month. For example, he estimated risk of a stock in month n from OLS regression over 101 observations from month $(n - 50)$ to $(n + 50)$. Since this procedure gives equal weight to all observations, it is not efficient for estimating risk in a changing environment. Rosenberg (1968), Fisher (1971) and Cooley and Prescott (1972) have proposed estimation procedures which are shown to be optimal in an unstable environment. Some of these estimators are being used to estimate the time path of relative risk of each firm.

(c) Abnormal price changes are measured by using an estimate of relative risk for each month obtained from the procedures mentioned above. These estimates of price change are not only free of the market factor but also of the effect of changes in relative risk.

(d) The cross-sectional average of estimated relative risk of firms for each of the 24 months around the date of accounting change is calculated. Hypotheses about the relationship between accounting and risk changes (discussed in Section 9) can be tested from these estimates.

11. SUMMARY

Information about the relationship between alternative accounting procedures for financial reporting and investor behavior is important to three different groups of decision makers—financial accounting policy makers, corporate managers and investors. This paper presents a study of this relationship for accounting changes to and from the Lifo method of inventory costing. Studies of this relationship at the individual level in an experimental environment have the advantage of being able to test hypotheses about the existence of manipulative causality. But because of the absence of competing investors and sources of information in such an environment, the results from such studies are hard to generalize. Valuation

[27] See Sunder (1973).

theory models for studying this relationship at the market level have the disadvantage of being dominated by the scale factor and do not measure the association between *changes*. These models consider the pricing of each stock as an isolated problem. Another approach to the study of this relationship is to estimate the abnormal price changes associated with the accounting changes via the market model and a stationarity assumption about the risk of stocks.

Given an inflationary environment and a few other assumptions, the adoption of Lifo results in reduced earnings and increased economic value of the firm. The opposite is true for the firms which give up Lifo in favor of Fifo or the moving average method.

Measurement of abnormal price changes indicated that on average, stock price of the firms which changed to Lifo increased over the 12-month period immediately preceding the end of the fiscal year during which the change was made. This observation can be given two interpretations: (a) increase in price was the effect of accounting changes and (b) price rise merely reflected the good business prospects of the firm which, in turn, motivated management to bring about the accounting change. Lack of availability of data on the dollar effect of the accounting changes in most cases did not permit identification between these two cases.

When steel firms, which constituted 19% of the sample, are excluded from analysis, the abnormal price increase becomes much smaller. The results still support the hypothesis that price changes follow the changes in the economic value of the firm against the alternative hypothesis that they follow the changes in reported earnings.

As the sample of firms which abandoned Lifo is very small, no significant results could be obtained from its analysis.

Since no evidence could be found to support the view that the reduction in the reported earnings of a firm which accompanies a switch to Lifo method is viewed by the stock market as a sign of adverse performance on the part of the corporation, corporate managements need not hesitate to adopt Lifo for fear of such adverse reaction.

The study has two implications of interest to policy makers for financial accounting standards and investors: (a) the *announcement* of earnings report which includes an accounting change to Lifo does not *cause* any change in the price of the stock on average and (b) if the price rise observed in the year preceding the adoption of Lifo was caused by the accounting change, the possibility of the insiders making an unusual though small profit on the basis of this information exists. However, it could not be established if the observed price rise was caused by the accounting change, though it was accompanied by it.

The research design used in this study assumes that the relative risk of firms does not change. This parameter can, however, change for various reasons. Preliminary measurements indicate that the relative risk of firms which switched to Lifo increased after the accounting change. It can be

shown that changes in risk make the abnormal price changes measured by this design quite arbitrary. Research to develop estimates of relative risk and abnormal price changes when relative risk is unstable is now in progress.

APPENDIX A

GROUP A

A.V.C. Corp.
Allegheny Ludlum Steel Corp.
Allegheny Ludlum Steel Corp.
Allegheny Ludlum Steel Corp.
Allis Chalmers Manufacturing Co.
Alpha Portland Cement
Dixie Cup Co.
Marathon Corp.
American Can Co.
Climax Molybdenum Co.
American Metal Products Co.
American Standard Corp.
Armco Steel Corp.
Armco Steel Corp.
Armour & Co.
Armour & Co.
Arnold Constable Corp.
Associated Dry Goods Corp.
Barker Bros. Corp.
Bethlehem Steel Corp.
Borden, Inc.
Borden, Inc.
Briggs Manufacturing Co.
Kinney G. R. & Co., Inc.
Budd Co.
Pacific Mills
California Packing Corp.
Calumet & Hecla Inc.
J. I. Case Co.
Caterpillar Tractor Co.
Consolidated Copper Mines Corp.
Champion Papers, Inc.
Chrysler Corp.
Collins and Aikman Co.
C. F. and I. Steel Corp.
Continental Can Co., Inc.
Continental Steel Corp.
Crown Cork & Seal Co., Inc.
Crown Cork & Seal Co., Inc.
Crucible Steel Corp.
Crucible Steel Corp.
Cyclops Corp.
Deere & Co., Del.
Diamond International Corp.
Eastern Stainless Steel Corp.
Eastman Kodak
Electric Auto Lite
Firestone Tire & Rubber Co.
First National Stores Inc.
General Electric Co.
General Electric Co.
Gimbel Brothers Inc.
Goodrich, B. F.
Goodrich, B. F.
Goodyear Tire Rubber
Grant, W. T.
Hercules Motors Corp.
Hercules Inc.
Hershey Foods
Cletrac Corp.
Hunt Foods & Industries Inc.
Indian Head Inc.
Inland Steel Co.
Interchemical Corp.
Interchemical Corp.
International Silver Co.
International Silver Co.
International Silver Co.
Johns Manville Corp.
Jones & Laughlin Steel Corp.
Joy Manufacturing Co.
Kroger Co.
Lambert Co.
Lehigh Portland Cement Co.
Lukins Steel
R. H. Macy and Co., Inc.
May Department Stores
McCall Corp.
Mead Corp.
Mead Corp.
Melville Shoe Corp.
Continental Oil Co.
National Biscuit
National Cash Register Co.
Bridgeport Brass
National Gypsum Co.
National Lead Co.
Nautec Corp.
Pan American Petroleum and Transport Co.

APPENDIX A (cont'd)

Penn Dixie Cement Corp.
Phelps Dodge
PPG Industries, Inc.
Pullman, Inc.
Reliance Electric Engineering
Republic Steel Corp.
Reynolds Metals
Reynolds Tobacco
Schlumberger, Ltd.
Scott Paper
Screw and Bolt Corp. of America
Sharon Steel Corp.
Sharon Steel Corp.
Mobil Oil Corp.
Sperry-Rand Corp.
Square D, Co.
Standard Brands
Beech Nut Life Savers Inc.
Stokely Van Camp Inc.
Swift & Co.
Textron Inc.
Tidewater Oil Co.
Union Camp Corp.
Union Camp Corp.
U. S. Steel
Union Chemical & Materials Corp.
Westinghouse Electric Corp.
Wheeling Steel
Wheeling Steel
Youngstown Sheet and Tube Co.
*Brown & Sharpe Mfg. Co.
*Cities Service Co.
*Copper Range Co.
*Cosden Petroleum Corp.
*Derby Oil Co.
*Medusa Portland Cement
*Reliance Electric Engineering
*Signode Corp.
*A. E. Staley Mfg. Co.
*Time Inc.

GROUP B

Associated Dry Goods Corp.
Barker Bros. Corp.
Basic Inc.
Belding Heminway Co.
Briggs Manufacturing Co.
Pacific Mills
Calumet & Hecla Inc.
Emhart Corp.
Goodrich, B. F.
Goodyear Tire Rubber
Graniteville Co.
*Indian Head Inc.
*Kellogg Co.
Grant, W. T.
Wesson Oil Snowdrift
Hupp Corp.
Johnson & Johnson
Libby McNeill and Libby
Maytag Co.
Melville Shoe Corp.
Melville Shoe Corp.
Trans United Industries Inc.
Trans United Industries Inc.
Wheeling Steel
*Kendall Co.
*Sherwin Williams Co.

APPENDIX B

American La France Foamite Corp.
Amp Incorporated
Abitibi Power and Paper
Addressograph-Multigraph
Affiliated Gas Equipment
Pittsburgh Metallurgical
Alabama Gas Corp.
Allegheny Ludlum Steel Corporation
Allied Albany Paper Corp.
Allied Products Corp.
Allis Chalmers Manufacturing Co.
Aluminum Co. of America
Amerada Petroleum Corp.
American Bakeries Co.
American Broadcasting Co.
American Can Co.
American Colortype Co.
American Crystal Sugar Co.
Truax Traer Coal
American Enka Corp.
American & Foreign Power
American Home Products
Adams Express
American Metal Climax, Inc.

* These companies were not included in analysis because data available for these firms were

APPENDIX B (cont'd)

Kelvinator Corp.
American Optimal Co.
Mullins Manufacturing Co.
American Republics Corp.
American Ship & Commerce Corp.
American & South African Investment Ltd.
American Telephone & Telegraph
American Tobacco Co. (Com.)
Ametek, Inc.
Amsted Industries, Inc.
Chile Copper Company
Anderson Clayton
Apco Oil Corp.
Arlan's Dept. Stores Inc.
Armco Steel Corp.
Armstrong Cork Co.
Art Metal Construction Co.
Ashland Oil & Refining Co.
Stix, Baer and Fuller Co.
Associated Investment
Atlantic Coast Line R. R.
Atlas Chemical Industries, Inc.
Atlas Corp.
Austin Nicholas
Canteen Corporation
Crosley Corporation
Avon Products Inc.
Baker Oil Tools, Inc.
Baltimore & Ohio RR
Barber Oil Corp.
Bates Manufacturing Co.
Bayuk Cigard
Beatrice Foods Co.
Beech Aircraft
Bell & Howell Co.
Bendix Corp.
Berman Leasing Co.
Best Foods Inc.
Birmingham Electric Co.
Bliss & Laughlin Inc.
Twin Industries Corp.
Bond Stores
Smith Douglass
Borg Warner Corp.
Bower Roller Bearing Co.
Briggs & Stratton
Brooklyn and Queens Transit Co.
KVP Sutherland Paper Co.
Brown Shoe Co., Inc.
Buckingham Corp.
Haveg Industries
Bullard Co.
Pacific Mills
Burndy Corp.
Butte and Superior Mining Co.
C.I.T. Financial
California Financial Corp.
Calumet & Hecla Inc.
Canadian Breweries Ltd.
Carborundum Co.
Carolina Telephone and Telegraph Co.
Carriers & General Corp.
Caterpillar Tractor Co.
Celanese Corp.
Central Foundry
Central Ill. Public Service Co.
Central Southwest Corp.
Consolidated Coppermines Corp.
Bestwall Gypsum Co.
Champion Papers, Inc.
Checker Motors Corp.
Chesapeake Corp. Va.
Chicago & Eastern Illinois R.R.
Chicago, Milwaukee, St. Paul
Chicago Rock Island & Pa.
Chicago Yellow Cab Co.
Chrysler Corp.
Citadel Industries, Inc.
Cities Service Co.
City Stores Co.
Cleveland Electric Illuminating Co.
Cluett, Peabody & Co., Inc.
Coca Cola
C. F. and I. Steel Corp.
Colt Industries Inc.
Columbia Gas System Inc.
Commercial Credit Co.
Conde Nast Publications
Conley Tin Foil Corp.
Consolidated Edison Co. of New York
Consolidated Laundries Corp.
Mengel Co.
Hazel Atlas Glass Co.
Fidelity-Phenix Fire Ins.
Continental Steel Corp.
Cooper Industries

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