An Empirical Evaluation of the Predictive Power of Purchase-Pooling Accounting Numbers.

Benjamin Edward Clark

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AN EMPIRICAL EVALUATION OF THE PREDICTIVE
POWER OF PURCHASE-POOLING
ACCOUNTING NUMBERS

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Accounting

by

Benjamin Edward Clark
M.B.A., Louisiana State University, 1950
December, 1973
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B. E. C.

Bolivar, Missouri
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ABSTRACT

In recent years one of the more controversial alternatives in accounting appears to have been the purchase-pooling choice in accounting for business combinations.

This study attempts to evaluate these alternatives in the context of "usefulness to investors." Impetus for this research was provided by recent developments in capital market theory spearheaded by Markowitz, Sharpe, Fama, Lintner, Jensen, Beaver, and others. Their research into the behavior of security prices has led to the development of the operational test of usefulness applied in this investigation. The individual security performance measure thus developed reflects adjustments for the individual risk faced by the firm as well as market wide effects.

Using the predictive ability criterion, this empirical study assesses the relative association ($r^2$) of multivariate sets of purchase-pooling accounting numbers with the risk-adjusted performance measure described in the preceding paragraph.

Matched samples (purchasing and pooling) were selected from companies listed on the New York Stock Exchange using SIC classifications and asset size as
matching criteria. To qualify for either sample, a firm must have engaged in one or more combinations during the period 1968-1971. In addition the firm must have used principally either the purchase or pooling method in all such combining activity engaged in during the study period. Thus the samples have a distinct pooling or purchase "character."

The independent variables were limited to eleven accounting numbers classified primarily as either profitability, margin, return or turnover measures. Emphasis was also given to accounting numbers which would likely differ depending upon the accounting method chosen for the combination.

The test results substantiate the hypothesis that purchase accounting numbers are more closely associated with a firm's stock market performance than are accounting numbers from firms using principally the pooling method in accounting for business combinations. This conclusion is based on the fact that approximately 70 per cent of the statistically significant cases favored the purchase sample. However, the fact that pooling was favored in 30 per cent of the comparable cases would tend to justify, at least to some extent, the existence of both alternatives.

The results of this study should encourage other investigations of alternative methods using the predictive ability criterion in a decision oriented context. The
writer believes this study will give direction to other similar investigations which can lead to further refinement and testing of the research methodology utilized.
CHAPTER I

THE PURCHASE-POOLING CONTROVERSY

In the decade of the 1960's one highlight of the American business scene was the increased amount of business combination activity. According to one economist:

Many combinations have been encouraged as companies sought to increase earnings per share. In some instances this objective has been facilitated by the tax laws through debt-equity switching or the acquisition of companies with a tax loss carry forward, while in others it has been sought through the economies that could be effected. However, reported earnings also have been increased in some cases by the accounting methods used to record the transaction.¹

This latter observation refers directly to the two alternative methods of accounting for business combinations, namely, the purchase and pooling methods.

The Nature of the Problem

From its research study on accounting for business combinations, the Accounting Principles Board (APB) of the American Institute of Certified Public Accountants (AICPA) asserted that "the accounting treatment of a combination may affect significantly the reported financial position and net income of the combined corporation for prior,

current, and future periods."^2

Specifically, important accounting numbers such as net income, earnings per share and numerous financial ratios are affected by the choice between purchase and pooling methods because:

1. Historical cost continues as the basis of accountability in a pooling as the book figures of each of the combining companies are simply added together for the entire period in which the combination occurs. However, in purchase accounting the resulting combination reflects the actual cost of the acquired assets less any liabilities assumed and gives rise to new accounting data consisting of a mixture of historical costs and current values from the date of acquisition.

2. In a purchase the newly recorded current values may give rise to higher depreciation charges in subsequent years than would have resulted had the companies continued separately or combined as a pooling.

3. Goodwill, if any, arising from a purchase transaction must now be amortized to expense over some period of time up to forty years.^3

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Thus it is possible that the financial statements of a newly combined company may convey different meanings to financial statement users depending on the accounting method chosen. This conclusion is supported by the recent comment of security analyst B. Richard Wakefield. Speaking about the Accounting Principles Board's recent pronouncements (Opinions 16 and 17) on accounting for business combinations, he noted that:

The adoption of the proposed changes will seriously impair any attempt by the individual investor to appraise the earnings potential and therefore the value of any security where the company has previously been involved in a business combination.4

Such a conclusion points up an apparent inconsistency of accounting practice with the basic objective of accounting as defined by a committee of the American Accounting Association in A Statement of Basic Accounting Theory (ASOBAT). In that monograph usefulness to decision makers clearly emerged as the single most important purpose of accounting. More specifically, ASOBAT defined accounting as "the process of identifying, measuring, and communicating economic information to permit informed judgments and decisions by users of the information."5 Thus facilitating decision making is the criterion for settling the purchase-


pooling and other accounting alternative arguments.

Immediately, however, we encounter the fact that general decision models of investors are as yet precisely undefined. True, we know many of the individual acts performed by managers and investors leading to decisions (such as statement analyses, trend analyses, industry studies, etc.), but as Beaver, Kennelly and Voss point out:

Most business decisions currently are not made within the framework of a formally specified decision model. That is, in most decision-making situations, no model is available with which to evaluate alternative accounting measurements.⁶

Beaver, Kennelly, and Voss then proceeded to explore the decision domain for possible surrogate areas where testing might provide known aspects of decision models. They noted an interesting relationship between the predictive ability of independent variables and decision-making in a given context. They observed that "... a prediction can be made without making a decision, but a decision cannot be made without, at least implicitly, making a prediction."⁷

In the context of the purchase-pooling controversy, this point can be illustrated as follows: assume that an investor is considering investment in one of two companies


⁷Ibid., p. 680.
in a particular industry. Each company has engaged in significant business combinations in the past three years. One company used the pooling accounting method whereas the other company used the purchase accounting method.

The investor is rational and seeks some target rate of return, considering risk, his stock of reserve funds and other unidentified variables. Now, while we may not know the nature of the variables which serve as inputs to his decision model or the relative weight which this investor attaches to the variables, we do know he would need to make a prediction about the future rate of return (or performance) of each security under consideration. This prediction would be based on all available financial, economic and political information.

Upon evaluating all information (including accounting data) and assessing the prospects of attaining his investment goal with each alternative, the investor can make his decision in a more rational manner because of the predictive data now available to him. Conversely, the availability of predictive data does not require that a decision be made.

Thus as Beaver, Kennelly, and Voss point out:

... predictive ability of accounting data can be explored without waiting for the further specification of the decision models.

Because prediction is an inherent part of the decision process, knowledge of the predictive ability of alternative measurements is a prerequisite to use of the decision criterion. At the same time it permits tentative conclusions regarding alternative measurements, subject to subsequent confirmation when the
decision models eventually become specified. The use of predictive ability as a purposive criterion is more than merely consistent with accounting's decision-making orientation. It can provide a body of research that will bring accounting closer to its goal of evaluation in terms of a decision-making criterion.\(^8\)

Furthermore, "The predictability approach provides a method for drawing operational implications from the a priori arguments such that the measurement controversies become empirically testable according to a purposive criterion."\(^9\)

We can reason a priori that the decision process of investors is facilitated when information is available which aids in the prediction of the actual future performance of a given security. Since accounting information is one source of information used by investors in the appraisal of investment alternatives, we recall that different messages are given by accounting systems utilizing different measurement alternatives for the same type of transaction (say a business combination). Therefore, the purpose of this study is to determine empirically if there is a significant difference in the predictive ability of financial statements prepared on the purchase basis as contrasted with those prepared on the pooling basis.

**Identification of Terms**

Accounting terms particularly relevant to this study are defined below:

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\(^8\)Ibid. \(^9\)Ibid., p. 678.
Business Combination

A business combination occurs when two or more companies merge their assets or place them under common ownership or control by any one of a variety of methods.\(^{10}\) Thus a single accounting entity replaces previously separate and independent enterprises.

Pooling Method

The pooling of interest method of accounting for a business combination is the uniting of the ownership interests of two or more companies by exchange of equity securities. No acquisition is recognized because the combination is accomplished without disbursing resources of the constituents.\(^{11}\)

Purchase Method

The purchase method accounts for a business combination as the acquisition of one company by another. The acquiring corporation records at its cost the acquired assets less the liabilities assumed.\(^{12}\)

Viewpoint of the Accounting Profession

Accounting for business combinations has been a difficult and often debated question within the profession. This is evidenced by the publication of two research studies by the AICPA in the past ten years:


\(^{10}\) APB Opinion No. 16, op. cit., p. 71.

\(^{11}\) Ibid.

\(^{12}\) Ibid.
for Goodwill by George R. Catlett and Norman O. Olson in 1968.

Significant pronouncements of the Accounting Principles Board of the AICPA came in August, 1970, with the issuance of Opinion No. 16: "Business Combinations" and Opinion No. 17: "Intangible Assets." Opinions apparently differ somewhat as indicated by the 12 to 6 vote on Opinion 16 and the 13 to 5 vote on Opinion 17. The following paragraphs examine the background from which these opinions evolved.

Historical Perspective

In ARS No. 5, Arthur Wyatt observed that the nature and form of business combinations changed drastically in the period from 1890 to the 1950's. The purchase and pooling methods evolved largely as a result of these changes.\textsuperscript{13}

In the period 1890-1904 business combinations brought together leading business competitors and were largely initiated by investment bankers. Typical combinations involved complex corporate structures featuring holding companies. In this period par value of stock given in exchange was the common basis of accounting for the properties involved.\textsuperscript{14}


\textsuperscript{14}Ibid., p. 3.
Wyatt observed that:

. . . . in the opinion of many at the time, the shares issued to effect some of these combinations were considerably watered because the acquiring company (frequently a holding company) issued a greater dollar amount of par value stock than tangible net assets acquired were worth, either in terms of book value or market value.\(^\text{15}\)

In the 1920's anti-monopoly laws limited the number of large corporations promoting business combinations. Management became involved in merger negotiations along with investment bankers. Although not as common as in the 1890-1904 period, watered stock and overstated assets were commonplace. Following World War II a variety of motivations began to emerge as the basis for merger activity. Operating management executives became the typical initiators of business combinations. Major corporations were less frequently involved than were those disproportionate in size or those not particularly dominant in an industry. Typical motivations for combining were:

1. Shortage of managerial personnel.

2. Technological changes requiring costly research more likely to be profitable on a large scale operation.

3. Tax laws permitting tax-free exchanges made closely held corporations likely merger candidates.

4. Apparent growth prospects existing in the economy following World War II.\(^\text{16}\)

\(^{15}\)Ibid., pp. 2-3. \(^{16}\)Ibid., pp. 4-5.
One noteworthy characteristic of these combinations in the 1950's was that accounting for business combinations was more conservative, being largely influenced by the security laws of the 1930's. It was in this latter period that the purchase-pooling alternatives emerged amid a wide variety of combination patterns; for instance,

1. Consideration in cash or outright purchase.
2. Exchange of stock with one company remaining in existence.
3. Exchange of stock with both companies remaining in existence.
4. A new company issuing stock to holders of the stock of two or more companies, whose names might or might not remain.\(^{17}\)

As Wyatt observed:

The area of business combinations produces accounting difficulties because of the wide variety in form which the transaction may take and because many combinations are effected without the existence of a definite objective basis for determining the dollar magnitudes involved in the transaction.\(^{18}\)

Theoretical Support for the Alternatives

Advocates of the purchase method hold that:

1. A business combination is a bargained transaction between independent parties. In this process each side evaluates its prospects separately and its future prospects as a part of the proposed combined company.
2. In almost every business combination one

\(^{17}\)Ibid., pp. 9-10. \(^{18}\)Ibid., p. 12.
company acquires another.

3. One company is usually dominant and continues in control and identity whereas one or more companies usually lose control of their assets and operations to the acquiring company. In many cases identity of the acquired company is also lost.

4. Acquisition by issuance of equity securities is an economic event sufficiently objective to require recording in an accounting sense. Each party to the stock transaction must evaluate the fairness of the consideration given in the process of reaching an agreed value to be placed on the transaction in the same manner as if cash was the consideration used.\(^{19}\)

The essence of the purchase method is the establishment of a new accountability for assets acquired, including goodwill, based on bargained values assigned as of the date of the combination. Correspondingly, net income (or loss) and retained earnings arising from operations utilizing the acquired assets are measured from the date of the combination.\(^{20}\)

Proponents of the pooling of interests method contend that a business combination effected with an exchange of stock is different from one effected with cash. A new accountability is not conceptually supportable because:

\(^{19}\)APB Opinion No. 16, op. cit., pp. 71-72.

\(^{20}\)Ibid.
1. Corporation assets are not disbursed to stockholders.
2. There is no new invested capital.
3. Stockholder groups remain intact, simply combined.
4. Net assets of the participants remain intact, simply combined.
5. Corporate entities remain intact, while it is the equity interests which are merely combined.
6. The bargaining that occurs considers the earning power of each participant on the basis of its historical cost records and is reflected in the exchange ratio agreed upon. Similarly, the stock market values considered in setting the exchange ratio consider future earning power and goodwill, thus offsetting the need to directly value the assets.\(^{21}\)

Dissenting Views

One principal objection to the purchase method relates to the difficulties encountered in measuring the fair market value of assets acquired, particularly where goodwill and other intangible assets are present. Furthermore, many assets do not have readily identifiable markets.

Further complicating the assignment of value to particular assets is the lack of an active market for

\(^{21}\)Ibid., p. 72.
the stock given in exchange in the case of closely held
companies or a newly issued stock.

Even an available quoted market price may not
always be a reliable indicator of fair value of
consideration received because the number of
shares issued is relatively large, the market for
the security is thin, the stock price is volatile,
or other uncertainties influence the quoted price. 22

Furthermore, security prices are:

. . . affected by forces which are significantly
different from those determining asset values.
Speculation, market fads, interest rates,
inflationary forces, government policies and
many other forces determine security prices which
often fluctuate widely in short periods of time. 23

A second major objection relates to the requirement
that goodwill be amortized over some period up to forty
years. According to George R. Catlett:

. . . there is no continuing relationship between
the value of goodwill and its cost. Goodwill does
not have a demonstrable useful life; and its
expiration, if any, cannot be related on any
logical basis to the operating revenues of
particular periods. 24

Other opponents of required amortization of goodwill
point out that goodwill may increase as well as decrease,
hence from a conceptual viewpoint, amortization should be
a matter of professional judgment, rather than arbitrary
rules. 25

A third major objection centers on the one-sided

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22 Ibid.  
23 Jules Backman, op. cit., p. 47.  
25 Ibid.
recording of goodwill. In the bargaining process the stock market value of all participants includes consideration for any existing goodwill, yet only the goodwill of the acquired company is valued and recorded at the time of the transaction.

Opponents of the pooling method fail to find an accounting concept to support the method. The principal objection is that the asset values used in the bargaining process leading to the combination are ignored in the accounting for the combination. In this connection the substance of the transaction does not change merely because the form of consideration is stock in lieu of cash. In most cases the stock could be readily converted to cash. The fact that asset valuation may be difficult does not support a principle (pooling) which ignores the substance of the transaction.26

Pooling advocates contend that a fusion of equity interests occurs which is merely a transaction among stockholders, but this ignores the entities involved; namely, the companies (and net assets) involved in the bargaining process. The fact that many combinations in the 1960's were followed by the profitable sale of some acquired asset lends support to the idea that bargained asset values are usually real, and should in fact be recognized fully in the accounting for the combination.27

26APB Opinion No. 16, op. cit., p. 84.
27Ibid.
One overriding view of opponents to pooling is that the great majority of combinations using stock are of such size disparity as to leave little doubt that an acquisition has occurred.

No attempt has been made to list all arguments for and against each of the two methods, but a review of the principal arguments points up the still serious and unresolved nature of the purchase-pooling controversy and emphasizes again the need for empirical research as a possible means of resolving the question.

**Development of Hypothesis**

The consummation of most business combinations could be termed an investment decision since one firm is usually larger than the other, and where securities are the form of consideration, the respective common stocks seldom have the same market value or price earnings ratio.

Since the major stock exchanges are considered near perfect markets in an economic sense, the security values on which the transaction is based are considered valid measures of the future service potential of assets acquired. Therefore, the recognition of transaction values (cash or securities exchanged) on the books presents to the investor a more realistic picture of asset values and thus earning power and profitability, since the current market appraisal updates information about the firm, thus enabling a better prediction about future performance.
Whereas pooling accounting merely combines historical accounts of both firms, the books of account fail to provide timely market appraisals of firm value which could in turn serve as benchmarks for potential investors. Purchase accounting does not entirely suffer this disadvantage.

The foregoing rationale leads to the following hypothesis to be tested in this study:

As between the purchase and pooling methods of accounting for business combinations, financial statements prepared using the purchase method of accounting more clearly reflect the events which are useful to investors in the prediction of a stock's actual future performance and are, therefore, more closely associated with a stock's actual performance in the period measured.

**Review of Prior Research**

As previously noted the AICPA has conducted two major research studies dealing with the purchase-pooling question. Perhaps the principal accomplishment of these studies was to identify the major theoretical questions. The rather controversial adoption of APB Opinions 16 and 17 previously cited would indicate that the purchase-pooling controversy continues. An apparent weakness of these and past AICPA studies is the noticeable absence of published empirical tests which might have validated the usefulness of either or both alternatives.

In recent years, however, a noticeable increase in empirical accounting research is found. Francis A. Mlynarzyk, a research officer with the First National City
Bank of New York observed that:

In the area of alternative accounting methods and decisions, the research to date has fallen into four broad categories: empirical study, experimental study, simulation study, and theoretical exposition. The studies in the area of specific alternative accounting methods and securities are few in number, and have been primarily experimental or empirical. 28

O'Donnell on Depreciation/Tax Alternatives

One of the earliest empirical studies of specific accounting alternatives was made by J. L. O'Donnell. According to Mlynarczyk this study dealt with depreciation and tax alternatives in the electric utility industry. This univariate analysis examined trends in price earnings ratios in relation to security prices. The conclusion in both first and second studies was that investors interpreted flow-through earnings as an overstatement of profits. 29

Mlynarczyk on Tax Alternatives

In his 1969 study, Mlynarczyk studied the effect of alternative methods for federal income taxes on security prices using the electric utility industry as O'Donnell did. His study permitted a comparison with the O'Donnell study. His conclusions basically confirmed the O'Donnell results although the methodology was multivariate. 30

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29 Ibid., pp. 66-67.

30 Ibid., pp. 70-77.
Summers on Investor Reaction to Alternatives

This univariate study investigated the effects on investors of investment credit use, interperiod tax allocation, and funds-flow statement. According to Mlynarczyk, Summers concluded that investors were apparently indifferent to the effects from the use of these accounting alternatives. Thus the result of this study conflicts with the findings of O'Donnell and Mlynarczyk cited above.  

Staubus on Inventory Alternatives

Between 1965 and 1968 George Staubus conducted several studies in which he tested the correlation between various accounting variables and an arbitrarily discounted stock value. In 1968 he applied these techniques to the various alternatives in inventory accounting.  

A serious weakness in his methodology related to arbitrary assignment of a discount rate to various stock values without regard to the individual risk and market-wide influences faced by each firm. It is unlikely that his results reflect a valid test of observed behavior in the market place.  

Ball and Brown Appraise Income Numbers

In their often quoted study of 1968, these

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31 Ibid., p. 67.
researchers investigated the usefulness of existing accounting numbers; namely, earnings per share and net income. According to Ball and Brown, their findings demonstrate that the information contained in the annual income number is useful in that if actual income differs from expected income, the market typically reacted in the same direction. However most of the information contained in reported income is anticipated by the market before the annual report is released.

Their measure of market return for individual firms was the difference between realized return and expected return net of market-wide effects. This residual in effect reflects the impact of new information including the unexpected income change (actual minus expected). Ball and Brown concluded that "of all the information about an individual firm which becomes available during a year, one-half or more is captured in that year's income number. Its content is therefore considerable."  

This study leads one to the conclusion that much of the information (events, etc.) investors use in adjusting their expectations is measured by the income number. Even though an investor's reaction to events measured by the income number takes place before release of the income number, the important implication gained from the Ball and Brown study is that the content of the income number (and very likely other key ratios) is significantly related to

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34 Ibid., p. 176.
observed behavior in the market place.

Siebel on the Usefulness of Ratios

Numerous other empirical studies have been made to test the usefulness of published annual accounting data as shown by Siebel's exhaustive study of the relevant literature. His conclusion was that published annual accounting data is useful in the decision models of investors, creditors and executives.\(^\text{35}\)

Summary

As the above listing shows, it appears there have been few empirical tests of specific accounting alternatives. With the exception of the Siebel and Ball and Brown studies, a major weakness of prior predictive investigations seems to have been the inadequacy of the market measure used as an operational test of usefulness, because no consideration was given to the risk faced by the individual firm or the market-wide effects on the security price tested.

The Need for Further Research

To the writer's knowledge no empirical study has been made to test the usefulness of purchase-pooling accounting numbers. Prior published research provides support for such a study. Mlynarczyk, in his conclusion

notes: "Finally, it appears that multivariate statistical techniques can be effectively utilized to test hypotheses about the effects of accounting variations on security prices." Ball and Brown observed that:

Recent developments in capital theory provide justification for selecting the behavior of security prices as an operational test of usefulness. An impressive body of theory supports the proposition that capital markets are both efficient and unbiased in that if information is useful in forming capital asset prices, then the market will adjust asset prices to that information quickly and without leaving opportunity for further abnormal gain.

The successful application of the above theory by Ball and Brown as previously noted led the researchers to comment that "... finally, a mechanism has been provided for an empirical approach to a restricted class of controversial choices in external reporting."

Following a comprehensive review of the latest research methods utilizing the behavior of security prices, Beaver commented that now:

... research methods can be used to examine the relative association between accounting alternatives and security prices. Knowledge of such association is a prerequisite to specifying what data are impounded in prices and how prices might be altered if the information set were altered.

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36 Mynarczyk, op. cit., p. 77.
37 Ball and Brown, op. cit., p. 160.
38 Ibid., p. 177.
Therefore, it is the purpose of this study to assess the relative association of a multivariate set of purchase-pooling accounting numbers with a risk-adjusted measure of individual stock performance for each sample firm.
CHAPTER II

THE CRITERION OF PREDICTIVE ABILITY AS A MEASURE OF THE RELATIVE USEFULNESS OF ALTERNATIVE ACCOUNTING MEASURES

This chapter will describe the theoretical and scientific support for the predictive criterion and demonstrate its relevance to decision making. A review of accounting research using the criterion as a test of measurement methods is then followed by a discussion of the adaptation of the criterion to the purchase-pooling question.

Theoretical and Scientific Description of the Criterion

The ASOBAT definition of accounting cited earlier would classify accounting as a language communicating information to facilitate informed judgments by users. To be relevant this information would have to relate to the decision models of particular users or at least to known aspects of decision models.

As such this would place the study of the language of accounting in the area of pragmatics, which, according to Sterling, is one of the scientific approaches to the study of languages, the other two being semantics and syntactics. In fact much of philosophical scientific
inquiry is simply a study of the language peculiar to that particular area of interest (i.e., accounting).  

In identifying the three approaches Sterling observed that:

**Syntactics** is the study of the relation of signs to signs. . . . **Semantics** is the study of the relation of signs to objects or events. . . . **Pragmatics** is the study of the relation of signs to users of those signs. Different signs invoke different responses from a particular user even though those signs are intended to have the same referent. Different users may interpret the same sign in different ways.

The Committee on Accounting Theory Construction and Verification (Committee) of the American Accounting Association stated that the study of the sciences is logically divided into empirical and non-empirical classifications. Whereas the non-empirical areas (i.e., mathematics) do not depend on empirical findings for verification, the empirical sciences (pragmatics, and thus accounting) are directly concerned with explanations and predictions of events in the real world.

It follows then that accounting theory should provide for useful accounting measurements which relate to, explain, or otherwise predict events in the decision models of users (i.e., investors). Since investor decision

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2Ibid., p. 446.

models are unspecified, opponents of the predictive criterion may observe the impossibility of verifying theoretical propositions not observable in the real world.

The response of the Committee is that:

It is not required that every proposition in an empirical inquiry be verifiable; there are many terms that operate within the formal system that are not subject to observation. (These are often called "theoretical terms" in contrast to "observational terms.") However, an empirical theory must have some propositions that are verifiable. The verification of these individual propositions is taken as a test of the theory.4

Theoretical support for this viewpoint is also given by Hempel.5 The importance of the verification process is also emphasized by Margenau who asserts that "theories ... attain validity through empirical confirmation."6

Therefore, a properly specified accounting prediction model is the means whereby a priori propositions making up an accounting system can be related to decision models (investor decision models in the context of this study).

Increasing use of prediction models has given rise to the term, predictive ability criterion. According to Beaver, Kennelly and Voss, predictive ability is a process whereby "... accounting measurements are evaluated in

4Ibid.


terms of their ability to predict events of interest to decision makers." The Committee defined predictive ability as the "... use of accounting measurements in models which predict events of interest to decision makers." 8

From an extensive review of the literature in scientific methodology, Beaver, Kennelly and Voss noted that "the criterion is well established in the social and natural sciences as a method for choosing among competing hypotheses." 9 Alternative accounting measurements are similar to competing hypotheses in several key respects:

1. Both are abstractions.
2. Each can be evaluated by tests of logical propriety.
3. Both have prediction of events as a primary purpose.
4. Where the predictive ability criterion is used, it is assumed that each alternative has an a priori self-supporting theory and has met the tests of logical propriety. 10

In the last part of this chapter the relationship of the above criteria to the purchase-pooling alternatives

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7 Beaver, Kennelly and Voss, op. cit., p. 675.
8 Committee on Accounting Theory Construction and Verification, op. cit., p. 63.
9 Beaver, Kennelly and Voss, op. cit., p. 676.
10 Ibid., p. 677.
will be shown.

Relationship of the Criterion to the Facilitation of Decision Making

Since the purpose of accounting is the communication of information to facilitate decision making, the validity of the criterion is dependent to a large measure on logical establishment of the purposive nature of the criterion.

Paton long ago recognized the highly purposive relationship between accounting principles and the end uses of the measurements generated.  

The Committee on Accounting Theory Construction and Verification also emphasized the importance of the purposive criterion in its study of accounting. It observed that the total (accounting) theory plane included three elements:

1. The accounting system (the measurement-communication function).
2. Prediction models.
3. Decision models.  

This model proposes that ideal accounting theory would be relevant because it sought to measure only variables useful to decision makers.

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12 Committee on Accounting Theory Construction and Verification, op. cit., p. 60.
13 Ibid., p. 61.
Stressing this same point, ASOBAT defined its relevance standard in this manner:

For information to meet the standard of relevance, it must bear upon or be usefully associated with the action it is designed to facilitate or the result it is desired to produce. This requires that either the information or the act of communicating it exert influence or have the potential for exerting influence on the designed actions.14

Shwayder suggests that there are three levels of relevance of concern to accounting theorists: (1) decision relevance, (2) result relevance, and (3) semantic relevance.15 Shwayder emphasized the interrelationship of the three levels by noting that "... information cannot affect decisions without influencing the impressions of the user, and information cannot affect goal fulfillment without changing the user's decision."16

Shwayder observed that none of the three relevance standards dominated either of the other two in terms of operationality and meaningfulness, but of the three standards researchers have been more successful in developing experimental and empirical models applying decision relevance in which a significant or intermediate level of success is obtained.17

Shwayder's view tends to reinforce the ASOBAT emphasis of decision relevance as the single most important

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15 Keith Shwayder, "Relevance," *Journal of Accounting Research*, VI (Spring, 1968), 89.

16 Ibid., p. 89. 17 Ibid., p. 91.
standard for usefulness.

At this point critics of the predictive criterion may again remind us of the undefined nature of decision models. In other words, empirical studies applying a decision relevance standard cannot be valid since many aspects of decision models are unknown, as has already been acknowledged. However, as noted in Chapter I, Beaver, Kennelly, and Voss have correctly observed that predictions can be made without making decisions, whereas a decision requires that at least an implicit prediction be made. Thus, as long as some parameters of decision models are known which may be expressed operationally, then predictive tests of these known decision variables can be made. Thus, a portion of the knowledge needed for evaluation of alternatives is supplied.18

ASOBAT reinforces this viewpoint by noting that "it is not necessary to know in detail the needs of all diverse users of accounting information to prepare relevant reports for them for certain classes of information are relevant to many decisions."19

Although the predictive ability criterion can be logically supported, one is not to conclude that all problems of implementation have been either discovered or erased. At least two major problems relating to the

18 Beaver, Kennelly and Voss, op. cit., p. 680.
19 A Statement of Basic Accounting Theory, op. cit., p. 19.
non-specification of the decision process are noted by Beaver, Kennelly and Voss as cited by the Committee on Accounting Theory Construction and Verification:

First, without a knowledge of the loss function of the errors in predictions, it may be impossible even to rank alternative measurements in terms of predictive ability. A specification of the loss function would require explicit introduction of the decision process. Second, even if an ordinal ranking were possible according to predictive ability, ordinal relationships are insufficient, if the "better" measurement alternative involves a higher cost. The evaluation must be then conducted in terms of a cost-benefit analysis—that is, the incremental benefit must be at least equal to the incremental cost.20

Thus, while it may be difficult to generalize across different contexts, the predictive ability methodology is still logically correct, and therefore, empirical studies using the criterion can advance the evolutionary state of accounting knowledge even though conclusions may be tentative.21

Further logical justification for this step-by-step approach to determination of the usefulness of accounting data can be drawn from Hempel. In generalizing regarding the structure of scientific prediction, he notes that:

The chain of reasoning which leads from given observational findings to the prediction of new ones actually involves, besides deductive inferences, certain quasi-inductive steps each of which consists in the acceptance of an intermediate statement on the basis of confirming, but usually not logically

20 Committee on Accounting Theory Construction and Verification, op. cit., p. 77.

21 Beaver, Kennelly and Voss, op. cit., p. 683.
conclusive, evidence. 22

In commenting on this somewhat circular nature of successful prediction, Hempel observed that:

Indeed, in order to make the original formulation of the prediction-criterion of confirmation sufficiently comprehensive, we should have to replace the phrase can be logically deduced by can be obtained by a series of steps of deduction and quasi-induction; and the definition of quasi-induction in the above sense presupposes the concept of confirmation. 23

Accounting Research Using the Criterion

Beaver, perhaps the foremost proponent of the predictive methodology for accounting research, has noted that, in general, predictive studies using accounting earnings have been made in a broad range of different contexts; for example:

1. Valuation models of the firm.
2. Valuation models of the firm's securities.
3. Dividend policies of firms.
4. Earnings growth rate forecasts.
5. Applications of portfolio theory to assess the information content of accounting data.
7. Relationship between industrial concentration and accounting rates of return.
8. Income smoothing.
9. Forecasting ability of income numbers as

23Ibid.
measured under alternative measurement rules.

10. Predictive content of interim reports.24

A review of all such studies would be a major project in itself. Therefore, this study will merely review the principal investigations in those classes with particular relevance to this study. As will be noted, the methodology varies greatly despite the similarity of subject matter being investigated. However, more important for this study is the revealed fact that many predictive studies have been successful in relating accounting data to real world aspects of decision models.

Solvency Determination and Bond Ratings

In a 1966 study, Beaver tested the ability of financial ratios to predict bankruptcy or bond default. He used two samples of seventy-nine firms each (failed and non-failed) which were matched as to industry and asset size. Thirty ratios were used as predictors in a dichotomous classification test. Ratios particularly effective in predicting failure were cash flow/total debt and net income/total assets.25 Beaver's study indicated "... that financial ratios signal increases in the


probability of failure for as much as five years prior to the failure of the firm." 26

Continuing that study in 1968, Beaver observed the ability of changes in the market prices of stocks to predict failure of the firm. The sample firms were studied for a period of five years prior to failure of the failed firms. Annual rates of return were adjusted for dividends and capital changes. In an additional test, the returns were adjusted for market-wide effects, but the results were not significantly different after this adjustment. With regard to both studies, Beaver concluded that:

\[ \ldots \text{(1) Investors recognize and adjust to the new solvency positions of failing firms. (2) The price changes of the common stocks act as if investors rely upon ratios as a basis for their assessments, and impound the ratio information into the market prices.} \text{27} \]

Beaver's latter study permitted a comparison of investors and financial ratios as predictors of failure. With regard to his cross-sectional analysis the ratios were found to be the better predictor. 28 In his time series analysis, Beaver concluded that investors forecast failure sooner than ratios, which was consistent with his belief heretofore expressed that investors utilize ratios in judging the solvency position of firms. 29

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27 Ibid., p. 192.

28 Ibid., p. 186.

29 Ibid., pp. 189-91.
Two studies have been made to test the ability of accounting data to predict bond ratings. The Horrigan study in 1966 covered the period 1959-1964 during which time the sample firm's bond ratings remained unchanged. The initial phase of the study was the determination of various prediction models by regressing fifteen financial ratios with bond ratings of the sample firms. One year data was utilized in computing the ratio values. The best predicting model consisted of total assets and four ratios. This model was then used to predict changes in bond ratings for a sample of firms whose ratings did change in the period 1961-1964. Horrigan successfully predicted the new bond rating in over 50 per cent of the cases, and he was within one rating for most of the remaining sample cases.

Using a more sophisticated model previously developed by Fisher, West conducted a study similar to Horrigan's. However, the Fisher model utilized by West contained some non-accounting variables and, according to West, was more theoretically correct in its conception. West reasoned that "the model does an excellent job of

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31 Ibid., pp. 59-60.

estimating risk premiums and these are highly correlated with ratings. Therefore, the model should also perform well as a predictor of ratings."\(^{33}\)

West's results were similar to Horrigan's and only slightly better despite the more sophisticated (and costly) model utilized. As a result of his study West agreed with Horrigan that financial ratios are useful in the determination of corporate bond ratings.\(^{34}\)

A more recent study of the ability of ratios to predict bankruptcy was conducted by Altman in 1968. Citing the univariate approach used by most other researchers on this subject, Altman chose multiple discriminant analysis as the statistical technique for the study. He selected two samples (failed and non-failed) consisting of sixty-one firms each. Each of the sample firms had filed for bankruptcy during the period 1946-1965.\(^{35}\)

His final predictive model was the result of analyzing twenty-two potential ratios from which five were selected after giving consideration to inter-correlation, statistical significance, predictive accuracy, and judgment. The five were:

1. Working capital/total assets.
2. Retained earnings/total assets.

3. Earnings before interest and taxes/total assets.


5. Sales/total assets.  

Application of the model resulted in a sample firm being classified as bankrupt or non-bankrupt. Altman's model successfully classified the sample firms in 94 per cent of the cases.  

Predictive Content of Interim Reports

In 1967 Green and Segall investigated the ability of quarterly earnings reports to forecast future annual earnings per share. Using naive forecast models (those with no known relationships), they compared forecasts which utilized first quarter reports with other forecasts which did not consider an interim report. Forecast errors for each of the fifty sample firms taken from the New York Stock Exchange were compared. Naive forecast models were justified since there was no known relationship between first quarter reports and annual earnings. Green and Segall concluded that first quarter earnings reports are poor predictors of future annual earnings figures.  

Whereas Green and Segall confined their study to

36 Ibid., pp. 594-608.  
37 Ibid., p. 609.  
first quarter earnings reports, Brown and Niederhoffer examined the predictive ability of first, second, third, and fourth quarter reports. The earnings data tested was located on the Compustat Tape of Standard and Poor Corporation. Using naive models, both annual and interim predictors were utilized in the test of 519 firms during the period 1947-1965. Three tests were applied in determination of predictive accuracy, (1) average percentage of error forecast, (2) average rank of the predictors, and (3) a complete empirical distribution of percentage forecast error. Their study provided some comparison with the Green and Segall study of first quarter reports. Contrary to the Green and Segall results, the Brown and Niederhoffer first quarter predictions were superior to the annual predictors as a group. Furthermore, the interim predictors were consistently found to be superior to the annual predictors. The study led the researchers to conclude:

... that interim reports as currently prepared are useful in predicting annual earnings and that, since predictive ability improves with each new interim report, the market must be increasing its anticipatory powers as the announcement date of the annual report approaches.

The latter conclusion is consistent with the Ball and Brown study previously discussed in Chapter I. Their

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40 Ibid., p. 496.

41 Ibid.
... suggests not only that the market begins to anticipate forecast errors early in the 12 months preceding the report, but also that it continues to do so with increasing success throughout the year.\textsuperscript{42}

Of the three studies in this area the Ball and Brown research seems far superior since the investment decision as reflected in security price changes is a much more valid criterion of usefulness than the predicted annual income numbers used by the other researchers.

Recognizing the continuing debate over the value of interim reports, Brown and Kennelly used an experimental model in which the following basic procedures were followed:

1. Forecast rules were used to predict earnings per share.

2. Actual earnings per share were then compared with predicted earnings per share and classed in a dichotomous fashion as good news, bad news, or no news.

3. Using the assumption of an efficient market, investment portfolios were then constructed on the basis of buying stocks where future reports were predicted to carry good news, selling short those with a predicted bad report, and taking no action in the neutral case.

4. On the order of Ball and Brown\textsuperscript{43} abnormal


\textsuperscript{43}Ibid.
monthly rates of return were then computed and expressed in an index form.

5. As the last step the forecasting rules were evaluated by their ability to maximize the index in step four above. 44

Both naive and regression forecasts models were tested, but neither proved better than the other. 45

Important conclusions from this study are:

1. The earlier results of Ball and Brown are confirmed in that stock prices apparently do discount future annual reports such that the release of the annual report does not cause an unusual jump in the abnormal return index in the month of release. 46

2. The quarterly report data is useful in predicting aggregate abnormal security returns of individual firms.

3. The predictive accuracy of the earnings per share series is improved by 30 to 40 per cent by reporting in a quarterly fashion. 47

Forecasting Ability of Alternative Measurement Rules

Chapter I gave an account of three of the very few empirical studies which attempted to evaluate the effect


45 Ibid., p. 413.

46 Ibid., p. 414.

of alternative measurement rules on investors. The absence of both significant studies and results may be partially attributed to failure to utilize concepts of portfolio theory in conjunction with the predictive methodology outlined earlier in this chapter. A number of the successful predictive studies have indicated that these research tools successfully relate accounting data to the real world aspects of decision making.

In 1971 Gagnon tested certain models as to their ability to predict the choice of accounting method actually used in business combinations. A sample of 330 firms was drawn from Listing Applications with the New York Stock Exchange. This study is based on the assumption that firms adopt the maximization of earnings as a goal and as a result, an implicit hypothesis of Gagnon was that the new AICPA guidelines for the purchase-pooling choice will be ineffective.48

The key relationship empirically tested is the difference between the Exchange Price (security values exchanged) and Book Value of assets exchanged divided by a naive estimate of future earnings for the surviving company. Gagnon's hypothesis was that where the Exchange Price exceeds the Book Value, the trend is toward the pooling method. Conversely, where the Exchange Price is

less than Book Value, the trend is toward purchasing.\textsuperscript{49}  

A dichotomous classification test was applied to the test data to identify each sample firm as a pool or a purchase. Gagnon's results tend to support the hypothesis of a trend toward pooling where Exchange Price exceeded Book Value. However, the percentage of classifications missed ranged from 32 to 38 per cent. None of his predictors were successful in predicting the purchase choice when the Exchange Price was less than Book Value.\textsuperscript{50} The models do not appear well specified as shown by the inconclusive results obtained. Furthermore, the study may be questioned from the standpoint of relevance, since the usefulness of future earnings estimates has not been fully demonstrated empirically.

An investigation by Werner in 1969 evaluated the relative ability of historical cost (accounting income) and current cost (current income) income measures to predict future income values. Normal operating income before taxes was the variable tested in this study. Price level indexes were used to restate cost of goods sold and depreciation amounts to current year dollars in determining the current income measure to be tested.\textsuperscript{51}

Werner used two forecast models, (1) a simple least-squares regression model and (2) a series of moving

\textsuperscript{49}Ibid., pp. 53-54. \hspace{1cm} \textsuperscript{50}Ibid.  

average models.\textsuperscript{52}

A principal purpose of the study was to test the hypothesis that past values of current income give better predictions of current income. Both models failed to indicate an advantage for reporting current income in lieu of accounting income although Werner suggested that another period with greater price fluctuations might have produced different results.\textsuperscript{53} For the oil and chemical industries, the study gives some indication that "a better basis for making predictions about future accounting earnings may be obtained if the current income of the previous year is extrapolated instead of reported accounting income."\textsuperscript{54}

Applications of Portfolio Theory

A number of significant predictive studies utilizing portfolio theory have been made to assess the predictive power of accounting income numbers. The first really significant study was the Ball and Brown investigation described in Chapter I.

In 1970, Beaver, Kettler and Scholes released a study which investigated the relationship between market determined risk measures and accounting determined risk measures. Applying the principles of portfolio theory and a capital asset pricing model, which are fully discussed in Chapter III, the researchers computed \textit{beta}, the measure

\begin{itemize}
  \item \textsuperscript{52} Ib\textit{id.}, p. 129.
  \item \textsuperscript{53} Ib\textit{id.}, p. 133.
  \item \textsuperscript{54} Ib\textit{id}.
of an individual security's systematic risk, as the market
determined risk measure to be tested. The accounting
risk measures were:

1. Dividend payout.
2. Growth.
3. Leverage.
4. Liquidity.
5. Asset size.
7. Covariability in earnings computed in a
manner similar to the market beta and referred to as the
accounting beta.

The study covered the period 1947-1965 and included
307 firms whose data appeared on the Center for Research in
Security Prices (CRSP) Tape and the Compustat Tape of
Standard and Poor Corporation. Basically, the association
was measured by cross-sectional correlation analysis
between the market beta for the individual firm and each
of the seven accounting risk measures for each sub-period
in the study. A strong association was found in all
accounting risk variables with the exception of the
liquidity measure.

Since portfolio theory is of primary concern to

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56 Ibid., pp. 655-59.
57 Ibid., pp. 668-69.
investors, correlations were also made at that level of decision making. Portfolios were formed by arranging the accounting risk measures in order of descending magnitude, and then the highest five were selected for the first portfolio, the next five for the second portfolio, continuing in this manner until sixty-one portfolios were formed.58

The researchers reported that:

The evidence indicates that accounting risk variables can be used to select and rank portfolios such that the ranking has a high degree of correlation with ranking the same portfolios according to the market risk measure. The evidence is consistent with the contention that the accounting risk measures are impounded in the market risk measure.59

This study has significant implications for future empirical investigations into the usefulness of various accounting alternatives. Many aspects of the successful methodology used by Beaver, Kettler and Scholes, and Ball and Brown will be utilized in evaluation of the purchase-pooling alternatives in this dissertation.

Summary

Even with the very few predictive studies available it is evident that in a given area of inquiry, the methodological quality has improved with each new investigation. This is in line with the step-to-step approach to theoretical confirmation described earlier in the chapter. This was particularly true with the

58Ibid., p. 669. 59Ibid., p. 670.
studies on the predictive content of interim reports.

The success of Beaver, Ball and Brown, and Beaver, Kettler and Scholes with portfolio theory as a means of confirming the usefulness of income numbers and risk measures provides a basis for empirical evaluation of measurement alternatives with similar methodology.

**Adaptation of the Criterion to the Purchase-Pooling Question**

Earlier in this chapter it was noted that accounting alternatives are similar to competing hypotheses and are thus amenable to analysis using the predictive methodology. Each measurement alternative may be considered an abstraction. Each method has a considerable body of theory supporting it as evidenced by the two research studies on Goodwill and Accounting for Business Combinations. All efforts to resolve the issue on the basis of tests of logical propriety have been unsuccessful. To accept the purchase method as the best since some poolings (where there is size disparity) appear to abstract from the basic underlying economic event which takes place does not seem reasonable. In many cases both companies are of similar size and all ownership and management interests still continue, a situation which, other things being equal, tends to call for pooling.

The lengthy period of argument over the purchase-pooling choice reveals the inability of a priori arguments to settle the question. The basic question is--which
method is the most useful to decision makers? It seems that a purposive criterion is called for. Therefore, with the recent developments in portfolio theory, a real world criterion for evaluating the usefulness of each method is provided.

Inasmuch as accounting income numbers and various financial ratios have been successfully used to predict various investor interests in the foregoing studies, this investigation will use multiple regression models to test the ability of similar accounting numbers and ratios to predict actual stock market performance as determined by a capital asset pricing model which considers individual firm risk. The measure of association will be the coefficient of determination ($r^2$).

The accounting numbers tested will be correlated with concurrent market performance under the assumption that the accounting numbers are measuring the same underlying events which investors are reacting to in the market place.
CHAPTER III

THE RELATIONSHIP OF ACCOUNTING DATA TO THE INVESTOR'S DECISION PROCESS

In previous chapters it has been repeatedly stated that accounting information should be useful to decision makers. In the context of business corporations decision makers may be classified as internal (owners and/or management) and external (investors, lenders, etc.).

Although the decision processes of investors in general are relatively undefined, even less is known about the decision processes followed by internal decision makers. Therefore, this study will focus on the relationship of accounting data to external users and in particular, to investors.

This chapter will discuss the nature of security investments, the environment of the security markets and the behavior of security prices as a means of developing a predictive model operationally suitable to this study.

The Nature of Security Investments

According to one dictionary to invest is "... to put (money) into business, stocks, bonds, etc., for the
purpose of obtaining a profit." The act of investing then is a foregoing of consumption in the present in the interest of a greater amount of consumption in the future. As Hirshleifer noted,

Investment is, in essence, present sacrifice for future benefit. But the present is relatively well known, whereas the future is always an enigma. Investment is also, therefore, certain sacrifice for uncertain benefit.2

The uncertainty of future benefit may be lessened (if not in fact eliminated) under some investment strategies. For example, if one abstracts from the potential effects of inflation and/or failure of the government backing the currency, it is possible to invest in a guaranteed or risk-free asset such as a government bond, government insured savings account, etc. In fact these are common forms of investment for conservative accounts.

Investment in the securities market, however, would be risky or uncertain. Whereas the rate of return (or performance) of risk-free assets is easily and precisely determinable, the measurement of the performance of risky assets is dependent upon knowledge about the behavior of security prices and some assumptions about

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the nature of the capital markets where securities are traded.

The Role of Information in the Investment Decision

The very act of investing money for profit implies a pre-evaluation of all known facts to provide a rational basis for selecting the preferred profitable investment from among the various investment considerations available. Factual information may take the form of political news, labor actions (strike or settlement), new inventions, a disclosure of economic indicators, a change in interest rates, or financial information in the form of earnings reports or balance sheets, to mention only some of the types of information of interest to investors in securities. It may be reasoned a priori that the more accurate, timely, and complete the information package, the more efficient will be the investor's choice among alternatives. Thus more optimal decisions by investors lead to a more optimal allocation of resources, a desirable economic strategy.

As the Committee on Research Methodology in Accounting of the American Accounting Association noted,

... the role of information is two-fold: (1) to aid in establishing a set of security prices, such that there exists an optimal allocation of resources among firms and an optimal allocation of securities among investors, and (2) to aid the individual investor, who faces a given set of prices, in the selection of an optimal portfolio of securities. These two functions reflect the two-fold distinction described above, and the behavior of security prices
is an inherent part of both contexts. ³

Accounting information as found in financial statements is a part of the total information set confronting investors. Following a comprehensive review of recent accounting research on the usefulness of accounting numbers, Beaver concluded that:

(1) Evidence is provided regarding the efficiency of the market in processing accounting information. ⁴
(2) The evidence indicates an association exists between accounting data and security prices both in the context of returns and risk measures. The implication is that the market acts as if it uses accounting data in setting equilibrium prices. Alternatively stated, accounting data are consistent in many respects with the underlying information set used by the market. The consistency reflects either or both of two possible states of the world. The market literally uses accounting data, or the market uses other sources of information where these sources and accounting data reflect the same underlying relationships. ⁴

This study will test the latter supposition by relating accounting numbers with concurrent changes in market prices of the sample firms.

The Role of the Securities Market

Webster defines a market as "... a gathering of people for buying or selling things." ⁵ In the modern sense a securities market is a system composed of sites, traders, trained specialists and communication networks

⁴Beaver, op. cit., p. 417.
⁵Webster's New World Dictionary, op. cit., p. 458.
which interact to bring information and buyers and sellers together. Therefore to interpret the behavior of security prices one must have some knowledge of the market process itself.

The important product of the securities markets is the generation of security prices. Beaver emphasized this point when he noted that:

The implications of security price changes (and hence, wealth changes) are clear. A price increase implies an increase in current wealth, which permits the investor to consume more. A decrease in prices (wealth) will result in a reduction in consumption opportunities. Hence, price changes induce a change in consumption decisions, even though the precise nature of the change will depend upon the individual's preference for time-dated, consumption claims in each state. Moreover, the change in consumption, as measured in present certainty equivalent value terms, is exactly equal to the change in wealth. . . .

Given the importance of security prices upon the wealth and overall level of well being of investors, it is inconceivable that optimal information systems for investors can be selected without a knowledge of security price behavior.6

Given the importance of security price changes in the process of wealth maximization, an important question is how accurate or efficient is the market in establishing security prices. Whereas one school views the market as disorganized and imperfect or inefficient, Fama has indicated that the efficient market model has been confirmed by the intensive research of many with only

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6 Beaver, op. cit., p. 409.
limited contradictory evidence being offered.\textsuperscript{7}

Hirshleifer's research also tends to confirm the efficient market school of thought which "... maintains that the divergencies of observed yield conceal an underlying harmony of the capital markets."\textsuperscript{8} In his conclusion he noted that:

... the formulation of investment choice under uncertainty in terms of time-state preferences, with the assumption of risk aversion (or rather, the slightly generalized assumption of conservative behavior) does seem to promise progress toward harmonizing the bewildering diversity of market yields.\textsuperscript{9}

Gonedes, in commenting on the extensive research supporting the efficient market hypothesis, describes an efficient market as having two properties:

1. Market prices fully reflect all publicly available information.

2. By implication in (1), market prices react instantaneously and unbiasedly to the new information.\textsuperscript{10}

In an examination of 115 mutual funds, Jensen found that:

... prices of securities seem to behave according to the "strong" form of the martingale hypothesis. ...
That is, it appears that the current prices of securities completely capture the effects of all currently available information. Therefore, their attempts to analyze past information more thoroughly have not resulted in increased returns.\textsuperscript{11}

More important to accounting research are tests of the semi-strong\textsuperscript{12} form of the efficient market hypothesis. According to the American Accounting Association's Committee on Research Methodology in Accounting report:

Tests of the semi-strong form have also supported the efficient market hypothesis. In many respects this research is most relevant to accounting because financial statements are contained in the information set, which includes all publicly available information.\textsuperscript{13}

As to results of tests made on the semi-strong form, Beaver reported that to his knowledge "... there is not a single prominent empirical study of security price behavior that has documented an inefficiency in the semi-strong form."\textsuperscript{14}

With full consideration of the impact of the foregoing research, this study will accept the efficient market hypothesis as an underlying assumption in the predictive model to be developed.


\textsuperscript{12}Referring to Fama's delineation of the forms (degrees) of market efficiency, Beaver notes that in the semi-strong form, the information set includes all publicly available information. Thus superior returns can only be earned by monopoly control or early access to the information. In the strong form neither inside information nor superior trading rules will bring superior returns. (Beaver, op. cit., p. 418.)

\textsuperscript{13}Ibid., p. 419. \textsuperscript{14}Ibid., pp. 419-20.
Theoretical Description of the Formation of Security Prices

The preceding section has discussed the investment process including the nature of the capital market and the role of information in the formation of security prices. A capital asset pricing model will now be described in some detail. This model will be utilized in the evaluation of security prices (the dependent variable) for the sample firms in the study.

Portfolio Theory

A basic assumption of the capital asset model developed in this chapter is the risk-averse nature of investors operating in a world of uncertainty. The average investor selected at random would likely hedge the future by doing one or more of the following:

1. Buy insurance.
2. Retain a reserve of liquid assets (cash).
3. Invest in low-risk retirement annuities.
4. Hold some risk-free assets (government bonds).
5. Diversify other assets (real estate, stocks).
6. Diversify securities (type, industry, etc.).

Therefore it is unlikely that the rational investor will hold only one type of security investment at a time. Instead, he will seek to form an optimal portfolio of investments, balanced in terms of expected return (E) and variance or risk (V). In this regard Markowitz concluded that "diversification is both observed
and sensible; a rule of behavior which does not imply the superiority of diversification must be rejected both as a hypothesis and a maxim."\textsuperscript{15}

According to Markowitz, effective diversification is not related to the number of different securities invested in but includes the idea of investing across industries so as to minimize covariances among firms held.\textsuperscript{16}

In developing his portfolio theory for selecting alternatives under uncertainty, Markowitz began with the assumption that "... the investor does (or should) consider expected return a desirable thing and variance of return an undesirable thing."\textsuperscript{17} Thus the portfolio decision can be expressed in the form of a mean (E)–variance (V) analysis. Markowitz depicted the investment opportunity set as shown in Figure 1:


16Ibid., p. 599.  
17Ibid., p. 588.
the investor would (or should) want to select one of those portfolios which give rise to the \((E, V)\) combinations indicated as efficient \ldots \text{i.e.,} those with minimum \(V\) for given \(E\) or more and maximum \(V\) for given \(E\) or more and maximum \(E\) for given \(V\) or less.\(^{18}\)

It should be noted that the area representing the attainable \(E, V\) combinations in Figure 1 includes all risky alternatives confronting the investor.

An investor considers the broad range of investment alternatives (each with its own expected value and variance) facing him as a probability distribution. With regard to this frame of reference, Jensen noted:

\ldots that a rational individual, when faced with a choice under conditions of uncertainty, acts in a manner consistent with the expected utility maxim. That is, he acts as if he (1) attaches numbers (utilities) to each possible outcome and (2) chooses that option (or strategy) with the largest expected value of utility.\(^{19}\)

Given the normal distribution characteristics of security returns and the risk-averse nature of investors, Tobin has described investor utility in terms of a set of positively sloped indifference curves as shown in Figure 2.\(^{20}\)

The indifference curves in Figure 2 illustrate that the diversifying risk averter will accept added risk only if there is additional expected return.\(^{21}\)

\(^{18}\)Ibid., pp. 592-93.

\(^{19}\)Jensen, op. cit., p. 171.


\(^{21}\)Ibid., p. 611.
line OC reflects an opportunity set of risky alternatives indicating that expected return increases with an increase in risk. A maximization of utility would occur at M, point of tangency between indifference curve $I_2$ and the opportunity set OC.

Fig. 2 - Indifference Curves of Risk-Averse Investors
Going a step further, Sharpe has combined the work of Markowitz and Tobin to give the geometric representation of utility maximization shown in Figure 3.

Fig. 3 - Utility Maximization in An Uncertain World
The enclosed area represents all possible risky alternatives facing the investor. Point X would not be a feasible solution since investments C, M, and others dominate it. Utility would be greatest at M where the investment opportunity curve is tangent to indifference curve $I_2$, although other efficient portfolios may be found along the efficient line, ACMTO.  

The Time Period Problem

The acceptance of utility maximization as an underlying assumption in portfolio analysis poses a question as to the time period over which utility is calculated. The concept of utility for the risk averter connotes both present consumption, future consumption, and terminal wealth considerations. Naturally, an investment decision involved with these variables must also consider the time period question.

To illustrate, the short-term trader with current period consumption needs may wish to form a portfolio which will be cashed out or altered after six months at which time long-term capital gains treatment is available to him. Thus his period of utility analysis will likely be confined to a predictive horizon of one year or less. On the other hand the investor with sufficient salary to 

meet current and immediate future consumption needs may be only interested in building his estate by long-term growth vehicles. Theoretically, his analysis of utility is essentially a multi-period problem.

However, the multi-period problem does not in fact exist for even the long-term investor because of the constantly changing nature of market factors. With constantly changing micro and macro economic factors, political conditions, competition, new inventions, etc., it is necessary that the long-term investor periodically review and reassess each investment in his long-term portfolio. In reality the annual reporting requirements for firms with listed securities tacitly leads even long-term investors to a recurring one-period analysis of expected return and risk (and thus utility).

In its comments on this multi-period consumption-investment decision, the Committee on Research Methodology in Accounting noted that:

... the ... decision can be reduced to a one-period decision involving current consumption and terminal wealth at the end of the first period ... The individual can act as if he is solving a one-period problem, when, in fact, it is only one step in a recursive process. The conditions are quite general, and hence, the one-period formulation does not appear to be a restrictive one.²⁳

Many researchers in portfolio analysis and capital asset pricing have adopted this assumption. One example is Linter who assumed the investor:

²³Beaver, op. cit., p. 430.
... makes all purchases and sales of securities and all deposits and loans at discrete points in time, so that in selecting his portfolio at any "transaction point," each investor will consider only (i) the cash throw off (typically interest payments and dividends received) within the period to the next transaction point and (ii) changes in the market prices of stocks during the same period. The return on any common stock is defined to be the sum of the cash dividends received plus the change in its market price.24

Building on the earlier work of Markowitz, Tobin, and Sharpe, Jensen combined the Markowitz EV model with the indifference analysis of Tobin to produce the geometric representation of investor maximization shown in Figure 4.25

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If we consider investment among a set of alternatives limited to risky assets, then Portfolio C in Figure 4 would be the optimal combination. However, we have previously stated that the rational investor is more likely to be risk averse. This assumption is further supported by the fact that investment counselors usually recommend that investors refrain from risky security investments unless they have provided for a rainy day. Usually it is recommended that the investor own his home, have some insured savings, have adequate insurance on his life and property and some immediately available cash.

Therefore, the rational diversifier will likely divide his investment balances (those not needed for transaction purposes) between safe and risky assets. However, with transaction costs less than the risk-free rate of interest, Tobin has indicated the irrationality of holding cash, since it is a non-interest bearing obligation of the government; whereas a government bond is a near cash monetary asset free of default risk.26

Following Sharpe's earlier analysis27 Jensen has observed that with a given risk-free asset \( R_F \), an investor can obtain a higher Utility with Portfolio E in Figure 4 which is a combination of the risk-free asset \( F \) and portfolio M. As Jensen notes, other feasible solutions may lie below portfolio M on the straight line

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26 Tobin, op. cit., pp. 602-03.
27 Sharpe, op. cit., p. 660.
\( R_{FMZ} \) and are given by: 28

\[
E(R) = R_F + \frac{E(R_M) - R_F}{\sigma(R_M)} \cdot \sigma_R
\]  \hspace{1cm} (3.1)

\( \sigma(R) < \sigma(R_c) \)

Continuing, Jensen observes that if the investor can borrow as well as lend at the riskless rate, the line of feasible solutions can be extended beyond point M. 29

In this case lending portfolios are located on the efficient market line \( (R_{FMZ}) \) below point M. Borrowing portfolios would occur between points M and Z on \( R_{FMZ} \).

Equilibrium and the Capital Market Process

In reality each investor would likely have a different set of indifference curves. Sharpe has shown that differing sets of indifference curves are related to the efficient market line in a manner described in Figure 5. 30 For a given set of capital asset prices each investor would view his alternatives similarly under the following necessary assumptions:

First, we assume a common pure rate of interest with all investors able to borrow or lend on equal terms. Second, we assume homogeneity of investor expectations: investors are assumed to agree on the prospects of various investments—the expected values, standard deviations and correlation coefficients. . . . 31

In addition and as earlier stated, the capital asset pricing model in portfolio analysis assumes an efficient

\[\text{Jensen, op. cit., p. 175.}\]  \hspace{1cm} (28)

\[\text{Ibid.}\]  \hspace{1cm} (29)

\[\text{Sharpe, op. cit., p. 662.}\]  \hspace{1cm} (30)

\[\text{Ibid.}\]  \hspace{1cm} (31)
market without taxes or transaction costs where full information is equally available to all investors without costs. While these assumptions are obviously unrealistic, the value of a theory is related to the acceptability of its implications and not how realistic are its underlying assumptions.32

Fig. 5 - Equilibrium in a Market with Many Investors, Each with Different Indifference Curves

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32Ibid.
Whereas investor A in Figure 5 may lend some of his investment balances at the risk-free rate, the remainder will be invested in M, the market portfolio, so as to reach his preferred position at A. Investor B will neither lend or borrow and thus attain his preferred position at M by investing all available funds in the market portfolio. Investor C will borrow at the risk-free rate and invest all available funds in M so as to reach his preferred position at C where his indifference curve \( C_3 \) is tangent with the efficient market line.33

Investors A, B, and C and many other investors are simultaneously bidding for portfolio M causing the price of M to rise. With no change in the income expectations of M, then the \( E(M) \) will fall. Simultaneously, as all investors strive to obtain the market portfolio M, the demand for A, C, and other portfolios on the market declines. With constant income expectations for A and C and other portfolios the expected returns from these portfolios will rise making A and C more attractive to bidders for combination M. Therefore, many bidders for portfolio M will switch and purchase A, C, or other portfolios with greater expected returns than M. As this equilibrating process continues, the investment opportunity curve (or efficient market line) \( R_{pMZ} \) in Figure 5 becomes more linear and takes the form shown

\[33\] Ibid., pp. 662-63.
in Figure 6, giving one or more equilibrium points, each of which must be perfectly correlated according to Sharpe.\textsuperscript{34}

\textbf{Fig. 6 - Multiple Efficient Combinations of Risky Assets}

\textsuperscript{34}Ibid., pp. 663-64.
According to Jensen, a most significant result of the foregoing analysis is the fact that: "... in equilibrium the expected return on any efficient portfolio e will be linearly related to the expected return on the market portfolio M in the following manner:  

$$E(R_e) = R_F + \frac{E(R_M) - R_F}{\sigma(R_M)} \cdot \sigma(R_e)$$  

(3.2)

**Systematic Risk and the Pricing of Individual Assets**

Sharpe extended his analysis to show that a similar relationship in terms of $E(R)$ and $\sigma(R)$ existed between individual assets and efficient combinations of assets as depicted in Figure 7.  

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**Fig. 7 - Individual Assets in Relation to an Efficient Combination**

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35 Jensen, op. cit., p. 175.

36 Sharpe, op. cit., p. 665.
For a given asset T in combination with portfolio M all possible values of E(R) and \( \sigma(R) \) would lie along \( M^T \). It has been rigorously shown that such a line must lie tangent to the efficient market line \( R_{F,MZ} \) but within the area of all possible risky alternatives.\(^{37}\) In reality then it can be shown that a linear relationship exists between \textit{ex post} returns of Asset T and combination M as shown in Figure 8.\(^{38}\)

![Figure 8 - Relation of Individual Returns to Market Return](image)

This result gives rise to the concept of \textit{systematic risk} which Sharpe has defined as the component of asset T's total risk measured by the change in \( R(T) \) in response to changes in \( R(M) \). Therefore, the relationship between \( R(M) \) and \( R(T) \) can be used as an \textit{ex ante} predictive model.

\(^{37}\)Ibid., p. 666. \(^{38}\)Ibid., p. 667.
which states that all assets becoming a part of portfolio M are required to have $B_{tM}$ and $E_{Rt}$ values lying along $R_FZ$. Systematic risk is determinable in a similar manner for any other efficient combination since, as previously noted on page 66, the returns on all efficient combinations must be perfectly correlated in equilibrium. A concluding key point in this analysis is the fact that an asset's systematic risk cannot be diversified away when the asset is included in the combination which in turn has been used to calculate its systematic risk.\(^{39}\)

Applying Sharpe's equilibrium model, Jensen expresses the expected return on any single security as a linear function of the covariance of its returns with that of the market portfolio M in the following functional form.\(^{40}\)

$$E(R_j) = R_F + E(R_M) - R_F \cdot \frac{\text{cov}(R_j, R_M)}{\sigma^2(R_M)} \tag{3.3}$$

Within the context of efficiently diversified portfolios formed from risky assets with capital markets in equilibrium, equation 3.3 "implies that the relevant measure of the riskiness of any single security (or portfolio) is the quantity $\text{cov}(R_j, R_M)$, and the market price per unit of risk is $E(R_M) - R_F/\sigma^2(R_M)$."\(^{41}\)

\(^{39}\)Ibid., pp. 667-69.

\(^{40}\)Jensen, op. cit., p. 176.

\(^{41}\)Ibid.
Continuing, Jensen defines $B_j = \frac{\text{cov}(R_j, R_M)}{\sigma^2(R_M)}$ so that the expected one-period return on any individual asset (or portfolio) will be a linear function of its beta as depicted in Figure 9. Since individual security risk is related to the risk of the market portfolio, the beta value for the market portfolio is unity as shown in Figure 9, since $\text{cov}(R_M, R_M) = \sigma^2(R_M) = 1.42$

*Fig. 9 - The Risk-Return Relationship*

Disequilibrium in the Capital Markets--Its Implications

By Sharpe's own admission, the assumptions underlying the capital asset pricing model are "highly

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42Ibid., pp. 177-78.
restrictive and undoubtedly unrealistic. . . ."\(^{43}\)

Therefore, the capital asset model described in the preceding section is an ideal not likely attainable since equilibrium conditions seldom exist in the real world.

Fama's work with the random walk theory led him to conclude that disequilibrium is the most likely state of the market. Using intrinsic values as equilibrium values, Fama noted that:

In a world of uncertainty intrinsic values are not known exactly. Thus there can always be disagreement among individuals, and in this way actual prices and intrinsic values can differ.\(^{44}\)

However, it seems very likely from the research of Sharpe, Jensen and others that equilibrium theory applied in the context of an efficient market will indicate that the direction of change in security prices is toward the efficient market line shown in Figure 7.

Therefore, it is suggested that the difference between the expected return on a security and its equilibrium price as described in this chapter is important in the investor's decision to buy, sell or hold.

\(^{43}\)Sharpe, op. cit., p. 662.

CHAPTER IV

OPERATIONAL DESCRIPTION OF THE PRINCIPAL DECISION INPUT

The capital asset pricing model (3.3) described in the preceding chapter gives an ex ante relationship between the expected (equilibrium) return of an asset (or portfolio) and its systematic risk measurement ($B_j$). However, with the exception of the risk-free rate of return, the parameters of the model are expectational and thus unobservable. Therefore, in this form the model is not suitable for use in an empirical study such as this one.

Jensen has suggested that the expected return results derived by use of the model "... will be much more useful if they can be translated into a relationship between ex post realizations."¹ Therefore, this chapter will show how the capital asset pricing model of Chapter III is transformed from an ex ante model to an ex post model. In this revised form, the equilibrium or required rate of return for a given security can be determined empirically. This chapter will further show that the

difference between the actual rate of return and the expected rate of return described above is operationally determinable and thus a suitable measure of a security's actual market performance. This difference will become the decision input or dependent variable for this study. In other words, this performance measure will become the object to be predicted by the purchase-pooling accounting numbers of the sample firms in this study.

**Market Relationships**

Much of the recent research in security price behavior has been based on the market model first suggested by Markowitz. This stochastic model was originally expressed in the following form:

\[ R_j = A_j + B_j I + u_j \]  \hspace{1cm} (4.1)

where \( I \) represents some general index of market returns, \( u_j \) is a random variable uncorrelated with \( I \), and \( A_j \) and \( B_j \) are constants.\(^2\) Simply interpreted, the return on any security is a linear function of some general market factor.

Subsequently, Sharpe extended the market model by substituting returns on the market portfolio (\( M \)) for Markowitz's very general market index (\( I \)). Sharpe's model was expressed in the following manner:

\[ R_j = A_j + B_j M + u_j \]

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This model assumes that the only relationship between individual security returns is the fact that each individual return is related to the market portfolio (M) as in (4.2).³

Sharpe referred to this function as the diagonal model "... since its portfolio analysis solution can be facilitated by re-arranging the data so that the variance-covariance matrix becomes diagonal."⁴ As observed by Beaver, Kettler and Scholes, the principal advantage of the diagonal model is the reduction in the number of parameters to be estimated when compared to the original formulation by Markowitz.⁵

In Chapter III it was shown that the expected or


equilibrium return on an individual asset (j) is given by:

\[ E(R_j) = R_F + \frac{E(R_M) - R_F}{\sigma^2(R_M)} \cdot \text{Cov}(R_j, R_M) \]  

(3.3)

Fama extended Sharpe's work by substituting the market relationships of (4.2) into the definition of co-variance between an individual security and R(M) so as to give:

\[ \text{Cov}(R_j, R_M) = E \left\{ \left( B_j[R_M - E(R_M)] + u_j \right) [R_M - E(R_M)] \right\} \]

\[ = B_j \sigma^2(R_M) + \text{Cov}(u_j, R_M) \]

\[ = B_j \sigma^2(R_M) \]  

(4.3)

Substituting the right hand side of (4.3) into Sharpe's expression for the conceptual definition of equilibrium or required return (3.3) gives:  

\[ E(R_j) = R_F + \frac{[E(R_M) - R_F]}{\sigma^2(R_M)} \cdot B_j \sigma^2(R_M) \]  

(4.4)

\[ = R_F + B_j[E(R_M) - R_F] \]

According to Siebel's observation, equation (4.4):

\[ \ldots \text{implies that in computing the rate of return required to induce ownership, the slope (b_j) from a least squares regression of individual security returns may be substituted for the strictly unobservable measure of relevant risk (B_j)} \ldots \]

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Clarification of the Market Model

In an effort to clarify and expand Sharpe's capital asset pricing model, Fama discovered an inconsistency as regards the assumption that Cov\(U_i, R_M\) = 0. Whereas Sharpe's market factor \(R_M\) was an index of market returns, this specification could not hold since \(U_i\) was one of the terms in \(R_M\). Fama then suggested the following model in which the market term \(r_M\) "... is interpreted as a common underlying market factor which affects the returns of all assets."\(^8\) Fama's revised version of the Sharpe model is shown below:

\[
R = a_i + b_i r_M + e_i \\
E(e_i) = 0 \\
\text{Cov}(e_i, e_j) = 0 \\
\text{Cov}(e_i, r_M) = 0
\]

Continuing, Fama shows that the amount of required (or equilibrium) return \(E(R_j)\) is obtainable in the following functional form:

\[
E(R_j) = R_F + \left[ E(R_M) - R_F \right] \frac{b_i \xi X_j b \sigma^2(r_M) + X_i \sigma^2(e_i)}{\sigma^2(R_M)}
\]

"... where \(X_j\) is the proportion of the total market value of all assets that is accounted for by asset j."\(^9\)

The effect of Fama's work was to clarify and

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\(^8\) Fama, op. cit., p. 39.

\(^9\) Ibid., p. 36.
extend the general impressions of Sharpe, Lintner,10 and Lintner11 as regards the market model approach to the measurement of the risk premium for a given security. In the closing comments of his clarifying article Fama noted that the $r_M$ value in (4.6) could be scaled so that $X_ja_j = 0$, $E(r_M) = 0$, and $X_jb_j = 1$.12 Using these assumptions Jensen has extended the Fama model to the following form:13

$$E(R) = \frac{b_j \sigma^2(r_M) + X_j \sigma^2(e_j)}{\sigma^2(r_M)}$$  (4.7)

Immediately, we note that the market factor ($r_M$) is not observable. However, a simplifying technique to eliminate this term has been made possible by the empirical work of King. King studied sixty-three New York Stock Exchange securities over the period 1927-1960 and found "... that the typical stock has about half of its variance explained by an element of price change that affects the whole market."14

King also found that this percentage has been

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12 Fama, op. cit., p. 40.


diminishing over time with only about 31 per cent of the variance being explained by market factors for the latest years in his study period.\textsuperscript{15}

Utilizing the results of King's study and Fama's foundational work, Jensen has rigorously shown that $\sigma^2(r_M), \sigma^2(R_M)$ and $\sigma^2(e_j)$ are approximately equal in size.\textsuperscript{16} Hence (4.7) can be reduced to the form:

$$E(R_j) = R_F + [E(R_M) - R_F] \cdot (b_j + X_j) \quad (4.8)$$

However, as Jensen further observes, "since there are more than 1,000 securities on the New York Stock Exchange alone, $X_j$ will be much smaller than 1/1000 on the average, ..."\textsuperscript{17} Therefore, the $X_j$ may be dropped from (4.8) without serious effect. Equation (4.8) may be modified to the following form:

$$E(R_j) = R_F + (R_M - R_F)b_j \quad (4.9)$$

Equation (4.9) is an important result for this study. The significance is noted by Jensen who concludes that:

It gives us an expression for the expected return on security $j$ conditional on the ex post realization of the return on the market portfolio. ... We now have shown that we can explicitly use the observed realization of the return on the market portfolio without worrying about using it as a proxy for the expected return and without worrying about devising an ad hoc expectations-generating scheme.\textsuperscript{18}

The practical explanation of (4.9) is that the equation provides the rate of return required in a given

\textsuperscript{15}Ibid. \quad \textsuperscript{16}Jensen, op. cit., pp. 180-81.
\textsuperscript{17}Ibid. \quad \textsuperscript{18}Ibid., p. 188.
period (t) by an investor to justify his taking the risk related to a particular security (j).

The Horizon Problem

An underlying assumption of the capital asset pricing model is that all investors have identical length horizon periods. Obviously, this is not an accurate view of the real world. Investors are continuously trading every business day, and holding periods are likely to be both different and overlapping in most cases.

Jensen has rigorously demonstrated that the linear relationship of (4.9) "... will hold for returns calculated over a holding period of any length as long as we state the returns in terms of the proper compounding interval."^{19}

Given the previously stated assumption that there are no transaction costs and full information is available to all investors, Jensen suggests that the market horizon is instantaneous. This view is also supported by the observation that large numbers of investors with non-zero horizons are entering (or leaving) the market at exceedingly short time intervals.\textsuperscript{20}

Therefore, as Siebel has observed, "... market prices may behave as if investors all had instantaneous (i.e., very short and, therefore, homogeneous) horizon periods."\textsuperscript{21}

\textsuperscript{19}Ibid. \hspace{1cm} \textsuperscript{20}Ibid. \\
\textsuperscript{21}Siebel, op. cit., p. 110.
An analysis of the results of Jensen's empirical work demonstrates that where sample return data is continuously compounded, the estimated values of $b_j$ will be independent of the time period during which the returns are calculated. Therefore, an important conclusion for this study is the fact that ". . . we may calculate the measure of systematic risk ($b_j$) on the basis of the most efficient sample that is available, whether it be daily, monthly or yearly data. . . . "

**Functional Definition of the Decision Input**

The preceding section has supplied an ex post method for determining the measurement of systematic risk ($b_j$), that portion of a security's risk which cannot be diversified away since it is explained by general market movement. Used in conjunction with the risk-free rate and actual market returns, the required (or equilibrium) rate of return for assuming a given level of systematic (or relevant) risk associated with a particular security is given by (4.9). This portion of a security's return may be referred to as systematic return. However, the total return from investment in a given security will usually include abnormal returns in addition to systematic returns as noted in the following paragraphs.

It has been suggested by Beaver and the American Accounting Association Committee on Research Methodology

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22 Jensen, op. cit., p. 191.  23 Ibid.
in Accounting that "the market model is a specification of the stochastic process generating individual security returns." As previously noted, the model (4.1) states that security returns are linearly related to some general market factor. The market model suggests that a security's return can be decomposed into several distinct parts, characterized by the kind of events affecting the price of the security, namely:

1. Economy-wide or general market events.
2. Events affecting a particular company only.
3. Events affecting a particular industry.

As for industry-wide effects a comprehensive empirical study by King has shown that only about 10 percent of a security's variance is explained thereby. Therefore, industry effects have been successfully ignored by Jensen, Fama and others in empirical works previously cited in this paper.

As for economy-wide events, it is suggested that the effect of such events is principally reflected in the required (or equilibrium) return given by (4.9) repeated below:

\[ E(R_j) = R_F + b_j (R_M - R_F) \]  

(4.9)

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25 Ibid., p. 432.

26 King, op. cit., p. 166.
The remaining portion of a security's return would be that part which results from events peculiar only to that specific company. The measure of this portion of security return is given by the disturbance term \( u_j \) in (4.1). This part of a security's return is commonly referred to as the **abnormal** return in the sense that it is derived from events peculiar only to that particular company rather than economy-wide events affecting all companies. For example, a corporate tax increase would affect all companies, and the effect would be reflected in the market related portion of security return. On the other hand, if a company develops a significant new product with vast sales potential, or if it alone suffers a major strike, the effects of these individual events would usually be reflected in its abnormal portion of the total return.

Jensen has expressed the foregoing market relationships geometrically as shown in Figure 10.\(^{27}\)

The difference between a security's actual (realized) rate of return in period \( t \) and its required (or equilibrium) return as given by (4.9) can be interpreted as the security's performance measure for period \( t \). In other words as noted by Jensen, \( u_j \) is a very close approximation of the actual abnormal returns accruing to the holder of security \( j \) as opposed to the actual rate of return \( R_{FMj} \) he could have expected had he invested

\(^{27}\)Jensen, op. cit., p. 183.
in F and M at the same level of risk ($B_j$).\textsuperscript{28}

Ex Post

\begin{figure}
\centering
\includegraphics[width=\textwidth]{fig10}
\caption{Security Performance}
\end{figure}

"... the performance measure ... allows for the actual relationship between risk and return which existed during the particular holding period examined."\textsuperscript{29}

Recalling that all returns must be expressed in terms of the proper compounding interval, the functional derivation of the performance measure is given by the following equations:

$$RR_{jt} = \log e_{R_{Ft}} + (\log e_{R_{Mt}} - \log e_{R_{Ft}})b_j \quad (4.10)$$

where:

$RR_{jt}$ = required or expected return on security $j$ in period $t$

$R_{Ft}$ = 1 + yield available beginning of period $t$ on U. S. Government securities maturing at the end of period $t$

\textsuperscript{28}Ibid., p. 182. \quad \textsuperscript{29}Ibid.
\[ R_{Mt} = 1 + \text{rate of return realized on the market portfolio during period } t \]

Given the required return (\( RR_{jt} \)) from (4.10) the performance measure (\( P_{jt} \)) is obtained by:

\[ P_{jt} = \log_e R_{jt} - RR_{jt} \quad (4.11) \]

where:

\[ R_{jt} = 1 + \text{actual rate of return realized on security } j \text{ during period } t \]

Thus \( P_{jt} \) becomes the operational measure of the investor's decision input and is the dependent variable to be predicted in this study.

The actual measurement of the dependent variable will be discussed in the following chapter.
Chapter V

RESEARCH DESIGN

Introduction

As noted in Chapter II the development of portfolio theory provides for a risk adjusted measure of a security's actual performance. Decision makers assess many varied events and pieces of information as a basis for their market activities which in turn affect security performance. Accounting data (numbers, ratios, financial statements) attempt to measure events of interest to decision makers, for instance, business combinations.

In Chapter I we pointed out that purchase and pooling accounting methods have different effects on various accounting numbers important to investors. Probably the best example is earnings per share.

This study will attempt to test whether purchase accounting numbers are better predictors of a security's actual performance as compared to pooling methods. Several multiple regression models will be developed from the eleven accounting numbers (independent variables) under consideration. These variables are described later in this chapter.
General Description of the Models

The statistical procedures employed in this study are developed from the Statistical Analysis System (SAS) developed at North Carolina State University by Anthony J. Barr and James H. Goodnight.\(^1\)

The Statistical Analysis System (SAS) provides for a variety of multiple regression techniques to be performed on data coded under a single format. The principal statistical technique utilized in this study is stepwise multiple regression. In SAS, stepwise multiple regression can be performed under one of five optional forms:\(^2\)

1. Forward selection.
2. Backward elimination.
4. Maximum \(r^2\) improvement.
5. Minimum \(r^2\) improvement.

The maximum \(r^2\) improvement method was developed by James H. Goodnight and was selected for this study. According to Goodnight it "... is superior to the stepwise technique and almost as good as calculating regressions on all possible subsets of the independent variables."\(^3\)

Method 4 above differs from the first three methods

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\(^2\) Ibid., pp. 127-28.

\(^3\) Ibid., p. 128.
in that it does not settle on one particular model. Instead it searches out the best one-variable model, the best two-variable model, etc. In each case it finds the model with the highest $r^2$ statistic. As an example, in searching for the best two-variable model, the system looks through the remaining ten variables for the one variable which will increase the $r^2$ of the best one-variable model the most. In the process each variable in the two-variable model is compared with each variable not in the model. This procedure checks to see if removing a variable in the model and replacing it with one of the excluded variables would increase $r^2$. After all possible comparisons have been made, the switch which produces the highest $r^2$ is made and thus the best two-variable model is finally established. This same procedure is then followed in a search for the best three-variable model, etc.\textsuperscript{4} Thus in this study the SAS determines eleven individual models for each sample for each holding period being considered. This data then provides a systematic basis for determination of the five final models to be utilized in the predictive tests of this study.

The developers of SAS observe that the maximum $r^2$ improvement method:

... differs from the STEPWISE technique in that here all switches are evaluated before any switch is made. In the STEPWISE technique, removal of the "worst" variable may be accomplished without consideration of what adding the "best" remaining variables to the model would produce.

\textsuperscript{4}Ibid.
variable would accomplish.\textsuperscript{5}

This method of stepwise regression accomplishes three important steps in this study:

1. Computes a maximum value for $r^2$, the basic statistic in the study.

2. Permits an evaluation of the relative predictive value of each of the eleven independent variables in the study.

3. Provides a systematic basis for selection of the most appropriate predictive models for final use in the study.

Multiple regression models developed according to the above criteria take the following basic form:

\[
Y = a + b_1X_1, b_2X_2, \ldots, b_nX_n \quad (6.1)
\]

where

- $Y$ = DV Performance Measure for the Individual Firm
- $X_1$ = EPS1 Earnings Per Share before Extraordinary Items
- $X_2$ = EPS2 Earnings Per Share on Net Income
- $X_3$ = CR Current Ratio
- $X_4$ = NOII Income before Interest and Taxes divided by Sales
- $X_5$ = NOII2 Income before Interest and Taxes divided by Total Assets
- $X_6$ = NI1 Net Income divided by Sales
- $X_7$ = NI2 Net Income divided by Total Equity
- $X_8$ = COMEQ Common Equity divided by Total Capital

\textsuperscript{5}Ibid.
\( X_9 = BV \) Book Value of Common Stock
\( X_{10} = NBT \) Income before Taxes divided by Sales
\( X_{11} = TANR \) Tangible Assets divided by Total Assets

After an analysis of the frequency with which certain variables appeared significant in the maximum \( r^2 \) procedure, it was determined that the following five models would be used to assess the predictive ability of the purchase-pooling samples:

1. \( DV = f(\text{EPS2}) \)
2. \( DV = f(\text{EPS1,NI2}) \)
3. \( DV = f(\text{EPS1,TANR,NOI1,CR,BV}) \)
4. \( DV = f(\text{EPS1,CR,NOI2,COMEQ,TANR}) \)
5. \( DV = f(\text{all eleven independent variables}) \)

The Period of Study

Each model will be tested for calendar year holding periods of one to four years length as follows:


Two year periods - 1968 to 1969
1969 to 1970
1970 to 1971

Three year periods - 1968 to 1970
1969 to 1971

Four year periods - 1968 to 1971

This period of study has been selected because it appears that 1968 is the high point in a decade of heavy business combination activity. This increases the probability that adequate sample sizes can be developed.
Data Models Utilized

Three data models are utilized in computation of the values of the independent variables. For tests over the four one year periods, the data model will be the actual numerical value of the accounting number (earnings per share, book value, etc.)

The remaining holding periods are multi-year ranging from two to four years. Values assigned to the independent variables for these periods will be determined by two models:

1. The rate of change in "x" over the holding period.
2. The simple average of the yearly absolute values over the holding period.

Tests of Model Specification

The regression models will be first computed with all variables expressed in their normal (untransformed) form. Tests of the residuals will be made to insure that the models conform to the basic assumptions of linear regression analysis:  

1. Linearity.
2. Uniformity of scatter (homoscedasticity).
4. Independence.

---

Where necessary, loge transformations may be considered as a possible means of insuring compliance of the model results with the aforementioned assumptions.

Use of Matched Samples

For each model test, \( r^2 \) values will be computed for a pair of matched samples. The purchase sample will consist of companies which have engaged in business combinations using principally the "purchase" method of accounting. Similarly, the pooling sample will consist of companies using principally the "pooling" method of accounting for business combinations. The criteria for the selection of sample firms are presented in detail later in this chapter.

Interpreting the Results

The results of the regression analysis (\( r^2 \)'s) will be tested for statistical significance at the one, five, and ten per cent levels. For a given data model and holding period where both purchase and pooling samples have significant values of \( r^2 \), the relative predictive value of the purchase-pooling samples will be determined by comparison of the \( r^2 \) values obtained.

If the \( r^2 \) of one sample exceeds its matched counterpart by .05, that sample and its accounting method will be adjudged a significantly better predictor. The results will be analyzed to see if definite predictive superiority patterns emerge in any of the following ways:
1. Across the board superiority.
2. Superiority according to specific data model.
3. Superiority according to specific time periods.

Where one sample is judged the better predictor in 51 per cent or more of the significant cases in any one of the above three areas of analysis, that accounting method will be judged the better predictor of stock market performance.

**Empirical Measurement of the Dependent Variable**

Chapter IV has provided a theoretical basis for determination of the performance measure (dependent variable—DV) for this study. This section will describe the actual procedures applied in the computation of the measure.

Combining equations (4.10) and (4.11) from the preceding chapter gives the equation for determining the performance measure, which is:

\[
P_{jt} = \log_e R_{jt} - \left[ \log_e R_{Ft} + (\log_e R_{Mt} - \log_e R_{Ft})b_{j} \right]
\]

(5.1)

**Realized Return**

The Center for Research in Security Prices at the University of Chicago has developed a large volume of security price information on New York Stock Exchange securities. The various data tapes containing this information include capital changes and closing prices for each security on the tapes.
The data tapes are now distributed by Merrill Lynch, Pierce, Fenner & Smith, Inc. and were available to the author at the University of Iowa Computing Center.

The CRSP Price Relative Tape contains monthly price relatives for all common stocks listed on the New York Stock Exchange from January, 1926, through December, 1971. A price relative is equivalent to \(1 + \) the monthly return and is computed as follows:

\[
\frac{\text{Market price per share at close of business on the last business day of month } t \text{ plus dividends paid during month } t}{\text{Market price per share at the close of business on the last business day of the preceding month } (t - 1)}
\]

Realized return for a particular security over a certain time span (holding period) was determined by:

\[\ldots\ldots\text{multiplication of the monthly price relatives from the CRSP Price Relative Tape—which resulted in the security's terminal wealth ratio (i.e., } 1 + \text{ the rate of return) for that interval. The natural logarithm of this terminal wealth ratio is the measure of the continuously compounded rate of return realized on the security over the period.}^7\]

Realized returns were calculated for all successive one, two, three, and four year periods beginning with January, 1968. Therefore, for a firm with a fiscal year ending other than December 31, the exact rate of return could be secured from the list of successive returns referred to above.

\[7\text{Jerry D. Siebel, "An Empirical Investigation of the Usefulness to Investors of Published Annual Financial Statements" (unpublished Ph.D. dissertation, University of Iowa, 1970), pp. 129-30.}\]
Required Return

Required return in period $t$ is represented by the bracketed portion of (5.1).

The first term, $RF_t$, represents the return on risk-free assets during holding period $t$. The market yield on various U. S. Government certificates of indebtedness and selected note and bond issues as reported in the Federal Reserve Bulletin in the section "Money Market Rates" was used as the realized rate of return on risk-free assets ($RF$). For example, the market yield available on these types of securities during the first month of period $t$ was used as the measure of return realized on risk-free assets for the holding period $(t)$ beginning the first day of period $t$.

The second term in equation (5.1) represents the return realized on the market portfolio, $RM$, during period $t$. The computation of this return is based on a Composite Index of the individual monthly security price relatives from the Price Relative Tape referred to in the preceding section. This index was developed by the Business Administration Department of the University of Iowa and is weighted .56 arithmetic and .44 geometric. This procedure follows the original work of Fisher at the University of Chicago. 8

Since the market link relatives developed according

to the preceding paragraph are also equal to one plus the monthly rate of return, the return realized over any longer period can be calculated by successive multiplication of the link relatives in that given period.9

The third and final factor in equation (5.1) for required rate of return is the individual security risk factor, b_j. The discussion of systematic risk (b_j) in Chapter III has provided the theoretical support for use of this factor in the computation of required return.

Various approaches have been followed in the computation of risk measures or "betas" as they are now frequently called. Siebel used monthly return and market data for the period 1946 to 1966 in calculating his beta coefficients.10 Jensen's work with portfolio betas was conducted over the period 1955-1964. A conclusion of his portfolio study was that measures of systematic risk (betas) tend to be stationary over time.11 This result suggests that shorter periods of time are suitable for beta regression analyses.

Merrill Lynch, Pierce, Fenner & Smith, Inc. have now computed beta coefficients for various companies over the five year period ending December, 1971. Their

9 Siebel, op. cit., p. 128.
10 Siebel, op. cit., p. 120.
research builds on the earlier research of Markowitz, Sharpe, Jensen and others that have been referred to earlier in this paper. Their research has now been incorporated into a Security Risk-Evaluation Service available to their investment clients. Therefore, for the purposes of this study the betas used in computation of required rate of return are the Merrill Lynch betas, which are used with the permission of that firm.

Final Steps

The last step in the computation of the required rate of return calls for substitution of the individual security risk measure \( b_j \), the risk-free rate of return \( RF \), and the market rate of return \( RM \) into equation (5.1) for the various holding periods \( t \) under study.

The difference then between the Realized Rate of Return and the Required Rate of Return for a particular security for a given holding period constitutes that security's measure of performance for the holding period under study as graphically shown in Figure 10. This is the dependent variable (DV) which is to be predicted by the various accounting numbers from the concurrent time period.

The Independent Variables

A reader may pick at random a standard accounting text, a business finance text and an investment analysis book and very likely he will find a list of some 15-25
accounting numbers and/or key financial statement ratios common to each reference. Very likely these financial indicators could be divided into most of the following rather common classifications:

1. Profitability ratios (margin or return).
2. Liquidity ratios.
3. Capital structure ratios.
4. Turnover ratios.
5. Trend ratios.
6. Other miscellaneous types.

In his study of the usefulness of published financial statements to investors, Siebel made a comprehensive review of twenty-one security analysis references and found over sixty commonly used ratios in the securities field alone.\(^{12}\)

Dun and Bradstreet, the nationally known credit reporting firm, periodically publishes a brochure reporting fourteen key business ratios for firms classified according to Standard Industrial Classification Codes. Several of these ratios are incorporated in this study.

Despite the large number of apparently often used ratios, there is little evidence to show that the use of ratios is highly structured within the financial community in general or even in specified segments thereof. As an example of the latter condition, Deskins studied the uses of externally reported financial data by mutual funds

\(^{12}\)Siebel, op. cit., p. 139.
98

in 1965.13

A perusal of the responses from Deskins' respondents as to the type of quantitative systems analysis used in mutual funds failed to reveal the frequent use of any common list of procedures and/or ratios. Usually the lists contained less than ten ratios and even this small list varied among most of the funds reported on.

Deskins' findings on information systems of mutual funds served to:

. . . confirm the intrinsic value approach. . . . It also highlighted the importance of the measurement of liabilities as well as emphasized the importance of rate of return on common equity as an important measure, from the investor's viewpoint.14

Deskins also found that the "... analysts gave much attention to earning power."15 This confirms an earlier finding of Graham, Dodd, and Cottle who observed that:

. . . the more aggressive analysts are now using past income primarily as a guide to formulating estimates of future earnings, or "earning power," which will serve as the chief basis of their conclusions respecting the merits of a common stock.16

Deskins found from his interviews that establishing

14 Ibid., p. 198. 15 Ibid.
the historical "true operating (or ordinary earnings)" of the firm is basic in the determination of earning power.\(^{17}\)

Criteria for Selection

The eleven accounting numbers listed below were selected according to one or more of the following criteria which are listed in the order of importance from the investigator's viewpoint:

1. It is a number or ratio value likely to differ because of the purchase-pooling choice.
2. It is a commonly found profitability, margin, return, or turnover ratio.
3. It is necessary to provide a limited yet adequate cross-section of the ratio population giving consideration to the relatively small sample sizes in the study.
4. It is unique to this study in the judgment of the author.

The eleven accounting numbers representing the independent variables of the study are:

1. Earnings Per Share on Net Income.
2. Earnings Per Share before Extraordinary Items.
3. Operating Margin (Net Operating Income divided by Sales).
4. Earning Power (Net Operating Income divided by Operating Assets plus Goodwill or "Excess Cost of Acquired

\(^{17}\)Deskins, op. cit., p. 199.
5. Profit Margin (Net Income divided by Sales).
6. Rate of Return (Net Income divided by Common Equity plus Intangible Assets).
7. Common Equity divided by Total Capital (Equity plus Long-Term Debt).
8. Book Value (Common Equity divided by outstanding shares).
11. Tangible Assets divided by Total Assets.

In number 4 and 6 above, it is recognized that most financial analysts would likely exclude intangibles in the computation of these ratios. However, this exception seems justified particularly for this study since intangibles are uniquely related to one of the controversial alternatives being investigated (the purchase method). Further justification appears to be found in paragraph 21 of Accounting Principles Board "Opinion No. 17," wherein the Accounting Principles Board has stated that:

... the cost of goodwill and similar assets is essentially the same as the cost of land, buildings, or equipment under historical-based accounting. All assets which are represented by deferred costs are essentially alike in historical-based accounting. They result from expenditures or owners' contributions and are expected to increase revenue or reduce costs to be incurred in future
Therefore, if purchased goodwill is in fact productive, it should be reflected in the accounting numbers and impounded in the market price of the shares immediately upon recognition.

The Multicollinearity Question

Multicollinearity may occur in multiple regression analysis when the independent variables are highly correlated with each other. It is evident that in the independent variables selected for this study, there is the possibility of inter-correlation between several. However, although multicollinearity will likely affect the net regression coefficients of several variables, as noted by Spurr and Bonini, "... it may not alter the predictive power of the total regression equation."19

The Criteria for Sample Selection

Sample firms were chosen from firms classified as industrial whose common stock was listed on the New York Stock Exchange in 1968. Utility and transportation companies were excluded largely because they are affected by unique governmental regulations not common to industrial firms. Merchandising firms were excluded so


19Spurr and Bonini, op. cit., pp. 610-11.
that a more homogeneous type of sample population would be available. Similar types of firms could be expected to generate consistently more comparable data which should aid in the statistical analyses of the two accounting methods.

In addition a comprehensive classification system for industrial firms is available which permits specialized selection procedures related to a particular class of industrial firm. This will permit more accurate matching of sample firms.

**New York Stock Exchange Firms**

Selection of sample firms was confined to companies listed on the New York Stock Exchange for several reasons.

First, since the return data for sample companies is to be taken from the CRSP Price Relative Tape referred to earlier in this chapter, sample firms must be limited to those on the tapes. The CRSP tapes are limited to New York Stock Exchange companies. A list of company names and CRSP code numbers is available at the University of Iowa Business Administration Library, Iowa City, Iowa. Thus a preliminary list of sample firms satisfying other criteria listed below must be finally checked against the master list of companies on the CRSP tapes.

Secondly, the New York Stock Exchange is the largest securities exchange. Therefore, more of the large industrial firms involved in extensive significant
business combination activity are listed there rather than on other exchanges. Most trading activity takes place on the New York Stock Exchange in terms of the number of traders, the volume of shares traded, and the dollar value of shares exchanged. All of these factors contribute to the "efficient market" image which the "Big Board" conveys to many persons in the financial and academic communities. This idea is very important since the efficient market hypothesis is an important assumption in the theoretical development of the dependent variable as outlined in Chapter III.

The significance of a highly efficient securities market is emphasized in business combinations where consideration is often in the form of securities. Unless the securities of the participating companies are actively traded, it is difficult to arrive at fair exchange values which are incorporated in the records of account of the surviving company.

The names of firms listed on the New York Stock Exchange are readily available in the Wall Street Journal and Barron's, daily and weekly financial papers published by Dow Jones and Company for the financial community.

The Investigation Procedure

The history of each listed company was analyzed in Standard and Poor's Corporation Records. These

records are comprehensive and currently maintained for hundreds of corporations including such firms as are listed on the New York Stock Exchange.

Among other forms of information, these records provide brief chronological details on any significant business combination activity engaged in by a firm. Firms which engaged in one or more business combinations during the base period 1966-1968 according to these records were considered as a preliminary list of possible sample companies.

Although poolings are somewhat easily identified in these records, the same is not true for purchases. Therefore, it was necessary that Annual Reports be investigated for positive identification of the actual type of business combination engaged in. Annual Reports for the preliminary list of possible sample companies were requested for the years 1966-1971. After the Annual Report analysis was concluded, it was possible to divide the preliminary list of possible sample companies into two groups. The purchase list was made up of companies engaging principally in combinations classified as purchases during the period 1966-1968. The pooling sample consisted of companies which engaged in business combinations during 1966-1968 which were principally accounted for by the pooling alternative.
The Basic Selection Procedure

For a company to qualify initially for the purchase sample, all of the combinations engaged in must have been accounted for as purchases, or if poolings were involved, the effect on the financial statements was classified as minor as hereafter defined.

To insure trend data which shows a purchase or pooling "character," the sample company must show a history of primarily purchase or primarily pooling accounting for the period 1966 to the decision date being evaluated. A mixture of the two accounting methods during the period described above did not disqualify a company from inclusion in a particular sample provided:

1. The total value of assets acquired in the exceptional cases was less than 25 per cent of the total assets at January 1, 1966.

2. Net Income was less than 10 per cent of the Net Income of the acquiring company for the last year preceding January 1, 1966.

As an exception to the foregoing basic criteria, a company was included in the purchase sample despite the existence of poolings not meeting the above minimum standards provided its 1968 Balance Sheet reflected an amount of goodwill or "excess cost over book value of assets acquired" meeting certain standards. The amount of goodwill or "excess cost" must have equaled or exceeded 10 per cent of the firm's total assets. It is believed
that such companies overtly demonstrate a "purchase" character in their records.

**Industry Classification**

After a company was classified as a purchase it was assigned a three digit code according to its specific industry classification. These classifications are the Standard Industrial Classifications established by the U. S. Government, which have been applied to individual firms by Standard and Poor's Corporation. 21

**The Matching Process**

Once the purchase sample of companies was selected a pooling sample was selected using two basic criteria.

First, each company in the purchase sample was matched by three digit SIC code with a pooling candidate. This placed the two firms in basically the same industry.

The second criterion related to asset size and required judgment on the part of the author. Where two or more matching candidates were available, the company selected was more closely related in asset size to its purchase counterpart. Because of the limited number of purchase companies available, the size rule was not rigorously enforced where only one pool candidate was available. The relaxation of this standard to some degree may be considered a limitation to the study, but the

21 *Compustat Company and Industry Names and Codes* (June, 1971).
incidence was relatively infrequent and rarely extreme. Therefore, the effects of such an interpretation are not considered serious.

**Other General Criteria**

In general companies selected for the two sample groups had December 31 Balance Sheet dates. However, to insure adequate size samples, this criterion was relaxed for those companies whose fiscal periods fell between September 30 and March 31.

For example, a company with a fiscal year ending October 31 would have its performance measure (DV) computed over its actual fiscal period. However, in the regression analysis, this company would be correlated with other companies whose fiscal years ended September 30, October 31, November 30, or December 31.

Because the relaxation of the December 31 requirement was required in a very few cases, there appears to be no serious effect upon the uniformity of the performance periods being measured for the respective sample companies.

The type of consideration used in effecting the subject business combinations could be either cash, common stock, preferred stock, bonds or any combination thereof.
Limitations in the Sampling Procedure

The exclusion of all combining firms not listed on the New York Stock Exchange may introduce bias in the results. It is possible that the effect of different accounting methods is more likely to be perceived where the relative sizes of the participating companies are similar. This is in contrast to the very large company which might acquire a number of smaller companies with little noticeable effect on its financial indicators. Therefore, discernible results will necessarily be limited in their implications to firms listed on the New York Stock Exchange.
CHAPTER VI

RESULTS, CONCLUSIONS AND RECOMMENDATIONS

Introduction

Before presenting the results of this study, it will be helpful to briefly restate the purpose of the study and the methodological approach utilized.

Chapter I identified the purchase-pooling alternatives as two theoretically sound accounting methods from the viewpoint of the American Institute of Certified Public Accountants. At the same time the existence of dissenting viewpoints both in and out of the accounting profession was observed, which emphasized the need for new definitive ways to evaluate the two alternatives.

Chapter II presented the predictive ability criterion as a suitable basis for testing the usefulness to investors of the two alternatives. In Chapter III the relationship of accounting information to the investor's decision process was established. Then an observable performance measure was developed in Chapter IV which was to be the objective of the predictive tests described in Chapter V.

A Priori Expectations

The hypothesis to be tested in this study was
given in Chapter I as follows:

As between the purchase and pooling methods of accounting for business combinations, financial statements prepared using the purchase method of accounting more clearly reflect the events which are useful to investors in the prediction of a stock's actual future performance and are, therefore, more closely associated with a stock's actual performance in the period measured.

The expected superiority of the purchase method was based on the following points:

1. The security markets were assumed to be near perfect; therefore, security prices at any time reflect all available information relating to the future service potential of the firm's assets.

2. Purchase accounting procedures give effect to new transaction values, whereas the pooling method merely combines the historic book values reflected on the books of the combining firms.

Results of the Tests

The primary test is provided by the coefficient of determination ($r^2$) results for the eleven variable model which is described functionally as:

$$DV = f(EPS1, EPS2, CR, NOI1, NOI2, N11, N12, COMEQ, BV,$$

$$NBT, TANR)$$

Secondary tests are provided by the correlation measures determined from these selected models:

$$DV = f(EPS2)$$

$$DV = f(EPS1, NI2)$$

$$DV = f(EPS1, CR, NOI2, TANR, COMEQ)$$
**DV = f(EPS1,TANR,NOI1,CR,BV)**

These particular models were judgmentally determined with major consideration given to the order in which variables were selected in the stepwise regression analysis of the eleven variable model first described above.

Tables 1 and 2 below depict the order and frequency with which particular variables were selected in the stepwise maximum $r^2$ procedure.

**Table 1**

FREQUENCY AND ORDER OF SELECTION OF THE INDEPENDENT VARIABLES

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Order of Selection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>NI2</td>
<td>9</td>
</tr>
<tr>
<td>TANR</td>
<td>1</td>
</tr>
<tr>
<td>BV</td>
<td>5</td>
</tr>
<tr>
<td>COMEQ</td>
<td>1</td>
</tr>
<tr>
<td>EPS2</td>
<td>4</td>
</tr>
<tr>
<td>NOI1</td>
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<tr>
<td>EPS1</td>
<td>5</td>
</tr>
<tr>
<td>CR</td>
<td>1</td>
</tr>
<tr>
<td>NOI1</td>
<td>1</td>
</tr>
</tbody>
</table>

<sup>a</sup>See pages 88 and 89 for description of variables.

Probably the most noteworthy result in Table 1 is the apparent importance of the variable, TANR, which is the ratio of tangible assets to total assets. In the stepwise regression procedures, TANR was selected first,
Table 2
FREQUENCY AND ORDER OF SELECTION OF THE INDEPENDENT VARIABLES BY DATA MODELa

<table>
<thead>
<tr>
<th>Independent Variableb</th>
<th>Model Order</th>
<th>ONE 1-3</th>
<th>ONE 1-5</th>
<th>TWO 1-3</th>
<th>TWO 1-5</th>
<th>THREE 1-3</th>
<th>THREE 1-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPS1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EPS2</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>CR</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>NOI1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>NOI2</td>
<td>4</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>NI1</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>8</td>
<td>-</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>NI2</td>
<td>3</td>
<td>5</td>
<td>8</td>
<td>12</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>COMEQ</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>BV</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>NBT</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>TANR</td>
<td>4</td>
<td>5</td>
<td>9</td>
<td>10</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

aModel One - Numerical value of the variable for a year.
Model Two - Simple average of annual values of the variable over the holding period.
Model Three - Rate of change in the variable over the holding period.

bSee pages 88 and 89 for description of variables.
second, or third in fifteen of the thirty-two runs using the eleven variable model. This was the highest frequency of any of the eleven variables. On the basis of selections one through five, TANR was the second most frequently selected variable; NI2 (Net Income divided by Total Equity) was the most frequently selected variable; and NOI2 (Operating Income divided by Total Assets) was the fifth most frequently selected variable. This would seem to indicate that the market attaches considerable importance to intangibles in setting equilibrium prices. In other words, the $r^2$ values reflect a noticeably positive association between TANR, NI2, NOI2, and security performance as measured in this study. Because intangible asset values are included in TANR, NI2, and NOI2, the resulting close association of these variables with security performance seems to suggest that intangible values are significantly discounted in the market process.

**Regression Statistics--A Methodological Overview**

Tables 5 through 19 appearing in the next section of this chapter present the regression statistics for the five functional models described in the preceding section. For each regression model, statistics are presented in summary form in Tables 3 and 4. These tables summarize the results of the regression analyses including the test of the F-values at the one, five, and ten per cent levels of significance.

The $r^2$'s for the matched pairs of purchase and
pooling samples were judged eligible for comparison provided the F-values were significant at least at the 10 per cent level. In addition to the statistical significance requirement, to be classified as a clearly comparable case, the pair of samples to be compared had to meet an arbitrary .05 test described below:

1. If the purchase sample $r^2$ exceeded the pooling sample $r^2$ by at least .05, then the purchase sample was rated the best predictor for that data model and holding period. Conversely, if the pooling sample $r^2$ exceeded the purchase sample $r^2$ by at least .05, then the pooling sample was rated the better predictor.

2. If neither sample $r^2$ exceeded the other by at least .05, then the results were classified as "inconclusive."

This non-statistical dichotomous test is designed to compensate for a reasonable portion of sampling error which normally can be expected from the multitude of mathematical computations necessary in data accumulation. This procedure appears reasonable as a result of the examination of the "inconclusive" cases apart from the .05 error rule. Of the fourteen inconclusive cases, the purchase method was the better predictor in six cases and the pooling method was the better predictor in eight cases. By eliminating these marginal cases which were almost evenly distributed, attention could be focused on those cases with a material difference in $r^2$ values.
Tests Results Summarized—Their Implications

The results of these prediction classifications are tabulated in Tables 3 and 4. Table 4 displays the predictions by regression model and data model, and Table 3 shows the overall tabulation of predictions according to regression models only.

Table 3

SUMMARY OF PREDICTIONS BY REGRESSION MODEL

<table>
<thead>
<tr>
<th>Regression Model(^a)</th>
<th>Best Predictor</th>
<th>Pu</th>
<th>Po</th>
<th>Inconclusive</th>
</tr>
</thead>
<tbody>
<tr>
<td>EPS2</td>
<td></td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>EPS1, NI2</td>
<td></td>
<td>3</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>EPS1, CR, NOI1, BV, TANR</td>
<td></td>
<td>6</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>EPS1, CR, NOI2, COMEQ, TANR</td>
<td></td>
<td>7</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>EPS1, EPS2, CR, NOI1, NOI2, NI1, NI2, COMEQ, BV, NBT, TANR</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>25</td>
<td>11</td>
<td>14</td>
</tr>
</tbody>
</table>

\(^a\)See pages 88 and 89 for description of variables.

The test results do not provide conclusive proof of the superiority of the purchase method of accounting, since one-half of the tests were either inconclusive or favored the pooling method. In the fourteen inconclusive tests, neither method was clearly comparable based on the
<table>
<thead>
<tr>
<th>Regression Model&lt;sup&gt;x&lt;/sup&gt;</th>
<th>1 year Data&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Average Data&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Rate of Change Data&lt;sup&gt;d&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Best Predictor Pu Po Inc.&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Best Predictor Pu Po Inc.&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Best Predictor Pu Po Inc.&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>EPS1, EPS2, CR, NOI1, NOI2, NI1, NI2, COMEQ, BV, NBT, TANR</td>
<td>1 1 0</td>
<td>3 0 0</td>
<td>3 0 1</td>
</tr>
<tr>
<td>EPS2</td>
<td>1 1 0</td>
<td>1 0 2</td>
<td>0 0 1</td>
</tr>
<tr>
<td>EPS1, NI2</td>
<td>1 2 0</td>
<td>2 2 2</td>
<td>0 1 1</td>
</tr>
<tr>
<td>EPS1, CR, NOI2, COMEQ, TANR</td>
<td>2 0 1</td>
<td>2 1 1</td>
<td>3 0 1</td>
</tr>
<tr>
<td>EPS1, CR, NOI1, BV, TANR</td>
<td>2 1 0</td>
<td>2 1 2</td>
<td>2 1 2</td>
</tr>
<tr>
<td>Totals</td>
<td>7 5 1</td>
<td>10 4 7</td>
<td>8 2 6</td>
</tr>
</tbody>
</table>

<sup>a</sup> - Inconclusive.
<sup>b</sup> - Actual Numerical Value of the Variable over one year holding period.
<sup>c</sup> - Simple Average of Annual Values of the Variable over the holding period.
<sup>d</sup> - Rate of Change in the Variable over the holding period.
<sup>x</sup> - See pages 88 and 89 for description of the variables.
.05 error rule previously described. However, it is significant that in the thirty-six clearly comparable cases, the purchase method was the better predictor in 69 per cent of the cases.

**Analyzing the Results by Data Model**

Analysis of the results by data model as shown in Table 4 reveals that the purchase method is consistently superior across data models which encompass varying time spans from one to four years in length. For example, a comparison of the predictive results according to data models shows the purchase samples progressively superior in the following way:

<table>
<thead>
<tr>
<th>Data Model</th>
<th>Purchase Samples as Best Predictor—Percentage of Total Comparable Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Data</td>
<td>7 of 12 cases or 58%</td>
</tr>
<tr>
<td>Average Data</td>
<td>10 of 14 cases or 71%</td>
</tr>
<tr>
<td>Rate of Change Data</td>
<td>8 of 10 cases or 80%</td>
</tr>
</tbody>
</table>

These results provide considerable insight into the usefulness of the information generated by the two accounting methods as viewed by the investor. It would appear that purchase accounting information is more in harmony with the information set the market uses to establish equilibrium prices. As evidenced by the $r^2$ values in the study, this relationship appears to be strengthened as the study period is extended from annual data to multi-period data with varied market conditions.
In other words, considering both bull and bear market conditions which existed during the study period, the purchase accounting data seem to reflect the market's expectations more consistently than the pooling data.

Opinions and results of the preceding paragraph are both confirmed and strengthened by analysis of the results of the two multi-year data models (2 and 3) according to the time period studied, namely:

<table>
<thead>
<tr>
<th>Length of Holding Period</th>
<th>Purchase Sample as Best Predictor--Percentage of Total Comparable Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 year periods</td>
<td>5 of 7 cases or 71%</td>
</tr>
<tr>
<td>3 year periods</td>
<td>6 of 10 cases or 60%</td>
</tr>
<tr>
<td>4 year period</td>
<td>7 of 7 cases or 100%</td>
</tr>
</tbody>
</table>

These results depict purchase accounting data as more stable over time. This would seem to offer some justification for the purchase accounting procedure of capitalizing the market values of securities given in exchange for assets of the non-surviving company in a business combination. This conclusion is supported by the fact that intangible values were included in three of the independent variables contrary to typical security analysis procedures. These variables are: (1) TANR--Tangible Assets divided by Total Assets, (2) NOI2--Net Operating Income divided by Operating Assets plus Goodwill or Excess Cost of Acquired Assets, and (3) NI2--Net Income divided
by Common Equity plus Intangible Assets. According to Table 1 these three variables were among the first five in frequency of selection in the stepwise regression procedures, thus emphasizing their importance in the investor decision process.

**Analyzing the Results by Regression Model**

Examination of the results according to the five regression models is shown in Table 3. These results show that the purchase method was superior in four of the five models based on the thirty-six clearly comparable cases. As Table 3 shows, neither the purchase or pooling method has a clearly superior position based on the combined results of the one and two variable models which included the variables EPS1, EPS2, and NI2. In these two models, five of the eleven comparable cases favored purchasing. It is generally recognized that earnings per share (EPS1 and EPS2) and rate of return (NI2) figures are accounting numbers frequently found in investor decision models. Earnings per share figures and price-earnings ratios are emphasized in the publicly issued quarterly and annual reports of listed corporations. Similarly, return on equity (NI2) is one of the most often used indicators among financial analysts and research firms.

This perennial emphasis on earnings per share and return on equity figures would suggest that these variables probably are the principal inputs into investor decision
models. However, the importance of other accounting numbers to investors seems to be emphasized as the number of variables increases to five and eleven in the other three regression models. In fact, the superiority of the purchase method is further shown in Table 3 as the number of variables in the models increases from one to eleven.

In the three five and eleven variable models, twenty of the twenty-five comparable cases show the purchasing sample to be superior. This would seem to indicate that investor decision models are actually much broader than many theorists have believed. In other words, too much emphasis may be placed on per share and return figures by marginal investors to the exclusion of other meaningful accounting numbers such as disclosed in this study.

Results at a Higher Level of Statistical Significance

If a stricter test is made at the 5 per cent level of statistical significance, the results are very similar to that already reported. The number of comparable cases is reduced from fifty to forty-three, with the following distribution which can be compared with the totals of Table 3:

| Purchase method favored       | 21 |
| Pooling method favored        | 9  |
| Inconclusive according to the .05 error rule | 13  |
The results are only slightly different from that obtained with the 10 per cent statistical significance test. At the 5 per cent level of statistical significance the purchase method is favored in twenty-one of thirty or 70 per cent of the clearly comparable cases as compared to 69 per cent with the 10 per cent statistical significance test.

**Results Without the .05 Error Rule**

Some critics may object to the arbitrary .05 error rule applied to the regression $r^2$'s in the determination of the clearly comparable cases. If the rule is ignored, and the results are tabulated on the basis of the absolute $r^2$ values, the results are not significantly altered. For example, at the 10 per cent level of statistical significance, thirty-one of fifty or 61 per cent of the comparable cases favor the purchase method of accounting. At the 5 per cent level of statistical significance, twenty-seven of forty-three or 63 per cent of the comparable cases favor the purchase method of accounting.

These comparative results are shown below:

<table>
<thead>
<tr>
<th>Sample</th>
<th>Level of Significance</th>
<th>Prediction Results</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>With Error Rule</td>
<td>Without Error Rule</td>
</tr>
<tr>
<td>Purchase</td>
<td>10%</td>
<td>69%</td>
<td>61%</td>
</tr>
<tr>
<td>Pool</td>
<td>10%</td>
<td>31%</td>
<td>39%</td>
</tr>
<tr>
<td>Purchase</td>
<td>5%</td>
<td>70%</td>
<td>63%</td>
</tr>
<tr>
<td>Pool</td>
<td>5%</td>
<td>30%</td>
<td>37%</td>
</tr>
</tbody>
</table>
Thus, in this across the board test, these results show the purchase method to be the better predictor in a strong majority of the comparable cases.

**Stock Market Conditions**

A review of the general nature of the stock market during the period 1968-1971 provides additional insight into the results. First, we recall that 1968 was the peak year in a decade of intensive business combination activity. Also, a major bull market was nearing its peak. The bear market which began in 1969 lasted through 1970, thus spanning much of the study period.

For single year data (Data Model 1), the purchase samples were clearly the better predictors in the bear market of 1969-1970 with seven of eight cases favoring the purchase method. The pooling method was clearly superior during the bull market return of 1971 with all five comparable cases favoring the pooling method.

The results observed in the multi-year regression models tend to confirm that of the single year data model cited above. For instance, in the period 1969-1970 (mostly a bear market), the results from the Average and Rate of Return Data Models clearly show purchasing to be the better predictor in all four comparable cases. These results reflect the conservative psychology of the market during most of this period. In the period 1969-1971, four of the six comparable cases showed purchasing to be superior as most of this period was characterized as a
bear market. In the period 1968-1971, all six comparisons showed purchasing to be superior. The conservative impact is noted even though the market recovery was well underway in 1971. This is likely due to the fact that most stocks generally recover more slowly from bear market conditions, especially those companies which may have experienced a speculative run-up without strong intrinsic value support.

The foregoing results seem to confirm some of the expectations many have regarding the two methods of accounting. Some theorists have suggested that pooling accounting methods often give an inflated appearance to post-merger earnings per share figures. Such inflated earnings would tend to support the often speculative run-up of price-earnings ratios common to a bull market situation. On the other hand, in a bear market the more conservative type of security appraisal usually takes over. Such a pattern of market behavior seems to be found in a study by Jules Backman in 1970. Backman studied the stock price activity of ten conglomerate firms from their high and low of 1968 (a bull market) to April, 1970 (a bear market). His study showed steep declines in the stock prices for these combining firms which had principally a history of pooling accounting.¹

Since the performance measure used in this study

adjusts for general market movements, it is unlikely that these results are due to market-wide influences. Perhaps this observed phenomena is due to a relatively greater tendency for weaker firms to use the pooling method rather than purchasing, since they can less "afford" the dampening effect on earnings of the latter method. Nevertheless, it appears that investors' market reactions to the two accounting methods are to some degree related to the general market conditions prevailing at a given point in time.

Introducing the Regression Statistics

The actual regression statistics are presented in the tables appearing on the following pages. For each of the five regression models described on pages 88 and 89, coefficients of determination \( r^2 \)'s for the various purchase and pooling samples are presented according to three data models in the following manner:

| Tables 5-9 | Data Model 1--Numerical Value of the Independent Variable for One Year Data |
| Tables 10-14 | Data Model 2--Simple Average of Annual Values of the Variable Over Multi-Year Holding Periods |
| Tables 15-19 | Data Model 3--Rate of Change in the Variable Over Multi-Year Holding Periods |

Best predictor determinations are indicated only for samples with F-Values which indicate statistical significance at least at the 10 per cent level.
### TABLE 5

**COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)**

Predictive Model: $DV = f(EPS_1, EPS_2, CR, NOI_1, NOI_2, NI_1, NI_2, COMEQ, BV, NBT, TANR)$

Data Model: Numerical Value of the Independent Variable

<table>
<thead>
<tr>
<th>Sample</th>
<th>Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>$&gt; F$</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pu</td>
<td>1968</td>
<td>43</td>
<td>0.236</td>
<td>0.869</td>
<td>0.578</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Po</td>
<td>1968</td>
<td>42</td>
<td>0.180</td>
<td>0.599</td>
<td>0.815</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Pu</td>
<td>1969</td>
<td>43</td>
<td>0.565</td>
<td>3.668</td>
<td>0.002</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>Purchase</td>
</tr>
<tr>
<td>Po</td>
<td>1969</td>
<td>44</td>
<td>0.461</td>
<td>2.485</td>
<td>0.022</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>Pool</td>
</tr>
<tr>
<td>Pu</td>
<td>1970</td>
<td>43</td>
<td>0.548</td>
<td>3.414</td>
<td>0.004</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>Po</td>
<td>1970</td>
<td>44</td>
<td>0.280</td>
<td>1.134</td>
<td>0.369</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Pu</td>
<td>1971</td>
<td>44</td>
<td>0.413</td>
<td>2.048</td>
<td>0.056</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>Pool</td>
</tr>
<tr>
<td>Po</td>
<td>1971</td>
<td>42</td>
<td>0.533</td>
<td>3.118</td>
<td>0.007</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td></td>
</tr>
</tbody>
</table>

*See pages 88 and 89 for description of variables.*
TABLE 6

COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)

Predictive Model: $DV = f(\text{EPS2})$

Data Model: Numerical Value of the Independent Variable

<table>
<thead>
<tr>
<th>Sample</th>
<th>Holding Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>Probability $\gg F$</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pu</td>
<td>1968</td>
<td>43</td>
<td>.000</td>
<td>.006</td>
<td>.937</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Po</td>
<td>1968</td>
<td>42</td>
<td>.084</td>
<td>3.683</td>
<td>.059</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Pu</td>
<td>1969</td>
<td>43</td>
<td>.085</td>
<td>3.814</td>
<td>.054</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>yes</td>
</tr>
<tr>
<td>Po</td>
<td>1969</td>
<td>42</td>
<td>.003</td>
<td>.141</td>
<td>.710</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Pu</td>
<td>1970</td>
<td>43</td>
<td>.243</td>
<td>13.181</td>
<td>.010</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Po</td>
<td>1970</td>
<td>44</td>
<td>.175</td>
<td>8.925</td>
<td>.005</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Pu</td>
<td>1971</td>
<td>44</td>
<td>.177</td>
<td>9.058</td>
<td>.005</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
<td>Po</td>
<td>1971</td>
<td>42</td>
<td>.337</td>
<td>20.374</td>
<td>.001</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

aSee pages 88 and 89 for description of variables.
TABLE 7

COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)

Predictive Model: $DV = f(EPS1, NI2)^a$

Data Model: Numerical Value of the Independent Variable

<table>
<thead>
<tr>
<th>Sample</th>
<th>Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>Probability</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pu</td>
<td>1968</td>
<td>43</td>
<td>.035</td>
<td>.726</td>
<td>.506</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Po</td>
<td>1968</td>
<td>42</td>
<td>.080</td>
<td>1.693</td>
<td>.196</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
<td>Pu</td>
<td>1969</td>
<td>43</td>
<td>.266</td>
<td>7.231</td>
<td>.002</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes Pool</td>
</tr>
<tr>
<td>Po</td>
<td>1969</td>
<td>44</td>
<td>.336</td>
<td>10.391</td>
<td>.001</td>
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<td>.001</td>
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<td>yes</td>
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<td>43</td>
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<td>yes</td>
<td>yes Pool</td>
</tr>
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<td>1971</td>
<td>42</td>
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<td>yes</td>
<td>yes Pool</td>
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</tbody>
</table>

<sup>a</sup>See pages 88 and 89 for description of variables.
TABLE 8

COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)

Predictive Model: $DV = f(EPS1, CR, NOI2, TANR, COMEQ)^a$

Data Model: Numerical Value of the Independent Variable

<table>
<thead>
<tr>
<th>Holding Sample</th>
<th>Holding Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>Probability $&gt; F$</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pu</td>
<td>1968</td>
<td>43</td>
<td>.103</td>
<td>.849</td>
<td>.525</td>
<td>no</td>
<td>no</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Po</td>
<td>1968</td>
<td>42</td>
<td>.103</td>
<td>.826</td>
<td>.541</td>
<td>no</td>
<td>no</td>
<td>no</td>
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<td>1969</td>
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<td>yes</td>
<td>yes</td>
<td>Purchase</td>
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<td>yes</td>
<td>Purchase</td>
</tr>
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<td>1970</td>
<td>43</td>
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<td>1971</td>
<td>44</td>
<td>.371</td>
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<td>.003</td>
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<td>yes</td>
<td>yes</td>
<td>Inconclusive</td>
</tr>
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<td>1971</td>
<td>42</td>
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<td>4.864</td>
<td>.002</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td></td>
</tr>
</tbody>
</table>

$^a$See pages 88 and 89 for description of variables.
### TABLE 9

**COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)**

Predictive Model: \( DV = f(\text{EPS1}, \text{TANR}, \text{NOII}, \text{CR}, \text{BV}) \)^a

Data Model: Numerical Value of the Independent Variable

<table>
<thead>
<tr>
<th>Sample</th>
<th>Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>Probability $&gt; F$</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
</tr>
</thead>
<tbody>
<tr>
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<td>43</td>
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<td>no</td>
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<tr>
<td>Po</td>
<td>1968</td>
<td>42</td>
<td>.098</td>
<td>.782</td>
<td>.571</td>
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<td>no</td>
<td>no</td>
<td></td>
</tr>
<tr>
<td>Pu</td>
<td>1969</td>
<td>43</td>
<td>.431</td>
<td>5.611</td>
<td>.001</td>
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<td>yes</td>
<td>yes</td>
<td>Purchase</td>
</tr>
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<td>yes</td>
<td></td>
</tr>
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<td>Pu</td>
<td>1970</td>
<td>43</td>
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<td>Purchase</td>
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<td>Po</td>
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<tr>
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<td>1971</td>
<td>44</td>
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<td>yes</td>
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</tr>
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<td>42</td>
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<td>.002</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
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</tr>
</tbody>
</table>

^aSee pages 88 and 89 for description of variables.
### TABLE 10

**COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)**

Predictive Model: $DV = f(\text{EPS1, EPS2, CR, NOI1, NOI2, NI1, NI2, COMEQ, BV, NBT, TANR})^a$

Data Model: Simple Average of Annual Values of the Variable Over the Holding Period

<table>
<thead>
<tr>
<th>Sample</th>
<th>Holding Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>Probability $&gt; F$</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pu-2A</td>
<td>68-69</td>
<td>43</td>
<td>.246</td>
<td>.917</td>
<td>.536</td>
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<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
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<td>68-69</td>
<td>42</td>
<td>.309</td>
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<td>.319</td>
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<td>no</td>
<td>no</td>
<td>no</td>
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<td>69-70</td>
<td>43</td>
<td>.706</td>
<td>6.783</td>
<td>.001</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
<tr>
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<td>69-70</td>
<td>44</td>
<td>.343</td>
<td>1.521</td>
<td>.172</td>
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<td>no</td>
<td>no</td>
<td>no</td>
</tr>
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<td>.005</td>
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<td>yes Purchase</td>
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<td>43</td>
<td>.683</td>
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<td>.001</td>
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<td>yes</td>
<td>yes</td>
<td>yes Purchase</td>
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<td>.611</td>
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<td>yes</td>
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<td>.062</td>
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<td>yes</td>
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</table>

^aSee pages 88 and 89 for description of variables.
TABLE 11

COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)

Predictive Model: $DV = f(EPS2)^a$

Data Model: Simple Average of Annual Values of the Variable Over the Holding Period

<table>
<thead>
<tr>
<th>Sample</th>
<th>Holding Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>Probability &gt;F</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
</tr>
</thead>
<tbody>
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<td>43</td>
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<td>42</td>
<td>.006</td>
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<td>.627</td>
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<td>no</td>
<td>no</td>
<td>no</td>
</tr>
<tr>
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<td>43</td>
<td>.306</td>
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<td>.001</td>
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<td>yes</td>
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</tr>
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<td>no</td>
<td>no</td>
<td>no</td>
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<td>yes</td>
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<td>.403</td>
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<td>yes</td>
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<td>no</td>
<td>no</td>
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<td>.001</td>
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<td>yes</td>
<td>yes</td>
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<td>yes</td>
<td>yes</td>
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</table>

$^a$See pages 88 and 89 for description of variables.
### TABLE 12

COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)

Predictive Model: $DV = f(EPS1, NI2)$  
Data Model: Simple Average of Annual Values of the Variable Over the Holding Period

<table>
<thead>
<tr>
<th>Sample</th>
<th>Holding Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>Probability &gt;F</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
</tr>
</thead>
<tbody>
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<td>.147</td>
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<td>yes</td>
<td>yes Pool</td>
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<tr>
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<td>42</td>
<td>.237</td>
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<td>.005</td>
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<td>yes</td>
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<td>43</td>
<td>.410</td>
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<td>.001</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes Purchase</td>
</tr>
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<td>44</td>
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<td>.094</td>
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<td>no</td>
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</tr>
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<td>70-71</td>
<td>43</td>
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<td>yes</td>
<td>yes</td>
<td>yes Inconclusive</td>
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<td>.001</td>
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<td>yes</td>
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<td>yes Pool</td>
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<td>42</td>
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<td>20.789</td>
<td>.001</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
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<td>68-71</td>
<td>43</td>
<td>.482</td>
<td>18.602</td>
<td>.001</td>
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<td>yes</td>
<td>yes</td>
<td>yes Purchase</td>
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<td>.351</td>
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<td>.001</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

aSee pages 88 and 89 for description of variables.
### TABLE 13

**COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)**

Predictive Model: $DV = f(EPS1, CR, NOI2, TANR, COMEQ)^a$

Data Model: Simple Average of Annual Values of the Variable Over the Holding Period

<table>
<thead>
<tr>
<th>Sample</th>
<th>Holding Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>Probability $&gt; F$</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
</tr>
</thead>
<tbody>
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<td>Pu-2A</td>
<td>68-69</td>
<td>43</td>
<td>.107</td>
<td>.891</td>
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<td>no</td>
<td>no</td>
<td>no</td>
</tr>
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<td>42</td>
<td>.199</td>
<td>1.794</td>
<td>.138</td>
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<td>no</td>
<td>no</td>
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<td>.001</td>
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<td>70-71</td>
<td>42</td>
<td>.492</td>
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<td>.001</td>
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<td>yes</td>
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<td>yes</td>
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</tr>
</tbody>
</table>

^aSee pages 88 and 89 for description of variables.
### TABLE 14

**COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)**

Predictive Model: $DV = f(\text{EPSl}, \text{TANR}, \text{NOII}, \text{CR}, \text{BV})^a$

Data Model: Simple Average of Annual Values of the Variable Over the Holding Period

<table>
<thead>
<tr>
<th>Sample</th>
<th>Holding Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>Probability $&gt; F$</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
</tr>
</thead>
<tbody>
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<td>Pu-2A</td>
<td>68-69</td>
<td>43</td>
<td>.173</td>
<td>1.548</td>
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<td>no</td>
<td></td>
</tr>
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<td>68-69</td>
<td>42</td>
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<td>1.846</td>
<td>.128</td>
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<td>no</td>
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<td>yes</td>
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</tr>
</tbody>
</table>

$^a$See pages 88 and 89 for description of variables.
TABLE 15

COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)

Predictive Model: $DV = f(EPS1, EPS2, CR, NOI1, NOI2, NI1, NI2, COMEQ, BV, NBT, TANR)$\(^a\)

Data Model: Rate of Change in the Variable Over the Holding Period

<table>
<thead>
<tr>
<th>Sample</th>
<th>Holding Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>Probability</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
</tr>
</thead>
<tbody>
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<td>Pu-2RC</td>
<td>68-69</td>
<td>43</td>
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<td>1.401</td>
<td>.222</td>
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<td>no</td>
<td>no</td>
<td>no</td>
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<tr>
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<td>68-69</td>
<td>42</td>
<td>.467</td>
<td>2.389</td>
<td>.029</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
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<td>43</td>
<td>.488</td>
<td>2.683</td>
<td>.015</td>
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<td>yes</td>
<td>yes</td>
</tr>
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<td>69-70</td>
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<td>.265</td>
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<td>.434</td>
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<td>no</td>
<td>no</td>
<td>no</td>
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<td>.593</td>
<td>4.108</td>
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<td>yes</td>
<td>yes</td>
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<td>yes</td>
<td>yes</td>
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<td>yes</td>
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<td>yes</td>
</tr>
</tbody>
</table>

\(^a\)See pages 88 and 89 for description of variables.


### TABLE 16

**COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)**

Predictive Model: $DV = f(EPS2)^a$

Data Model: Rate of Change in the Variable Over the Holding Period

<table>
<thead>
<tr>
<th>Sample</th>
<th>Holding Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>Probability</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
</tr>
</thead>
<tbody>
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<td>68-69</td>
<td>43</td>
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<td>no</td>
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<td>.392</td>
<td>.542</td>
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<td>no</td>
<td>no</td>
</tr>
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<td>.005</td>
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<td>yes</td>
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<td>yes</td>
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<td>44</td>
<td>.012</td>
<td>.498</td>
<td>.509</td>
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<td>no</td>
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<td>no</td>
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<tr>
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<td>68-71</td>
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<td>.006</td>
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<td>yes</td>
<td>yes</td>
<td>yes</td>
</tr>
</tbody>
</table>

$^a$See pages 88 and 89 for description of variables.
TABLE 17

COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)

Predictive Model: $DV = f(\text{EPS}_1, \text{NI}_2)^a$

Data Model: Rate of Change in the Variable Over the Holding Period

<table>
<thead>
<tr>
<th>Sample</th>
<th>Holding Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>Probability $&gt; F$</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
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<td>yes</td>
</tr>
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</table>

$^a$See pages 88 and 89 for description of variables.
TABLE 18
COMPARISON OF COEFFICIENTS OF DETERMINATION ($r^2$)

Predictive Model: $DV = f(\text{EPSl, CR, NOI2, TANR, COMEQ})$

Data Model: Rate of Change in the Variable Over the Holding Period

<table>
<thead>
<tr>
<th>Sample</th>
<th>Holding Period</th>
<th>n</th>
<th>$r^2$</th>
<th>F-Value</th>
<th>Probability $&gt; F$</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
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<td>42</td>
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<td>yes</td>
<td>no</td>
</tr>
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<td>Pu-2RC</td>
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<td>yes purchased</td>
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<td>3.162</td>
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<td>.006</td>
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<td>yes</td>
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</tr>
<tr>
<td>Po-4RC</td>
<td>68-71</td>
<td>40</td>
<td>.386</td>
<td>4.282</td>
<td>.004</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes purchased</td>
</tr>
</tbody>
</table>

*See pages 88 and 89 for description of variables.*
### TABLE 19

**COMPARISON OF COEFFICIENTS OF DETERMINATION \( (r^2) \)**

Predictive Model: \( DV = f(\text{EPS}_1, \text{TANR}, \text{NOI}_1, \text{CR}, \text{BV}) \)^a

Data Model: Rate of Change in the Variable Over the Holding Period

<table>
<thead>
<tr>
<th>Sample</th>
<th>Holding Period</th>
<th>n</th>
<th>( r^2 )</th>
<th>F-Value</th>
<th>Probability ( &gt;F )</th>
<th>Significant at 1%</th>
<th>Significant at 5%</th>
<th>Significant at 10%</th>
<th>Best Predictor at 10%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pu-2RC</td>
<td>68-69</td>
<td>43</td>
<td>0.255</td>
<td>2.532</td>
<td>0.045</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>Po-2RC</td>
<td>68-69</td>
<td>42</td>
<td>0.227</td>
<td>2.119</td>
<td>0.085</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Purchase</td>
</tr>
<tr>
<td>Pu-2RC</td>
<td>69-70</td>
<td>43</td>
<td>0.384</td>
<td>4.608</td>
<td>0.003</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Purchase</td>
</tr>
<tr>
<td>Po-2RC</td>
<td>69-70</td>
<td>44</td>
<td>0.230</td>
<td>2.268</td>
<td>0.067</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Purchase</td>
</tr>
<tr>
<td>Pu-2RC</td>
<td>70-71</td>
<td>43</td>
<td>0.242</td>
<td>2.366</td>
<td>0.058</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Purchase</td>
</tr>
<tr>
<td>Po-2RC</td>
<td>70-71</td>
<td>42</td>
<td>0.169</td>
<td>1.469</td>
<td>0.223</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Pu-3RC</td>
<td>68-70</td>
<td>43</td>
<td>0.400</td>
<td>4.893</td>
<td>0.002</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>Po-3RC</td>
<td>68-70</td>
<td>42</td>
<td>0.392</td>
<td>4.649</td>
<td>0.003</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Inconclusive</td>
</tr>
<tr>
<td>Pu-3RC</td>
<td>69-71</td>
<td>43</td>
<td>0.419</td>
<td>5.337</td>
<td>0.001</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Pool</td>
</tr>
<tr>
<td>Po-3RC</td>
<td>69-71</td>
<td>42</td>
<td>0.514</td>
<td>7.608</td>
<td>0.001</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Pool</td>
</tr>
<tr>
<td>Pu-4RC</td>
<td>68-71</td>
<td>43</td>
<td>0.532</td>
<td>8.403</td>
<td>0.001</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Purchase</td>
</tr>
<tr>
<td>Po-4RC</td>
<td>68-71</td>
<td>40</td>
<td>0.427</td>
<td>5.071</td>
<td>0.002</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Purchase</td>
</tr>
</tbody>
</table>

^aSee pages 88 and 89 for description of variables.
Before drawing final conclusions from the foregoing statistical analyses, it is necessary that certain specifications of the statistical models used in the study be examined. These results are presented in the following section.

Tests of Model Specifications

The validity of the regression statistic \( r^2 \) is dependent upon the results of certain tests of the residual or error term \( (e_i) \) of the model. According to Draper and Smith:

\[ \ldots \text{the residuals } e_i \text{ are the differences between what is actually observed, and what is predicted by the regression equation} \text{-- that is, the amount which the regression equation has not been able to explain.} \text{Thus we can think of the } e_i \text{ as the observed errors if the model is correct.} \]

In Chapter V four underlying assumptions of regression analysis were listed: (1) linearity, (2) independence, (3) uniform scatter, and (4) normality. In terms of the residuals (error term) these assumptions are restated by Draper and Smith in this manner:

1. The errors are independent.
2. The errors have zero mean and a constant variance.
3. The errors follow a normal distribution.


\[ ^3 \text{Ibid.} \]
Plot of the Residuals

A variety of residual plots were made as follows:

1. Predicted value of the dependent variable \( \hat{DV} \) versus the residual.
2. Residual versus independent variable.
3. \( DV \) versus independent variables.

Inspection of a sampling of these plots did not reveal a serious violation of any of the assumptions. This conclusion is supported by additional non-plot tests described in the following sections.

Autocorrelation Test

The Statistical Analysis System (SAS) procedures selected for the regression analysis included the calculation of the Durbin-Watson "d" statistic. Using the bounds test developed by Durbin and Watson, a two-tailed analysis at the 5 per cent level failed to reveal any serious serial correlation in the residuals.

The Runs Test

According to Smillie:

A non-parametric test of the residuals, which does not require any assumptions about the form of the random component, is given by a test of the number of runs in the signs of the residuals.\(^5\)

---


Draper and Smith describe this test in the following functional form for a unit normal deviate:

$$z = \frac{u - \mu + 1/2}{\sigma} \quad (6.1)$$

where $n_1$ = number of positive (+) signs
$n_2$ = number of negative (-) signs
$u$ = actual number of runs in signs

$$\mu = \frac{2n_1n_2}{n_1 + n_2} + 1 \quad (6.2)$$

$$\sigma^2 = \frac{2n_1n_2(2n_1n_2 - n_1 - n_2)}{(n_1 + n_2)^2(n_1 + n_2 - 1)} \quad (6.3)$$

One of the several successful random runs tests made is given below:

Sample - Purchase
Holding Period - 68-69
Data Model - Rate of Change

$$\mu = \frac{2(24)(19)}{24 + 19} + 1 = 22.2 \quad (6.4)$$

$$\sigma^2 = \frac{[2(24)(19)][2(24)(19) - 24 - 19]}{(24 + 19)^2(24 + 19 - 1)} = 10.2 \quad (6.5)$$

$$z = \frac{23 - 22.2 + .5}{3.2} = .40$$

The probability of obtaining a unit normal deviate of value .4 or greater is .35 (35 per cent), which could not be considered an unusual event. Therefore, residuals appear to exhibit an acceptable level of randomness in conformity with the earlier judgment from analysis of the plots of the residuals.

---

6 Draper and Smith, op. cit., pp. 95-97.
Typical Frequency Distribution

A random selection of the regression runs was tabulated in frequency distribution form. A typical example is that of the three year holding period for the pool sample for the average data model which is shown below:

<table>
<thead>
<tr>
<th>Residual Value</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>-.651 and lower</td>
<td>1</td>
</tr>
<tr>
<td>-.511 to -.650</td>
<td>2</td>
</tr>
<tr>
<td>-.361 to -.510</td>
<td>2</td>
</tr>
<tr>
<td>-.201 to -.360</td>
<td>2</td>
</tr>
<tr>
<td>-.051 to -.200</td>
<td>7</td>
</tr>
<tr>
<td>.050 to -.050</td>
<td>8</td>
</tr>
<tr>
<td>.051 to .200</td>
<td>10</td>
</tr>
<tr>
<td>.201 to .350</td>
<td>2</td>
</tr>
<tr>
<td>.351 to .500</td>
<td>5</td>
</tr>
<tr>
<td>.501 to .650</td>
<td>0</td>
</tr>
<tr>
<td>.651 and up</td>
<td>2</td>
</tr>
</tbody>
</table>

The mean value of -.036 does not suggest a serious violation of the assumption of a zero mean for the residuals in this sample run.

Summary

These varied sample tests of the residuals seem to indicate that the models used in the study are reasonably well specified with no serious violation of the assumptions of regression analysis previously listed.

Therefore, the following section will proceed with
summary conclusions drawn from the statistical results previously presented in Tables 3 through 19.

Conclusions

Several conclusions seem evident from the data review just presented. First, the evidence appears sufficient to show that the purchase method of accounting for business combinations produces accounting numbers which are more closely associated with actual stock market performance than does the pooling method. This conclusion is primarily based on the fact that 69 per cent of the clearly comparable cases (25 of 36) showed the purchase sample to be the better predictor. Also, the superiority is consistent across all data models and four of the five regression models. Furthermore, the superiority increases as the number of independent variables in the model increases. For example, in the eleven variable model, the purchase method was superior in 78 per cent (seven of nine) of the comparable cases. With due consideration to each of these contributing factors, the hypothesis that:

financial statements prepared using the purchase method (as opposed to the pooling method) of accounting more clearly reflect the events which are useful to investors . . . and are therefore, more closely associated with a stock's actual performance in the period measured is accepted.

Secondly, since 31 per cent of the clearly comparable cases (eleven of thirty-six) showed pooling to be the better predictor, it appears there is justification for the existence of the two alternatives as now
sanctioned by the American Institute of Certified Public Accountants. This secondary conclusion is strengthened by a comparison of the absolute $r^2$ values of the fourteen inconclusive cases. Disregarding the arbitrary .05 error rule, six of these cases showed purchasing had the higher $r^2$ while eight cases showed pooling had the higher $r^2$.

Thirdly, the results tend to support those theorists who say the pooling method often produces data which can give the impression of "instant earnings" accruing to the newly combined firm. Occurring during a sustained bull stock market, this may lead to a speculative or false run-up of security prices.

Finally, the results emphasize the importance of accounting variables other than earnings per share and return on equity. Intangible asset values appear to be a significant part of investor decision models as the performance measures tend to fully discount values assigned to the intangibles.

**Recommendations**

This study has presented sufficient empirical evidence to suggest that purchase and pooling accounting numbers differ in their relationship to actual stock market performance as defined in this study. Realizing that, to the knowledge of the author, this is the first evaluation of the purchase/pooling alternatives in a risk-adjusted performance context, it is recommended that other studies be undertaken. Such investigations could test
other independent variables, different data models, and a
time period composed of a single type of market (bull or
tear).

This study confirms the earlier suggestion of Beaver, Kettler, and Scholes that "... accounting
measures of risk are impounded in the market-price based
risk measure." 7 As these researchers have suggested, the
methodology applied in this study "... can be applied to
the evaluation of specific measurement controversies in
accounting. . . ." 8 Therefore, the results of this study
should encourage other investigators to extend accounting
research into the usefulness of accounting information to
decision makers.

7 William Beaver, Paul Kettler, and Myron Scholes,
"The Association Between Market Determined and Accounting
Determined Risk Measures," The Accounting Review, XLV
(October, 1970), 679.

8 Ibid., p. 680.
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C. Miscellaneous


Benjamin Edward Clark was born February 19, 1928, in Forest, Mississippi, the son of Pearl C. and Martin V. Clark, Sr. He was graduated in May, 1945, from Ouachita Parish High School of Monroe, Louisiana; and in June, 1945, entered Northeast Junior College of that city. In September, 1947, he transferred to Louisiana State University majoring in Accounting, and he received the Bachelor of Science Degree in June, 1949, and the Master of Business Administration Degree in August, 1950.

Following graduation in August, 1950, he entered the public accounting field as an auditor with Arthur Andersen and Company in Houston, Texas. During the Korean conflict, he served with the Audit Division of the U. S. Army until his discharge in 1953. In 1953, he entered private business as the principal in a general insurance agency in DeQuincy, Louisiana, and was President and General Manager of that firm until August, 1965, at which time he re-entered Graduate School at Louisiana State University.

In 1966, during his study toward the Ph.D. in Accounting, he began a teaching career in the Business and Economics Department of Southwest Baptist College, Bolivar, Missouri. In September, 1971, he became a college
administrator in charge of Financial Affairs. He now holds the position of Vice-President for Financial Affairs at Southwest Baptist College and the rank of Assistant Professor of Business.
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Candidate: Benjamin Edward Clark

Major Field: Accounting

Title of Thesis: An Empirical Evaluation of the Predictive Power of Purchase-Pooling Accounting Numbers

Approved:

S. Korea Cooper
Major Professor and Chairman

James R.捍
Dean of the Graduate School

EXAMINING COMMITTEE:

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Date of Examination:

October 22, 1973