THE RELATIVE USEFULNESS TO INVESTORS OF PRICE-LEVEL ADJUSTED FINANCIAL STATEMENTS: AN EMPIRICAL STUDY

Thesis for the Degree of Ph. D.

MICHIGAN STATE UNIVERSITY

PATRICK BRUCE McKENZIE

1970

This is to certify that the

thesis entitled

THE RELATIVE USEFULNESS TO INVESTORS OF PRICE-LEVEL ADJUSTED FINANCIAL STATEMENTS: AN EMPIRICAL STUDY

presented by

Patrick Bruce McKenzie

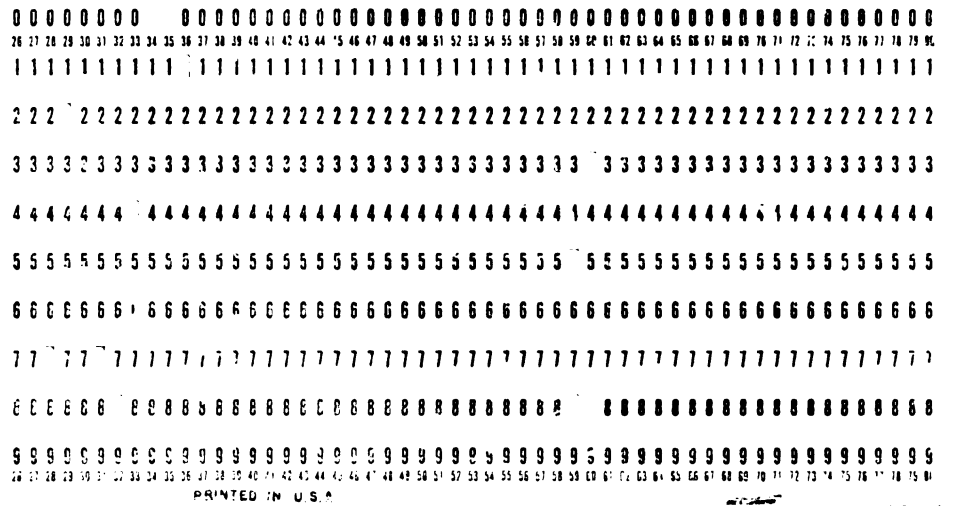
has been accepted towards fulfillment of the requirements for

Ph.D degree in Accounting

Major professor

Date April 11 1972

PB PHD01



PRINTED IN U.S.A.

ABSTRACT

THE RELATIVE USEFULNESS TO INVESTORS
OF PRICE-LEVEL ADJUSTED FINANCIAL
STATEMENTS: AN EMPIRICAL STUDY

By

Patrick Bruce McKenzie

The purpose of this research was to gather evidence of an empirical nature to examine the proposition advanced in Accounting Research Study No. 6 that financial statements adjusted for changes in the general price-level are more useful to investors than are the conventional historical cost financial statements that are not adjusted for such changes. The concept of usefulness was defined as the predictive capacity of various types of input data to yield future data of interest to the common stock investor.

The research methodology of this thesis relied upon a simple forecasting model and a multiple correlation model to evaluate the relative usefulness of two sets of financial data. One set of financial data was adjusted for changes in the general price-level while the other set was unadjusted.

The forecasting model used two sets of past income values (adjusted and unadjusted) to predict certain future income values. The income values forecast were compared to the actual income values and the related percentage forecast error was determined. The comparison of the forecast errors produced by the two sets of input data was used to determine whether price-level adjusted input data were more useful (a better predictor) than the unadjusted input data. An input value that

resulted in a lower percentage forecast error was interpreted as being a better predictor.

A multiple linear correlation model was used to evaluate the relative predictive capacity (usefulness) of two sets of financial ratios (a price-level adjusted set and an unadjusted set). The financial ratios for one period were the independent variables in the correlation model while the dependent variable was return to the investor (stated as a percentage) in the immediately following period. The two sets of coefficients of multiple determination produced by the correlation model were compared to determine whether the price-level adjusted financial ratios were more useful than the unadjusted ratios in the sense of having a greater predictive capacity. Greater predictive capacity was indicated by a higher coefficient of multiple determination.

The forecast model and multiple correlation model were implemented by price-level adjusting the financial statements of nine domestic trunk air carriers for the nine calendar years 1959 through 1967. The required financial ratios were computed for use in the correlation model, and the adjusted income values (both net and operating) were used in the forecasting model. Return to the investor was computed for the nine calendar years 1960 through 1968.

The empirical findings produced by the forecast model and multiple correlation model and their related statistical evaluation failed to support the proposition advanced in Accounting Research Study No. 6 that financial statements adjusted for changes in the general price-level are more useful to investors than unadjusted statements.

In addition, there was virtually no difference in the usefulness (as defined in this study) of the two sets of financial statements.

One argument for general price-level adjustments relates to the contention that it is unrealistic in accounting to assume that changes in the value of the dollar may be ignored. In other words, the level of inflation warrants the presentation of price-level adjusted financial statements. The empirical evidence gathered in this dissertation does not support the above position. The level of inflation in the United States in the years that affect the price-level adjustments made in this study was apparently so small that only a negligible difference in the usefulness of the two sets of financial statements was observed. Accordingly, the author concludes that price-level adjusted financial statements are not necessary during periods of inflation that are comparable to the level encountered during this study (principally 1951 through 1967 in which the average annual rate of inflation was 2%).

THE RELATIVE USEFULNESS TO INVESTORS OF PRICE-LEVEL ADJUSTED FINANCIAL STATEMENTS: AN EMPIRICAL STUDY

By

Patrick Bruce McKenzie

A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Accounting and Financial Administration

1970

ACKNOWLEDGMENTS

The author wishes to express his sincere gratitude to Dr. George Mead for his constant guidance and encouragement throughout the course of this research. His important contribution as well as those of Dr. Herbert Miller and Dr. Frank Bacon are gratefully acknowledged. Dr. Miller was especially helpful in formulating the direction and purpose of this dissertation.

In addition to needed financial support, Dr. James Don Edwards, Chairman of the Department of Accounting and Financial Administration, more importantly provided encouragement and inspiration throughout the course of my doctoral studies. His contribution will always be remembered.

A fellowship from the American Institute of Certified Public Accountants was the prime monetary support for this dissertation. The American Accounting Association and General Electric Foundation provided financial help during the early stages of my doctoral studies. The financial support provided by these three groups is gratefully acknowledged.

Also I extend sincere appreciation to the people at the Civil Aeronautics Board who were so helpful and cooperative during the data collection stage of this research.

My sincere thanks also go to Mrs. Jo McKenzie for her most skillful and professional job in the typing of this manuscript.

Finally, a special debt is owed to my wife, Sheila, for contributing more than her share of the effort required to complete this study.

TABLE OF CONENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

1.1 Purpose of research

It is the purpose of this study to gather evidence of an empirical nature to test the proposition that financial statements adjusted for changes in the general price-level are more useful than the conventional historical cost financial statements that are not adjusted for such changes. In other words and more specifically, given the degree of inflation encountered in the past decade, are price-level adjusted financial statements warranted as a replacement for or as a supplement to the conventional financial statements that have been and are currently being presented in published annual reports for investors and prospective investors? It was assumed in this study that accounting data are used in decision-making by present and potential investors.

A staggering amount of accounting literature has been devoted to the subject of price-level adjustments, their nature and necessity, and the related problems of implementation. For example, in the decade of the 1950's alone, there were 136 articles covering 1048 pages in The Accounting Review, The Journal of Accountancy, and the NAA Bulletin on price-level problems.[1] And the rapid pace did not slacken in the 1960's.

---

[1]Henry W. Sweeney, Stabilized Accounting (New York: Harper & Brothers, 1936; New York: Holt, Rinehart and Winston, Inc., 1964), p. xxx.

Although the price-level controversy is far from being settled, the Accounting Principles Board of the American Institute of Certified Public Accountants issued the following statement in 1961 which provided the impetus for Accounting Research Study No. 6: Reporting the Financial Effects of Price-Level Changes: the Board " . . . agreed that the assumption in accounting that fluctuations in the value of the dollar may be ignored is unrealistic . . ."[2] This statement was strongly approved by Sprouse and Moonitz in Accounting Research Study No. 3: A Tentative Set of Broad Accounting Principles for Business Enterprises.[3]

Apparently through a priori reasoning alone, the following conclusion was reached in Accounting Research Study No. 6:

> In a nutshell, financial data adjusted for price-level effects provide a basis for a more intelligent, better informed allocation of resources, whether these resources are in the hands of individuals, business entities or of government.[4]

As there is a dearth of empirical evidence in support of or in opposition to the usefulness of general price-level adjustments, hopefully this study can make a significant empirical contribution to this controversial area. Empirical evidence in most areas of accounting is lacking as evidenced in

---

[2]Staff of the Accounting Research Division of the American Institute of Certified Public Accountants, Accounting Research Study No. 6: Reporting the Financial Effects of Price-Level Changes (New York: American Institute of Certified Public Accountants, 1963), p. 1.

[3]Robert T. Sprouse and Maurice Moonitz, Accounting Research Study No. 3: A Tentative Set of Broad Accounting Principles for Business Enterprises (New York: American Institute of Certified Public Accountants, 1962), pp. 17-18.

[4]Staff of Accounting Research Division, Accounting Research Study No. 6, p. 16.

the following statement by Chambers:

> Compared with the volume of mere opinion and dogma which fill the so-called theoretical literature of the past fifty years, the amount of actual evidence, the empirical evidence, is pitifully small.[5]

Accordingly, the purpose of this study is to gather evidence to test the position advanced in Accounting Research Study No. 6.

1.2 Predictive capacity as a concept of usefulness

The relative predictive capacity of the two sets of financial data, one set adjusted for changes in the general price-level and the other unadjusted, will be the ultimate test of usefulness in this research. In other words, usefulness in this study is defined in the positive sense as meaning predictive capacity. That which is to be predicted as well as the accounting data on which the prediction will be based will be described later in this chapter.

This definition of usefulness is in keeping with the current trend in accounting that emphasizes the predictive value of information. The Committee to Prepare a Statement of Basic Accounting Theory (1966) of the American Accounting Association stated that the "utility of information lies in its ability to reduce uncertainty about the actual state of affairs of concern to the user."[6] Sprouse stated that " . . . the primary purpose of measurement of last year's income reported to investors

---

[5] R. J. Chambers, "Prospective Adventures in Accounting Ideas," The Accounting Review, Vol. XLII, No. 2 (April, 1967), p. 251.

[6] Committee to Prepare a Statement of Basic Accounting Theory, A Statement of Basic Accounting Theory (Evanston, Illinois: American Accounting Association, 1966), p. 8.

is to provide a basis for predicting future year's income."[7]

Anthony in discussing criteria for financial accounting data defines usefulness as being " . . . useful to the external world, to the person who seeks information from the financial statements."[8] The so-called "informed investor" ideally would prefer information that enables him to "predict: (1) future earnings, and (2) the safety of his principal."[9] Once again, the emphasis is on the predictive capacity of information provided by the accounting system.

The Statement of Basic Accounting Theory in discussing external uses of accounting information stated:

> Almost all external users of financial information reported by a profit-oriented firm are involved in efforts to predict the earnings of the firm for some future period. Such predictions are most crucial in the case of present and prospective equity investors and their representatives . . . The past earnings of the firm are considered to be the most important single item of information relevant to the prediction of future earnings.[10]

The notion of predictive value can be traced to the widely advocated methodology of positive economics as espoused by Milton Friedman and his predecessors which emphasizes the predictive capabilities of

---

[7]Robert T. Sprouse, "The Measurement of Financial Position and Income: Purpose and Procedure," Research in Accounting Measurement, R. K. Jaedicke, Y. Ijiri, and O. Nielsen (eds.) (Evanston, Illinois: American Accounting Association, 1966), p. 106.

[8]Robert N. Anthony, "Research in Accounting Measurement," Research in Accounting Measurement, R. K. Jaedicke, Y. Ijiri, and O. Nielsen (eds.) (Evanston, Illinois: American Accounting Association, 1966), p. 259.

[9]Ibid., p. 260.

[10]Committee to Prepare a Statement of Basic Accounting Theory, Basic Accounting Theory, p. 23.

models, theories, and information in general. As enunciated by Friedman, the "goodness" of a model is judged primarily by the correlation of predicted outcomes and observed reality. The test of the theory or model is pragmatic in all situations; that is, the most relevant model is the one that most accurately predicts the observable phenomena of future economic events.[11]

The concept of positive economics can be applied to this study as follows: if one set of the two sets of financial data is significantly more predictive than the other set, then that set will be judged as more useful in its ability to reduce uncertainty about the future. Remember that one set of financial data will be based on conventional historical cost accounting data and the other set will be based on accounting data adjusted for changes in the general price-level.

1.3 A priori arguments

No attempt was made in this study to evaluate the relative merits of the theoretical and pragmatic arguments for and against general price-level adjustments. These arguments are well-documented in accounting literature and can be summarized briefly as follows:

Arguments against general price-level adjustments:[12]

1. The current level of inflation in the United States is so insignificant as to have a negligible effect if price-level adjustments were to be made. Therefore, the costs of implementation would far outweigh any possible benefits from adjusted data.

---

[11]Milton Friedman, "The Methodology of Positive Economics," Essays in Positive Economics (Chicago: University of Chicago Press, 1953), pp. 3-43.

[12]Eldon S. Hendriksen, Accounting Theory (Homewood, Ill.: Richard D. Irwin, Inc., 1965), p. 182 and Staff of Accounting Research Division, Accounting Research Study No. 6, pp. 44-51.

2. The proposed adjustments may have undesirable consequences as investors are used to the conventional financial statements. Public confusion could result as investors might erroneously believe that current cost information was being presented in the price-level adjusted statements.

3. Companies are very reluctant to reduce reported net income by charges that are not recognized for tax purposes.

4. The purpose of accounting should be to determine monetary income rather than economic income as an objective measure of the results of past decisions (money return on money invested) is desirable. Therefore, replacement costs and price-level adjusted costs are not relevant to the accounting process.

Arguments for general-price level adjustments:

1. The income statement and balance sheet would be more meaningful if all items were measured by a stable yardstick and thus stated in terms of a common dollar.

2. Historical costs adjusted for changes in the general price-level would be relevant whereas unadjusted historical costs have serious limitations.

3. Accounting involves communication of observed economic reality between the accountant and the financial statement user. Price-level adjusted data more closely approximates economic reality and therefore would increase the quality of communication between observer and user.

4. "Financial data adjusted for price-level changes provide a basis for a more intelligent, better informed allocation of resources, whether those resources are in the hands of individuals, of business entities, or of government."[13]

Much of the price-level controversy contained in the foregoing arguments can be directly attributed to a broader problem that has confronted accountants for decades: a failure by the accounting profession

---

[13]Staff of Accounting Research Division, Accounting Research Study No. 6, p. 16.

to attain a general agreement on the fundamental objective or purpose that accounting should fulfill. Many of the continuing practical and theoretical controversies in accounting can be traced to this failure. The solution of this broader problem would be an important step in the settlement of several accounting dilemmas including the price-level dispute.

1.4 Existing knowledge

In reviewing the current and past accounting literature that would be relevant to this study, several significant research efforts were noted.

Although ignored at the time and not "discovered" until the inflationary period following World War II, the comprehensive work of Henry W. Sweeney, consisting of fifteen articles published in the leading accounting journals during 1927 to 1935 and his now classic Stabilized Accounting[14] published in 1936, indeed establish him as the founder of price-level accounting in the United States. His work represented the earliest comprehensive study into the theoretical problems and practical implications of assuming a stable measuring unit in times of inflation or deflation. The bulk of his conclusions and recommendations were incorporated in Accounting Research Study No. 6 some 28 years after first being published.

In 1949, Ralph C. Jones published the first significant article on price-level accounting since Sweeney's work in 1936. His article

---

[14]Henry W. Sweeney, Stabilized Accounting (New York: Harper & Brothers, 1936; New York: Holt, Rinehart and Winston, Inc., 1964).

entitled the "Effect of Inflation on Capital and Profits: The Record of Nine Steel Companies" presented empirical evidence of the difference in financial statements caused by the changing price-level.[15]

In 1951, the American Accounting Association in Supplementary Statement No. 2: Price Level Changes and Financial Statements concluded " . . . that knowledge of the effects of the changing value of dollar . . . may be useful information . . . "[16]

As a result of this directive, the American Accounting Association enlisted Ralph C. Jones to direct a price-level case study having the following objectives:

1. To develop and test techniques and methods for the preparation of supplementary financial statements expressed in constant-value units . . .

2. To compare the supplementary statements expressed in uniform dollars with the conventional statements expressed in historical dollars . . .

3. . . . for judging the need for and the usefulness of figures and statements in dollars of uniform purchasing power.[17]

Representing one of the early major empirical efforts in this area, the results of this milestone study were very striking. For example, one

---

[15]Ralph C. Jones, "Effect of Inflation on Capital and Profits: The Record of Nine Steel Companies," The Journal of Accountancy, LXXXVIII (January, 1949), pp. 9-27.

[16]Committee of Concepts and Standards Underlying Corporate Financial Statements, Supplementary Statement No. 2: Price Level Changes and Financial Statements (American Accounting Association, 1951), p. 2.

[17]Ralph C. Jones, Price Level Changes and Financial Statements: Case Studies of Four Companies (American Accounting Association, 1955), p. 2.

company studied for an eleven year period overstated the earning rate on average equity of stockholders by almost 100% of the rate based on the adjusted statements; also dividends as a per cent of net earnings were 56% for the published statements as compared to 89% for the adjusted statements.[18] This study provided the impetus for more research, mostly of a nonempirical nature, in the area of general price-level adjustments. The empirical work that was undertaken was similar to the case studies made by Jones in that they concentrated on showing the differences in the financial statements that would result from making price-level adjustments, and largely ignored the more important problem of the relative usefulness of the two sets of data.

The American Institute of Certified Public Accountants formally acknowledged the price-level problem in a letter to the membership reaffirming its opinion expressed in Accounting Research Bulletin No. 33 which was published in 1947:

> The committee on accounting procedure has reached the conclusion that no basic change in the accounting treatment of depreciation of plant and equipment is practicable or desirable under present conditions to meet the problem created by the decline in the purchasing power of the dollar.
>
> Should inflation proceed so far that original dollar costs lose their practical significance, it might become necessary to restate all assets in the terms of the depreciated currency, as has been done in some countries. But it does not seem to the committee that such action should be recommended now if financial statements are to have maximum usefulness to the greatest number of users.[19]

---

[18] Ibid., p. 67.

[19] American Institute of Certified Public Accountants, Accounting Research and Terminology Bulletins, Final Edition (New York: American Institute of Certified Public Accountants, 1961), pp. 68-69.

In 1963, Accounting Research Study No. 6: Reporting the Financial Effects of Price-Level Changes was issued under the directorship of Maurice Moonitz. As a result of this research effort, the following conclusions were reached:

1. They found "clear evidence of the widespread concern of businessmen and accountants with the need for changes in financial reporting to reflect the effects of inflation and deflation."

2. The "recognition of price-level changes in financial statements is practical, and not misleading or dangerous to investors."

3. At least one reliable general price-level index is available in the United States.

4. "The effects of price-level changes should be disclosed as a supplement to conventional statements."[20]

In 1967, the Accounting Principles Board discussed internally a draft of a proposed opinion on price-level accounting that included the following recommendations:

1. In cases of severe inflation or deflation, price-level statements should preferably be presented as the basic financial statements.

2. The degree of U. S. inflation does not require price-level data to be included for fair presentation.

3. However, the presentation of price-level data in addition to conventional data is encouraged.[21]

This draft was the predecessor of Statement of the Accounting Principles Board No. 3 which is discussed in the next section.

---

[20]Staff of Accounting Research Division, Accounting Research Study No. 6, p. xi.

[21]Accounting Principles Board, Exposure Draft: Financial Statements Restated for Price-Level Changes, July 14, 1967, pp. 6-7. (Mimeographed).

Before issuing an actual pronouncement, the Accounting Principles Board felt that more knowledge of the implementation process and effects was needed. It therefore authorized a field test which 18 companies of widely varying sizes and types were asked to adjust their financial statements for changes in the general price-level. Two significant conclusions resulted:

1. The participants in general agreed that . . . practical problems should not present a significant barrier to preparation of general price-level financial statements.

2. The results . . . seem to support the view of Accounting Research Study No. 6 that presentation of supplementary general price-level financial statements would make available potentially useful information that otherwise is not disclosed.[22]

During the last five years, three empirical studies involving the use of questionnaires and interviews with financial analysts and other related groups attempted to evaluate the usefulness of price-level adjusted data. Morton Backer concluded that the 48 analysts he interviewed were almost unanimously opposed to the adjustment of income by the use of a general price-index. In general, these analysts were against the introduction of more subjective measurements. However, they did favor a system of multiple measurements for balance sheet items.[23]

Estes investigated the perceived usefulness to external financial statement users (financial analysts, financial executives, and bank loan officers and credit men) of price-level and current value

---

[22]Paul Rosenfield, "Accounting for Inflation-A Field Test," The Journal of Accountancy, CXXVII (June, 1969), p. 50.

[23]Morton Backer, "Financial Reporting and Security Investment Decisions," Financial Executive, XXXIV (December, 1966), pp. 50-60.

information. For the price-level adjusted information, 70% of the respondents believed that such supplemental data would be useful as opposed to 30% who indicated that it would not be useful.[24]

In a research effort sponsored by the American Accounting Association, Dyckman used questionnaires sent to financial analysts to examine experimentally the effects of price-level adjustments on decision makers. The following behavioral conclusions resulted:[25]

1. The inclusion of statements adjusted for the changing value of the dollar or, alternatively, the reliance on adjusted statements alone, can influence relative investment evaluations. This study, however, suggests that this relationship is not a strong one.

2. The study respondents would prefer that, if price-level adjustments are to be made, they be supplied in the form of supplementary reports to conventional reports.

In summary, the existing price-level literature can be classified into three categories: (1) a priori research (normative theory), (2) empirical evidence (positive theory), and (3) official positions of authoritative bodies. It was not deemed necessary in this study to evaluate the a priori research. The empirical evidence falls into two classes: descriptions of differences between conventional and price-level adjusted financial statements of actual companies and surveys of investor opinions about the perceived usefulness of price-level adjusted

---

[24]Ralph W. Estes, "An Assessment of the Usefulness of Current Cost and Price-Level Information by Financial Statement Users," Journal of Accounting Research, VI (Autumn, 1968), p. 200.

[25]T. R. Dyckman, Studies in Accounting Research #1: Investment Analysis and General Price-Level Adjustments (Evanston, Illinois: American Accounting Association, 1969), p. 17.

data. Sub-section 1.4.1 describes the most recent and comprehensive statement on price-level adjustments by an authoritative body.

The major implication of the preceding research efforts for this study is that price-level adjusted financial statements may provide useful information. This thesis examines the proposition that price-level adjusted information is more useful than information unadjusted for changes in the general price-level.

1.4.1 Statement of the Accounting Principles Board No. 3

In mid-1969, the Accounting Principles Board (APB) issued its Statement No. 3: Financial Statements Restated for General Price-Level Changes.[26] While the Board's "statement" purposely lacked a Board "opinion", it nevertheless sets forth the conclusions and recommendations of the APB regarding general price-level adjusted financial reports. In addition to describing the basic nature of financial statements adjusted for changes in the general price-level, this statement provides detailed guidance on how to prepare and present general price-level financial statements. The major recommendations and conclusions of Statement No. 3 can be summarized as follows:[27]

1. The Board believes that general price-level financial statements or pertinent information extracted from them present useful information not available from basic historical-dollar financial statements.

2. General price-level information may be presented in addition to the basic historical-dollar financial

---

[26]Accounting Principles Board, Statement of the Accounting Principles Board No. 3: Financial Statements Restated For General Price-Level Changes (New York: American Institute of Certified Public Accountants, June 1969).

[27]Ibid., pp. 12-13.

statements, but general price-level financial statements should not be presented as the basic statements.

3. The Board believes that genral price-level information is not required at this time for fair presentation of financial position and results of operations in conformity with generally accepted accounting principles in the United States.

4. The Board recognizes that the degree of inflation or deflation in an economy may become so great that conventional statements lose much of their significance and general price-level statements clearly become more meaningful, and that some countries have experienced this degree of inflation in recent years. The Board concludes that general price-level statements reported in the local currency of those countries are in that respect in conformity with accounting principles generally accepted in the United States...

Statement No. 3 provided the following general guidelines to be used in the adjustment or restatement of conventional financial statements for changes in the general price-level:[28]

1. The same accounting principles . . . should be used in preparing general price-level financial statements except that changes in the general purchasing power are recognized . . . General price-level financial statements are an extension of and not a departure from the "historical cost" basis of accounting.

2. An index of the general price-level, not an index of the price of a specific type of goods or services, should be used to prepare general price-level financial statements. . . . the GNP Deflator is the most comprehensive indicator of the general price level in the United States. Consequently, it should normally be used . . .

3. General price-level financial statements should be presented in terms of the general purchasing power of the dollar at the latest balance sheet date.
4. Monetary and nonmonetary items should be distinguished for the purpose of preparing general price-level financial statements. Monetary items are

---

[28] Ibid., pp. 13-19.

> stated in terms of current general purchasing power in historical-dollar statements. On the other hand, nonmonetary items are generally stated in terms of the general purchasing power of the dollar at the time they were acquired.
>
> 5. The amounts of nonmonetary items should be restated to dollars of current general purchasing power at the end of the period.
>
> 6. Monetary assets and liabilities . . . are stated in dollars of current general purchasing power; consequently, they should appear in current general price-level statements at the same amounts.
>
> 7. The amounts of income statement items should be restated to dollars of current general purchasing power at the end of the period.
>
> 8. General price-level gains and losses should be calculated by means of the general price index and included in current net income . . . as a separate item in general price-level income statements.
>
> 9. General price-level financial statements of earlier periods should be updated to dollars of the general purchasing power at the end of each subsequent period for which they are presented as comparative information.
>
> 10. All general price-level information presented should be based on complete general price-level calculations.

As this statement represents the most comprehensive and authoritative pronouncement on the mechanics of price-level adjustments, it has been used as a guide for the price-level adjustments made in this study. Its pronouncements are very similar to the price-level theory and procedures espoused by Sweeney,[29] Jones,[30] and Accounting Research Study

---

[29] Sweeney, Stabilized Accounting.

[30] Jones, Price Level Changes and Financial Statements: Case Studies of Four Companies.

No. 6.[31]

1.5 Companies and time periods studied

The Air Transportation industry, more specifically the nine domestic trunk carriers publishing financial statements on a calendar year basis, was selected for analysis and implementation of this study. The carriers within this industry were suitable because the Civil Aeronautics Board requires these air carriers to file certain detailed reports of operating activity and financial position; these data happen to include information necessary in making price-level adjustments. Information of this nature is seldom if ever available in published annual reports. For this reason, it was not feasible to randomly sample from some larger population. This limitation will be discussed in greater detail in subsequent chapters.

In summary, the primary criterion for selection of companies studied was the availability of detailed information that would facilitate the price-level adjustment process. Other ancillary reasons for selecting the domestic trunk carriers include (1) the number of companies within this group represents a magnitude that was manageable in the actual implementation of the adjustments for changes in the general price-level; (2) these air carriers are subject to a uniform system of accounts and reports which permits more meaningful intercompany comparisons; (3) this industry has a relatively heavy investment in property and equipment so that price-level adjustments should produce significantly different

---

[31] Staff of Accounting Research Division, Accounting Research Study No. 6.

financial statements; (4) all carriers were subject to similar general economic and operating conditions; and (5) though there were some exceptions, the nine carriers followed similar accounting policies, especially in the determination of depreciation.

Domestic trunk carriers include only domestic operators primarily within the continental United States serving the larger cities and consist of:

1. American Airlines, Inc. (16.8%)
2. Braniff Airways, Incorporated (3.9%)
3. Continental Air Lines, Inc. (2.8%)
4. Delta Air Lines, Inc. (7.7%)
5. Eastern Air Lines, Inc. (13.0%)
6. National Airlines, Incorporated (4.1%)
7. Northeast Airlines, Inc. (1.9%)
8. Northwest Airlines, Incorporated (6.0%)
9. Trans World Airlines, Inc. (16.5%)
10. United Air Lines, Inc. (23.2%)
11. Western Air Lines, Inc. (4.1%)

Relative share of the market is indicated above in brackets based on 1968 revenue passenger miles.

Two of these air carriers, Delta Air Lines and National Airlines, issue their published annual reports on a June 30 fiscal year basis. Because of comparability problems, these two carriers were excluded from this study.

The time period studied was the ten year period 1959 through 1968 which includes the air carriers' transition into the so-called jet age.

1.6 Summary of basic research approaches

The purpose of this section and the two sub-sections that follow is to outline the two research approaches that were employed in this study to examine the proposition espoused in Accounting Research Study

No. 6 that price-level adjusted financial data are more useful than conventional financial data that have not been adjusted for changes in the general price-level. Recall that useful has been defined as predictive capacity.

The first approach consisted of a simple linear regression model that was used to forecast future income values based upon two sets of past income values. One set of these past income values was adjusted for changes in the general price-level while the other set was not adjusted for these changes. Sub-section 1.6.1 presents a brief summary of this model.

The second approach employed a multiple linear correlation model to evaluate the relative predictive capacity of two sets of financial ratios (one set price-level adjusted and the other unadjusted). The financial ratios were the independent variables in this correlation model while the dependent variable was investor return measured by market price appreciation (or depreciation) and cash dividends. Sub-section 1.6.2 describes this model in more detail.

1.6.1 A simple linear forecasting model

As indicated in a previous section, usefulness implies to many "predictive capacity", and the item that the investor would most like to predict would be his future returns from alternate investments. In order to make this type of prediction, many investor decision models depend heavily on a prediction of future earnings. Sprouse has stated " . . . the primary purpose of measurement of last year's income reported to investors is to provide a basis for predicting future year's

income."[32] Hayes has concluded that:

> . . . the valuation of most common stocks involves two principal steps or procedures. The first is the preparation of some estimate of the probable range of the earnings potential for the future . . . The second step . . . is to establish a reasonable price for the estimated earning power . . . In the majority of cases the statistical record of past earnings reflected by the income . . . statements constitutes the starting point for the calculation of possible future earning power . . . The objective (of any adjustments made by the investor) is to make the past record indicative to the greatest extent possible of the economic activities which seem most likely to prevail in the future.[33]

In summary, past income values can be used (and are used, it seems reasonable to assert) by investors to forecast future income values. The forecasted future income value can then be used by the investor to facilitate his market decisions. The efficiency of this decision making process depends in part upon the reliability of the forecasted income value; the more closely this value corresponds to the income value actually reported the greater the efficiency of this process will be. So, to be useful in investor decision models as specified above, the forecasted income value must be reasonably close to the actual income value.

In order to determine the relative usefulness (that is, relative predictive capacity) of adjusted financial data versus unadjusted financial data, forecasts were made using a simple linear time series regression model employing the six combinations of input data and

---

[32] Sprouse, "The Measurement of Financial Position and Income: Purpose and Procedure," Research in Accounting Measurement, p. 106.

[33] Douglas A. Hayes, Appraisal and Management of Securities (New York: The Macmillan Company, 1956), pp. 284-85.

forecast objective summarized in Figure 1.

FIGURE 1

COMBINATIONS OF INPUT DATA
AND FORECAST OBJECTIVE

Combination	Input Data	Forecast Objective
1	OI	OI
2	AOI	AOI
3	AOI	OI
4	NI	NI
5	ANI	ANI
6	ANI	NI

Codes used:
- OI = Operating Income before income taxes, as reported
- AOI = Operating Income before income taxes, price-level adjusted
- NI = Net Income after income taxes, as reported
- ANI = Net Income after income taxes, price-level adjusted

There were four different types of input data and four different forecast objectives. Each type of input data was used to predict itself (combinations 1, 2, 4 and 5) and the two adjusted types of input data were used to predict the corresponding unadjusted forecast objective (combinations 3 and 6). The selection of these six combinations of input data and forecast objective is discussed in Chapter III.

The four most recent annual income values were used as inputs into a time series regression model to determine the forecasted income value for the next year and the associated forecast error stated as a percentage of the actual value. Using nine years of income values, there were five forecasts for each of nine companies and each of the

six forecast models. Accordingly, there were 45 forecasts for each forecast model. This methodology is similar to that employed by Frank[34] and Parker[35] to test the predictive capacity of various income concepts. Frank investigated the historical cost versus current cost concepts of income argument while Parker examined the current operating income versus all-inclusive income controversy.

In summary, the following research hypothesis was tested employing the statistical methodology outlined in Chapter III:

> the use of income data adjusted for changes in the general price-level should result in more reliable forecast values, using a simple linear forecasting model, than would be obtained using unadjusted income data.

Chapter III contains a detailed description of the foregoing forecast model, a definition of "more reliable forecast value," and a summary of the related empirical findings.

1.6.2 A multiple linear correlation model

The usefulness of financial ratios in analyzing and comparing firms is well-established in financial literature. For example, William Beaver's doctoral dissertation and subsequent published journal articles investigated the predictability of financial ratios based on conventional

---

[34]Werner Frank, "A Study of the Predictive Significance of Two Income Measures," Journal of Accounting Research, VII (Spring, 1969), pp. 123-136.

[35]James E. Parker, A Study of the Predictive Significance of Several Income Measures Relative to the Accounting for Extraordinary Items and Prior Period Adjustments, Unpublished Doctoral Dissertation, Michigan State University, East Lansing, Michigan, 1969.

data.[36] More specifically, he compared the financial ratios of 70 "failed" companies over a period of five years prior to failure with the same ratios of comparable nonfailed companies. The nonfailed companies were comparable as to asset size and industry classification. As a result of his research, Beaver concluded that certain financial ratios "can be useful in the prediction of failure for at least five years prior to the event."[37]

These financial ratios have traditionally been based on conventional historical cost financial statements. Therefore, the following research hypothesis was used to test the position espoused in Accounting Research Study No. 6:

> financial ratios based on financial statements adjusted for changes in the general price-level are significantly more useful (predictive) than the same ratios based on conventional accounting financial statements.

This properly places the "burden of proof" on the price-level adjustment concept as it is (1) more complex and costly to apply, (2) more difficult to understand, and (3) unconventional.

Eldon Hendriksen in discussing general price-level adjustments and financial ratios stated:

---

[36]For example, see William H. Beaver, Financial Ratios as Predictors of Failure (Unpublished Ph.D. dissertation, Graduate School of Business, University of Chicago, 1965); "Alternate Accounting Measures As Predictors of Failure," Accounting Review, Vol. XLIII (January, 1968), pp. 113-122; "Market Prices, Financial Ratios, and the Prediction of Failure," Journal of Accounting Research, Vol. VI (Autumn, 1968), pp. 179-192.

[37]William H. Beaver, "Financial Ratios as Predictors of Failure," Empirical Research in Accounting: Selected Studies, 1966 (Baltimore: Institute of Professional Accounting, Graduate School of Business, University of Chicago, 1967), p. 102.

> Financial ratios computed from unadjusted balance sheet items may provide misleading information; these same ratios may be improved by stating both the numerator and denominator of the ratios in similar terms. The rate of return on investment is one of the best examples of a ratio that can be greatly improved by using figures restated in terms of a common dollar.[38]

In the same chapter, he reached these conclusions:

> Useful financial ratios can be obtained from the adjusted income statement and balance sheet, and useful comparisons can be made by restating the prior year's balance sheet in terms of the current purchasing power of the dollar . . . . The adjusted rate of return ratio is useful in the appraisal of a firm by management, stockholders, or outsiders.[39]

The financial ratios that were used in this model are those that are currently popular among financial analysts and investors, and are generally accepted as having predictive value. The following list is a result of searching various textbooks, financial journals, and research efforts by Horrigan and Beaver[40] to ascertain financial ratios with the characteristics mentioned above:

1. net income to average total assets
2. operating income to average total assets
3. cash flow to average total assets
4. cash flow to average total debt
5. total revenues to average total assets
6. net income to total revenue
7. operating income to total revenue

---

[38] Eldon S. Hendriksen, Accounting Theory (Homewood, Ill.: Richard D. Irwin, Inc., 1965), p. 170.

[39] Ibid., pp. 171-172.

[40] See a previous footnote for efforts by Beaver. For Horrigan, see James O. Horrigan, "The Determination of Long-term Credit Standing with Financial Rates," Empirical Research in Accounting: Selected Studies, 1966 (Baltimore: Institute of Professional Accounting, Graduate School of Bus., Univ. of Chicago, 1967), pp. 44-62; "Some Empirical Bases of Financial Ratio Analysis," The Accounting Review, Vol. XL (July, 1965), pp. 558-568; "A Short History of Financial Ratio Analysis," The Accounting Review, Vol. XLIII (April, 1968), pp. 284-294.

These financial ratios were computed based on two sets of financial data, conventional and price-level adjusted, and represent the independent or explaining variables in a multiple linear correlation model.

The ten balance sheets of the nine air carriers studied for the calendar years ended December 31, 1958 through 1967 and the nine related statements of income and retained earnings of each carrier for the calendar years 1959 through 1967 were adjusted for changes in the general price-level. At this point, the seven financial ratios were computed for each time period and for both sets of data.

The dependent or explained variable was "return to the investor" (stated as a percentage) in the period immediately following the financial ratio period. Return to the investor in period j was defined as follows:

$$R_j = \frac{(MPe_j - MPb_j) + CD_j}{MPb_j}$$

where MPe_j = market price per share at end of period j

MPb_j = market price per share at beginning of period j

CD_j = cash dividends per share paid during period j

In words, return to the investor was defined as the sum of (1) the change in market price during a period and (2) the cash dividends received during the same period both stated as a percentage of the market price at the beginning of the period.

The relative predictive capacity of the two sets of financial ratios was evaluated using the multiple linear correlation model

described in detail in Chapter IV. The output from this model was two sets of coefficients of multiple determination. The coefficient of multiple determination indicates the percentage of the variation in dependent variable (return to the investor) that can be explained by changes in the independent variables (financial ratios). Accordingly, the coefficients of multiple determination were used to evaluate the research proposition stated earlier in this sub-section.

Chapter IV presents the empirical findings from implementation of the correlation model described in this sub-section and also outlines the statistical methodology employed to evaluate the related research hypothesis.

1.7 Limitations and other considerations

In addition to the limitations and considerations already mentioned, several items require attention at this point. As mentioned previously, the companies to be analyzed were not randomly selected from some larger population. Due to this factor, the inferences to be derived from the statistical tests as outlined in Chapters III and IV must be prefaced with a qualification. In other words, the validity of the inferences will rest primarily on the proposition that the nine companies studied are representative of some larger population.

The a priori arguments for and against general price-level adjustments are well-documented in accounting literature, and this study has not evaluated these arguments. As a part of the present controversy, much has been written about the merits of using specific price-level index to make financial statements more relevant to investors' needs.

Resolving this dispute is outside the scope of this study. Accounting Research Study No. 6 and Statement of the Accounting Principles Board No. 3 both recommended that price-level adjustments be computed using a general price-level index for the rather obvious reason that the use of a specific index would introduce current costs as a replacement for historical costs.[41] Price-level adjustments made using a general price index are still on the historical cost basis. Accordingly, this study used a general price index following the reasoning espoused above.

One segment of this thesis investigated the relative capacity of financial ratios based on two sets of data to predict actual return to the common stock investor. Market price appreciation (or depreciation) is a segment of this return. To the extent that market prices are influenced by conventional unadjusted accounting data, an advantage in favor of this set of data will exist. Since price-level adjusted data are not generally available to directly influence market prices, there is no offsetting factor to this advantage, and it is difficult to construct a model on an a priori basis that would indicate a relationship between market prices and unavailable financial ratios based on data adjusted for changes in the general price-level. However, the philosophy of positive economics does not require a logically constructed theory prior to empirical observation. This philosophy is similar to the inductive approach. Hendriksen has written the following:

---

[41]Staff of Accounting Research Division, Accounting Research Study No. 6, pp. xi-xii, and Accounting Principles Board, Statement No. 3, p. 3.

> The advantage of the inductive approach is that it is not necessarily constrained by a preconceived model or structure. The researcher is free to make any observations he may deem relevant.[42]

According to Friedman, "the only relevant test of the validity of a hypothesis is comparison of its predictions with experience."[43] If a hypothesis or theory has predictive abilities, then it is judged useful. However, understanding depends primarily upon the explanation of this relationship.

In all the sciences, it is common that a logically derived theory follows the empirical observations of actual relationships. One segment of this thesis observes the relationship between certain financial data adjusted for changes in the general price-level and actual investor return. If a significant relationship is observed, then a logically derived theory could be constructed to explain and understand this phenomenon. The construction of a formally developed theory lies outside the scope of this research. However, speculation as to what such a theory would consist of is considered to be an essential part of this research effort.

Predictive capacity played a major role in both approaches to evaluating the relative usefulness of two sets of financial data. Involved in the first approach was a determination of the predictive

---

[42]Eldon S. Hendriksen, Accounting Theory (Homewood: Richard D. Irwin, Inc., 1965), p. 6.

[43]Milton Friedman, "The Methodology of Positive Economics," Essays in Positive Economics (Chicago: University of Chicago Press, 1953), pp. 8-9.

capacity of different income measures. This did not imply that predictive capacity should be the only criterion used in evaluating which set of financial data is more relevant. One concept of income may be preferred over another because it is more theoretically "correct" even though it is less predictive. In summary, predictive capacity is not the only criterion for determining which alternate concepts should be used, but it is probably one of the most important of many criteria.

Also involved in the first approach was an evaluation of forecast errors. For example, in comparing a 20% overforecast of a future income value with a 20% underforecast, the overforecast might be preferred by the investor due to the way that he has relied on the forecasted amount. This study has summarized the forecast errors and their distribution so that the individual reader can evaluate the importance of over-and under-forecasts depending upon his particular decision model.

In discussing the concept of predictive ability as a criterion for evaluating accounting data, Beaver, Kennelly, and Voss conclude that:[44]

> The preference for an accounting measure may apply only within the context of a specific predictive purpose or prediction model. It may be impossible to generalize about the 'best' measurement alternative across different contexts. Even within a specific context, the conclusions must be considered as tentative.
>
> The inability to generalize is a possibility, but not an inevitability. We have cited only potential difficulties, whose relevance can only be assessed empirically, not by a priori speculation. What is important is to know to what extent we can generalize across purposes, and the only hope of acquiring this knowledge is to conduct the predictive

---

[44] William H. Beaver, John W. Kennelly, and William M. Voss, "Predictive Ability as a Criterion for the Evaluation of Accounting Data," Accounting Review, XLIII (October, 1968), p. 675.

> studies. If we discover that different measures are best for different purposes, it would be erroneous to believe that the predictive studies are any less important because of that discovery. The inability to generalize, if it does exist, is not a flaw of the predictive ability methodology. It merely reflects the state of accounting theory, but in neither case is it an indictment of the methodology that exposes that fact.
>
> Extension of research efforts into the predictive ability of accounting data is necessary for the fulfillment of accounting's decision-making orientation and for the meaningful evaluation of alternative accounting measures.

Accordingly, this study has relied heavily on the criterion of predictive ability to empirically test the proposition that price-level adjusted financial data are more useful than financial data unadjusted for changes in the general price-level.

The results of this study are of course subject to the limitations set forth in this thesis and depend heavily upon the applicability of the predictive capacity criterion and approach to represent a proper measure of usefulness to investors.

CHAPTER II

METHODOLOGY: GENERAL PRICE-LEVEL ADJUSTMENTS

2.1 Introduction

The purpose of this chapter is to outline in detail the mechanical procedures for making general price-level adjustments. These procedures are well-documented in various sources in current accounting literature.[1] The American Institute of Certified Public Accountants has provided the most recent and comprehensive pronouncement on this subject in Statement of the Accounting Principles Board No. 3 (SAPB No. 3).[2] This statement was used as the primary guideline for making the general price-level adjustments in this study.

The discussion of the adjustment methodology contained in this chapter assumes that the reader has a fundamental understanding of the

---

[1]For example, Henry W. Sweeney, Stabilized Accounting (New York: Harper & Brothers, 1936; New York: Holt, Rinehart and Winston, Inc., 1964); Ralph C. Jones, Price Level Changes and Financial Statements--Case Studies of Four Companies (American Accounting Association, 1955); Ralph C. Jones, Effects of Price Level Changes on Business Income, Capital, and Taxes (American Accounting Association, 1956); Perry Mason, Price-Level Changes and Financial Statements--Basic Concepts and Methods (American Accounting Association, 1956); Staff of the Accounting Research Division, Accounting Research Study No. 6: Reporting the Financial Effects of Price-Level Changes (American Institute of Certified Public Accountants, 1963); and Ralph D. Kennedy and Stewart Y. McMullen, Financial Statements--Form, Analysis, and Interpretation, Chapters 18-22 (Homewood: Richard D. Irwin, Inc., 1968).

[2]Accounting Principles Board, Statement of the Accounting Principles Board No. 3: Financial Statements Restated for General Price-Level Changes (New York: American Institute of Certified Public Accountants, June 1969).

concept and mechanics of general price-level adjustments. In addition, the reader also should be acquainted with the general recommendations of SAPB No. 3.

The availability of adequate data sources normally presents a very formidable if not insurmountable hurdle for the external analyst attempting to make price-level adjustments to conventional financial statements. Fortunately, this hurdle is reduced considerably in the case of the air carriers under study due to certain reporting requirements of the Civil Aeronautics Board (CAB) and the Federal Aviation Act of 1958. The CAB prescribes a Uniform System of Accounts and Reports (USAR) for all certificated air carriers. In accordance with the Federal Aviation Act of 1958, as amended, all air carriers are required to file CAB Form 41 which reports financial and operating data on anywhere from a monthly to an annual basis.[3] The accounting data contained in this report together with that available in individual air carrier annual reports and Moody's Transportation Manual[4] was sufficient to make the required general price-level adjustments with a minimum of simplifying assumptions.

Fixed assets and inventory are the two areas that normally cause the greatest problems in making price-level adjustments. These problems in price-level adjustments have two important aspects: the first is the

---

[3]Civil Aeronautics Board, Uniform System of Accounts and Reports for Certificated Air Carriers, U. S. Government Printing Office, 1965.

[4]Moody's Transportation Manual (New York: Moody's Investors Service, Inc., 1945 through 1967).

data required to make the adjustment and the second is the materiality of the item in relation to its overall effect on the financial statements. Fortunately, due to the second factor, the relatively small amounts of "inventory" maintained by air carriers permitted certain assumptions to be made in place of a detailed analysis that would normally be required.

2.2 Monetary and nonmonetary items

In making general price-level adjustments to specific financial statement accounts, a dichotomous classification must be made. Each account must be classified as being monetary or nonmonetary in nature; this differentiation then dictates the type of adjustment necessitated.

According to SAPB No. 3, balance sheet items are monetary "if their amounts are fixed by contract or otherwise in terms of numbers of dollars regardless of changes in specific prices or in the general price-level."[5] Changes in the general price-level cause holders of monetary items to either gain or lose general purchasing power. This formal computation and recognition of purchasing power gain or loss is unique to price-level accounting. For a set of general price-level adjusted financial statements to be articulated with one another, the purchasing power gain or loss must be included.

A holder of cash or any other monetary asset suffers a real loss in general purchasing power during a period of inflation. The converse is true for any monetary liability. The computation of this gain or

---

[5]Accounting Principles Board, SAPB No. 3, p. 8.

loss can be illustrated by an example. Assume that a $1,000 monetary asset is held without change during a period in which the general price-level index rises from 100 to 110. The holder of this asset suffers a $100 loss in general purchasing power (in terms of end of the period dollars):

Purchasing power of $1,000 monetary asset at beginning of the period (in terms of end-of-period dollars)	
$1,000 x 110/100 =	$1,100
Purchasing power of $1,000 monetary asset at the end of the period (in terms of end-of-period dollars)	
$1,000 x 110/110 = (that is, no adjustment)	1,000
Loss in general purchasing power	$ 100

The computation of purchasing power gain or loss is somewhat more complicated in actual practice, as rarely will the net amount of monetary items remain constant throughout an entire year. The computation (as set forth in SAPB No. 3) necessitates many assumptions about the timing of additions to and reductions from all monetary accounts. In order to avoid the assumptions and computational problems of this approach, the methodology outlined in Section 2.15 was employed to determine price-level adjusted net income that by-passed the separate computation of purchasing power gain or loss.

Nonmonetary items are simply those items other than monetary as defined above. Changes in the general price-level do not by themselves cause holders of nonmonetary items to either gain or lose general purchasing power. The application of SAPB No. 3 concepts is described in

following sections. In general, though, all material nonmonetary balance sheet items, such as property and equipment, and capital stock, were aged initially as of December 31, 1958. The aging process was similar to that used to age accounts receivable in order that an appropriate allowance for doubtful accounts be maintained. In essence, the aging process reconstructed an account balance by date of individual acquisitions, issuances, or transactions depending upon the type of account. In this way, the purchasing power of dollars spent for existing fixed assets or of dollars contributed by issuances of capital stock was established and restated in terms of a common-sized dollar.

Aging was of course not required for monetary balance sheet items, such as cash, receivables, and payables, because these are already by their nature stated in terms of the "current" dollar or current purchasing power.

Remember that this study is concerned with only changes in the general price-level, and that the adjustments made will only in very rare cases reflect the "current cost" of balance sheet items. In other words, the distinction between changes in specific price-level and the general price-level is very basic, conceptually and the difference can be very material in actual application. Financial statements adjusted for changes in the general price-level are still on a historical (or invested) cost basis even though the unit of measurement has been changed. However, if historical cost were adjusted for changes in specific indexes, the current cost basis would be approximated. The purpose of general price-level adjustments is to reflect the financial statement items in terms of common or stable dollars; that is, dollars of the same general

purchasing power.

2.3 General price index used

As recommended in Accounting Research Study No. 6 and SAPB No. 3, the GNP Implicit Price Index was used to make the actual general price-level adjustments.[6] This index is available on a quarterly basis since 1947 and on an annual basis since 1929. All financial statements were restated in terms of the "current" dollar, which for this study was the dollar during the fourth quarter of 1967. The dollar of the fourth quarter of each year could have been selected, but to greatly simplify the computational manipulations involved, all financial data were restated in terms of one "current" dollar. Once this has been performed, to obtain, say, the December 31, 1964, balance sheet in terms of the 1964 fourth quarter dollar, all items in the December 31, 1964, balance sheet stated in "current" dollars, i.e. 1967 fourth quarter, would be multiplied by a conversion factor. This conversion factor would consist of the GNP Implicit Price Index for the fourth quarter of 1964 divided by the comparable index number for the fourth quarter of 1967. It is important to note that the magnitude of the financial ratios being computed in this study will remain unchanged regardless of whether the two components of the ratio are both stated in "current" dollars, 1964 fourth quarter dollars, or any other sized dollars.

Accounting Research Study No. 6 proposed that a 1945 cut-off date be used in the aging of all nonmonetary balance sheet items, for

---

[6]Staff of the Accounting Research Division, Accounting Research Study No. 6, p. 111 and Accounting Principles Board, SAPB No. 3, p. 14.

the following reason:

> ...so many of the goods and services currently available resulted from wartime (World War II) and postwar technology, the precision of comparisons of current price levels with those prevailing in periods prior to World War II are unreliable.[7]

Accordingly, fixed assets acquired or capital stock issued prior to 1945 were assigned the 1945 index in the adjustment process.

The sections that follow outline in detail the methodology of general price-level adjustments for the specific financial statement accounts.

2.4 Current assets

Cash and notes and accounts receivable, less the related allowance for doubtful notes and accounts, are clearly monetary items and were adjusted accordingly. Marketable securities were also classified as a monetary item and are discussed in the following sub-section. Flight equipment--expendable parts, miscellaneous material and supplies, and prepaid expenses are nonmonetary in nature, and sub-sections that follow outline the specific procedures used to adjust these accounts for changes in the general price-level.

2.4.1 Marketable securities

SAPB No. 3 classifies marketable securities that represent investments in stocks as a nonmonetary item.[8] A problem arises, however, in

---

[7]Staff of the Accounting Research Division, Accounting Research Study No. 6, p. xii.

[8]Accounting Principles Board, SAPB No. 3, p. 26.

the classification of marketable securities that represent investments in bonds. If the bonds are "held for price speculation", then they should be treated as nonmonetary. On the other hand, "if the bonds are held primarily for the fixed income characteristic, they are monetary."[9]

According to USAR, there are three accounts that are classified as marketable securities; the account titles and descriptions follow:[10]

1. Special deposits. Record here funds or securities deposited with fiscal agents or others for payment of current obligations.

2. United States Government securities. Record here the cost of United States Government securities.

3. Other temporary cash investments. Record here the cost of securities and other collectible obligations acquired for the purpose of temporarily investing cash, other than those issued by the United States Government or associated companies.

Marketable securities classified as special deposits, United States Government securities, and other temporary cash investments were treated as monetary items for several reasons. These investments are made primarily for their fixed income characteristics and clearly price speculation is not a dominant objective. Other temporary cash investments could conceivably include investments in common stocks which would dictate a nonmonetary classification. However, discussions with CAB field auditors and internal auditors at Trans World Airlines indicated that amounts so classified would be very small indeed. Therefore, all marketable securities were adjusted as monetary items. Table 1 illustrates the relative size of marketable securities to total assets.

---

[9] Ibid.

[10] Civil Aeronautics Board, USAR, p. 33.

TABLE 1

MARKETABLE SECURITIES STATED AS A PER CENT OF TOTAL ASSETS
BOTH ON A HISTORICAL COST BASIS AT DECEMBER 31

Air Carriers	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	Mean
American Airlines	16.3	17.6	11.6	13.3	18.0	18.7	13.2	12.9	13.6	10.4	14.6
Braniff Airways	14.4	7.7	3.9	1.6	5.7	4.7	5.6	4.1	6.4	0.0	5.4
Continental Airlines	0.0	0.0	0.0	0.0	8.3	16.1	6.3	8.2	3.1	5.8	4.8
Eastern Air Lines	14.5	9.5	0.0	0.0	0.0	2.8	1.1	8.2	0.0	8.2	4.4
Northeast Airlines	0.0	0.0	2.1	0.0	0.0	0.0	0.0	9.0	13.2	0.0	2.4
Northwest Airlines	4.2	0.0	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Trans World Airlines	7.0	11.0	3.7	5.3	10.2	9.0	7.6	4.7	2.7	6.9	6.8
United Air Lines	8.1	2.5	0.0	0.0	0.0	0.0	0.0	14.8	17.1	16.6	5.9
Western Air Lines	6.0	19.1	23.5	6.0	15.7	11.4	14.6	8.1	5.5	0.0	11.0

Source: Air Carrier Annual Reports.

2.4.2 Flight equipment--expendable parts and miscellaneous materials and supplies

CAB Form 41 has the following inventory type accounts; their USAR descriptions are indicated:[11]

1. Flight equipment -- expendable parts. Record here the cost of flight equipment replacement parts of a type which ordinarily would be recurrently expended and replaced rather than repaired and reused.

2. (less) Obsolescence and deterioration reserves--expendable parts. Accruals shall be made to this account when reserves are established for losses in the value of expendable parts.

3. Miscellaneous materials and supplies. Record here the cost of unissued and unapplied materials and supplies, including motor fuels and lubricating oils, held in stock . . .

These accounts are nonmonetary in nature and should be adjusted accordingly. However, due to their small relative size (see Table 2) and the difficulty in acquiring the data required for a detailed adjustment, the following alternative technique was used. It was assumed that the balance in this account at any year end was acquired uniformly throughout that year (thus adjusted at the average annual price index for the year) and was used uniformly throughout the following year (thus adjusted at that year's average annual price index).

Operating expenses with certain exceptions were assumed to have been incurred uniformly throughout the year (thus adjusted using the average annual price index for that year). This is discussed in a later section. That portion of operating expenses that represented the usage

---

[11] Ibid., pp. 34-35.

TABLE 2

FLIGHT EQUIPMENT--EXPENDABLE PARTS AND MISCELLANEOUS MATERIALS
AND SUPPLIES STATED AS A PER CENT OF TOTAL ASSETS
BOTH ON A HISTORICAL COST BASIS AT DECEMBER 31

Air Carriers	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	Mean
American Airlines	0.5	0.4	0.5	0.5	0.5	3.3	3.4	3.3	2.3	2.3	1.7
Braniff Airways	3.9	4.3	4.3	4.0	4.3	4.0	3.6	3.3	2.6	3.4	3.8
Continental Airlines	3.7	3.6	4.1	3.8	3.7	3.9	4.3	4.3	3.8	3.0	3.8
Eastern Air Lines	2.8	2.8	4.7	4.1	5.5	7.7	8.5	6.1	5.8	4.8	5.3
Northeast Airlines	4.2	5.5	8.9	11.3	11.0	18.8	15.9	11.8	6.7	7.0	10.1
Northwest Airlines	2.0	2.3	2.1	4.4	4.6	4.2	3.1	2.7	2.5	3.0	3.1
Trans World Airlines	4.9	5.4	3.4	2.7	2.8	3.3	3.3	4.0	4.0	3.6	3.7
United Air Lines	0.8	2.7	3.7	4.3	4.4	4.6	4.6	3.7	4.0	4.2	3.7
Western Air Lines	1.3	1.5	1.7	1.6	1.3	1.5	1.4	1.9	2.8	2.7	1.8

Source: Air Carrier Annual Reports.

of parts and supplies inventories constitute one such exception and were adjusted using the average annual price index for the year prior to the year of their assumed usage.

2.4.3 Prepaid expenses

Prepaid insurance, rent, etc. are essentially similar to depreciable fixed assets in nature as they represent an expenditure for an amount of services to be received in the future and will be amortized to expense over a specified period of time. This period is relatively short in the case of prepaid expenses. Accordingly, these prepaid items should be classified as nonmonetary and adjusted for changes in the general price-level in the same manner as depreciable fixed assets.

However, due to the immateriality of this account which averaged about 1% of total assets on a historical basis for all air carriers (see Table 3) and its relatively rapid turnover (thus the size of adjustment should not be large), a detailed analysis similar to that employed for depreciable fixed assets was not necessary.

To expedite the adjustment of prepaid expenses, it was assumed that the balance in this account at any year end was acquired uniformly throughout that year (thus adjusted using the average annual price index for the year). In addition, it was assumed that this balance was charged to expense uniformly throughout the immediately following year. Therefore, that portion of operating expenses that represented amortization of prepaid expenses was adjusted using the average annual price index of the year prior to the year of assumed amortization. The methodology described in this paragraph is similar to that outlined in the previous

TABLE 3

PREPAID EXPENSES STATED AS A PER CENT OF TOTAL ASSETS
BOTH ON A HISTORICAL COST BASIS AT DECEMBER 31

Air Carriers	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	Mean
American Airlines	1.1	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.1	0.1	0.3
Braniff Airways	0.3	0.8	1.1	1.1	1.2	0.9	1.0	0.6	0.3	0.4	0.8
Continental Airlines	1.2	2.0	1.6	1.0	2.4	1.6	1.1	0.5	0.4	0.3	1.2
Eastern Air Lines	0.0	0.7	0.6	0.4	0.4	0.6	0.6	1.0	1.0	0.9	0.6
Northeast Airlines	2.3	2.9	5.2	1.3	0.6	2.0	2.0	4.2	2.2	2.4	2.5
Northwest Airlines	0.4	0.5	1.0	1.1	1.3	1.4	0.9	0.6	0.6	0.6	0.8
Trans World Airlines	1.0	1.1	0.6	1.2	0.7	0.5	0.7	0.3	0.3	0.5	0.7
United Air Lines	0.4	0.5	0.5	0.4	0.6	0.4	0.5	0.7	0.5	0.6	0.5
Western Air Lines	2.3	1.7	1.6	2.2	1.2	1.5	0.8	1.3	1.2	1.1	1.5

Source: Air Carrier Annual Reports.

sub-section for flight equipment -- expendable parts and miscellaneous materials and supplies.

2.5 Property and equipment, accumulated depreciation and depreciation expense

The general price-level adjustment process for property and equipment (nonmonetary items) and for the related depreciation was the most time-consuming of all adjustments performed. This process had two dimensions: the first was the aging of the initial year's fixed asset balance and the second was the year-to-year updating of this balance for additions and retirements.

The initial aging of the air carriers' property and equipment as of December 31, 1958,was achieved through a combination of two techniques. For airframes, CAB Form 41 Schedule B-43 contains an annual inventory of these fixed assets that includes cost, date of acquisition, and accumulated depreciation. Using the information contained in this schedule, a detailed aging was performed that yielded a breakdown of airframe cost and related accumulated depreciation by quarter and year of acquisition. By applying the appropriate conversion factor, the price-level adjusted cost and accumulated depreciation was obtained. The appropriate conversion factor for an airframe acquired during the third quarter of 1952 was the GNP Implicit Price Index for the fourth quarter of 1967 divided by the GNP Implicit Price Index for the third quarter of 1952. Recall that all adjusted data were stated in fourth quarter 1967 sized dollars. This aging procedure for airframes was repeated for each balance sheet date for all the years studied.

This concludes the description of the adjustment technique

used for air carrier airframes. See Table 4 to ascertain the relative dollar size of airframes and the related accumulated depreciation to total property and equipment. Trans World Airlines was selected as being representative of this relationship.

TABLE 4

TRANS WORLD AIRLINES SUMMARY OF
PROPERTY AND EQUIPMENT
(000 omitted)

	Historical Cost	Accumulated Depreciation	Book Value
Flight Equipment:			
Airframes	$207,455	$111,378	$ 96,077
Aircraft engines	50,832	26,336	24,496
Other	33,117	23,031	10,086
	$291,404	$160,745	$130,659
Ground Property and Equipment	41,183	16,996	24,187
Land	46	-	46
Construction work in progress	6,187	-	6,187
Total Property and Equipment	$338,820	$177,741	$161,079

Source: CAB Form 41, Schedule B-5, December 31, 1958.

For all other depreciable property and equipment that could not be specifically aged as were air carrier airframes, an adjustment technique was employed to determine an approximate average acquisition date. This technique relied upon the estimated or actual depreciation rate and the ratio of accumulated depreciation to fixed asset cost. For example, if a fixed asset group were being depreciated at 10% per year, and the present ratio of accumulated depreciation to depreciable cost was 70%,

then the average acquisition date for this group would be seven years prior to the current balance sheet date. This adjustment technique was applied to the following depreciable fixed asset groups:

1. Aircraft engines
2. Airframe parts
3. Aircraft engine parts
4. Other flight equipment
5. Maintenance equipment
6. General ground property

CAB Form 41 Schedule B-43 does not detail the dates of acquisition for aircraft engines, but it does indicate the actual depreciation rates and classifies the aircraft engines by each manufacturer, type and model, and operation (domestic or foreign). The price-level adjustments and initial aging for these engines were made using the individual classifications and actual depreciation rates which should result in a more accurate restatement than using the totals for this group and estimated depreciation rates. Aircraft engine additions and retirements in most cases could be determined from Schedule B-43 to facilitate the year-to-year updating. However, where this information was not available, a first-in, first-out retirement system was assumed.

No attempt was made to update the initial year's fixed asset balance for depreciable property and equipment accounts other than airframes and aircraft engines. In essence, an average acquisition date was computed for these other fixed asset groups for each balance sheet date studied. This approach was justified for two reasons: (1) the immateriality of these accounts in relation to total property and equipment and (2) the time that would be required to analyze additions and retirements on a year-to-year basis. In other words, the small marginal addition to

precision of the adjustment process was not justified in relation to the extremely large time requirements of detailed analysis of these accounts.

Depreciation expense for each depreciable fixed asset category was adjusted by multiplying the normal depreciation rate by the average adjusted fixed asset balance for the year. The normal depreciation rate was computed by dividing historical depreciation expense by the average historical fixed asset balance for the year. The average fixed asset balance for the year was calculated as the simple arithmetic average of the balances at the beginning and end of the year.

The nondepreciable property and equipment accounts, land and construction work in progress, were immaterial in size throughout the periods studied. Construction work in progress was adjusted by assuming that the balance at the end of any year was acquired at the average price index for that year. The aging of the land account was estimated by examining its balance at the end of each year studied and by assuming a first-in, first-out retirement system.

As evidenced in Tables 5 and 6, property and equipment represented a significant percentage of total assets.

2.6 Investments and special funds

This balance sheet classification consisted primarily of investments in and advances to associated companies or divisions, long-term receivables, flight equipment deposits, and miscellaneous investments. Advances to associated companies or divisions and long-term receivables are monetary in nature and were adjusted accordingly.

Investments in subsidiaries not consolidated are nonmonetary

TABLE 5

GROSS PROPERTY AND EQUIPMENT STATED AS A PER CENT OF TOTAL ASSETS
BOTH ON A HISTORICAL COST BASIS AT DECEMBER 31

Air Carriers	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	Mean
American Airlines	93.7	83.6	92.1	94.2	97.1	93.0	100.5	97.5	91.1	92.2	93.5
Braniff Airways	96.2	111.7	115.3	122.2	121.9	129.2	128.4	125.2	85.1	101.6	113.7
Continental Airlines	86.2	89.6	89.3	96.6	99.0	105.6	110.1	94.0	94.0	83.4	94.8
Eastern Air Lines	116.9	125.7	135.8	140.0	142.9	152.5	153.2	125.4	119.6	100.4	131.2
Northeast Airlines	93.5	98.4	103.4	111.7	137.7	187.1	195.6	130.9	79.6	69.0	120.7
Northwest Airlines	106.5	98.7	101.1	101.6	101.9	100.7	101.7	98.8	102.1	104.7	101.8
Trans World Airlines	133.3	133.5	108.1	114.5	116.5	123.3	121.7	117.7	115.3	107.2	119.1
United Air Lines	115.2	119.4	115.1	121.4	125.6	127.0	123.9	98.6	89.8	86.2	112.2
Western Air Lines	93.4	86.2	85.8	102.6	106.2	109.5	114.7	120.5	117.2	114.3	105.0

Source: Air Carrier Annual Reports.

TABLE 6

NET PROPERTY AND EQUIPMENT STATED AS A PER CENT OF TOTAL ASSETS
BOTH ON A HISTORICAL COST BASIS AT DECEMBER 31

Air Carriers	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	Mean
American Airlines	43.7	52.2	58.2	62.7	63.3	58.1	61.8	61.1	63.2	65.9	59.0
Braniff Airways	47.1	65.8	71.5	75.0	72.4	71.2	65.9	73.5	61.6	76.1	68.0
Continental Airlines	67.4	75.7	67.8	63.7	65.6	62.2	70.7	61.6	64.6	66.6	66.6
Eastern Air Lines	56.1	65.1	72.0	73.2	68.6	60.8	68.0	63.6	67.4	61.8	65.7
Northeast Airlines	71.1	69.2	62.5	62.0	59.8	44.0	43.1	26.2	38.9	46.8	52.4
Northwest Airlines	62.5	68.3	69.6	76.1	71.3	69.4	71.7	73.8	77.4	75.9	71.6
Trans World Airlines	63.4	57.1	61.8	61.2	67.2	65.4	71.2	70.6	71.1	68.2	65.7
United Air Lines	69.0	76.2	77.0	77.5	74.0	71.7	74.9	56.9	53.9	53.4	68.5
Western Air Lines	62.6	54.1	44.2	66.9	63.6	64.0	64.4	75.7	72.0	68.7	63.6

Source: Air Carrier Annual Reports.

and, if carried at cost, were analyzed by year of investment. If the equity method was used, the subsidiary's financial statements were adjusted for general price-level changes, and the adjusted investment amount was determined by applying the parent's percentage ownership to subsidiary's adjusted net worth.[12]

Deposits made on future flight equipment acquisitions are non-monetary items and should be analyzed by year of deposit.[13] These deposits usually accounted for the major dollar amount of total investments and special funds. Due to the unavailability of detailed information to "age" these deposits, an assumption was made to facilitate its adjustment. It was assumed that the balance in this account at any year end was added at the average price index for the year being considered. The reasonableness of this assumption was examined for one air carrier that presented in its published annual reports the information necessary for a detailed aging of these flight equipment deposits. No material differences were noted during this examination between the set of year end balances that resulted from detailed analysis and the set resulting from employing the assumption outlined in the first part of this paragraph.

Theoretically, the actual or assumed dates that flight equipment deposits were made should be considered in the aging of the related flight equipment. For example, assume that 10% of the cost of an aircraft was deposited with the manufacturer July 1, 1960, and that the aircraft was delivered July 1, 1961. The aging for this aircraft at

---

[12]As suggested in SAPB No. 3, p. 27.

[13]Accounting Principles Board, SAPB No. 3, p. 28.

December 31, 1961, should reflect that 10% of the fixed asset balance is 18 months old and the remaining 90% is only six months old. The appropriate conversion factors would then be applied. Recall that air carrier airframes and aircraft engines were adjusted by using the actual or estimated acquisition date. However, as a practical matter, the additional precision to be gained by implementing this refinement would not be significant for the following reasons:

1. The length of time between the flight equipment deposit and the actual acquisition of the flight equipment is normally short.

2. These deposits are usually a small percentage of the total cost of flight equipment.

3. The effect on the income statement would be very immaterial due to a combination of the two factors above, and because the effect would be spread over several years as a result of depreciation.

Tables 7 and 8 indicate the relative size of flight equipment deposits and other investments and special funds.

2.7 Deferred charges

To facilitate the adjustment process, deferred charges were broken down into four categories: (1) developmental and preoperating costs, (2) unamortized debt discount and expense, (3) property acquisition adjustments, and (4) other deferred charges. Unamortized debt discount and expense, being related to bonds payable, was properly treated as a monetary item.[14] This was the only item classified as a deferred charge that was monetary in nature. See Table 9 to ascertain the relative

---

[14] Ibid.

TABLE 7

FLIGHT EQUIPMENT DEPOSITS STATED AS A PER CENT OF TOTAL ASSETS
BOTH ON A HISTORICAL COST BASIS AT DECEMBER 31

Air Carriers	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	Mean
American Airlines	18.8	8.4	9.5	5.1	1.0	3.9	5.3	6.1	4.6	3.6	6.6
Braniff Airways	18.1	7.2	4.2	1.4	2.3	3.9	7.2	1.1	6.3	.3	5.2
Continental Airlines	9.4	0.0	0.0	7.9	1.6	1.5	3.4	7.7	11.7	11.3	5.5
Eastern Air Lines	16.8	7.4	4.4	4.5	5.5	8.9	3.7	6.7	12.9	8.9	8.0
Northeast Airlines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9	7.8	3.7	1.5
Northwest Airlines	9.9	8.8	2.8	0.0	3.4	4.4	8.0	7.7	5.6	7.6	5.8
Trans World Airlines	0.0	0.0	3.7	9.5	1.3	5.8	3.8	7.6	7.9	6.5	4.6
United Air Lines	0.0	0.0	0.0	0.0	3.4	6.6	4.1	10.7	10.7	11.5	4.7
Western Air Lines	8.5	3.8	14.0	5.6	4.9	10.0	7.8	4.2	5.0	10.4	7.4

Source: Air Carrier Annual Reports.

TABLE 8

OTHER INVESTMENTS AND SPECIAL FUNDS STATED AS A PER CENT OF TOTAL ASSETS
BOTH ON A HISTORICAL COST BASIS AT DECEMBER 31

Air Carriers	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	Mean
American Airlines	0.8	1.7	0.6	0.7	1.6	1.4	1.0	1.1	1.0	1.9	1.2
Braniff Airways	0.2	0.3	0.4	0.3	0.2	0.2	0.4	0.3	9.8	0.3	1.2
Continental Airlines	0.1	0.1	3.2	0.4	3.7	0.2	0.1	2.1	1.7	1.7	1.3
Eastern Air Lines	0.3	0.3	0.3	0.5	0.4	0.4	0.3	0.2	0.3	3.1	0.6
Northeast Airlines	0.5	0.5	0.6	0.7	0.7	1.4	1.3	0.0	0.8	0.6	0.7
Northwest Airlines	0.3	0.1	0.1	0.1	0.2	0.3	0.2	0.2	0.7	0.4	0.3
Trans World Airlines	1.2	2.3	4.7	1.5	1.6	0.8	0.2	0.2	0.2	2.2	1.5
United Air Lines	0.4	0.3	0.3	0.3	0.5	0.5	0.2	0.1	0.2	0.1	0.3
Western Air Lines	0.2	0.2	0.2	2.5	1.3	0.4	0.2	0.3	0.2	0.2	0.6

Source: Air Carrier Annual Reports.

TABLE 9

TOTAL DEFERRED CHARGES STATED AS A PER CENT OF TOTAL ASSETS
BOTH ON A HISTORICAL COST BASIS AT DECEMBER 31

Air Carriers	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	Mean
American Airlines	0.5	1.2	1.5	1.2	0.6	0.5	0.5	0.6	0.8	0.9	0.8
Braniff Airways	2.6	2.8	2.6	2.5	1.8	1.9	2.0	2.6	2.7	5.2	2.7
Continental Airlines	5.5	5.3	4.1	3.7	2.4	1.8	1.6	0.2	0.0	0.2	2.5
Eastern Air Lines	1.9	2.4	3.1	3.9	4.6	3.2	3.2	1.0	0.3	0.4	2.4
Northeast Airlines	4.6	7.0	5.9	8.5	10.2	0.6	0.7	3.3	7.7	12.9	6.2
Northwest Airlines	1.0	1.6	3.2	3.2	2.9	2.5	1.8	1.2	0.7	0.6	1.9
Trans World Airlines	3.9	6.7	4.7	4.9	4.2	1.3	1.2	1.0	0.9	0.9	3.0
United Air Lines	0.3	1.2	1.7	1.1	0.2	0.2	0.7	0.6	0.5	0.4	0.7
Western Air Lines	0.3	0.6	0.6	0.7	0.2	0.2	0.1	0.1	0.3	0.4	0.4

Source: Air Carrier Annual Reports.

significance of total deferred charges in the historical balance sheets.

The largest individual deferred charge account was developmental and preoperating costs. This account includes "costs accumulated and deferred . . . pertaining to the development of new routes or extension of existing routes, preparation . . . of new routes . . ., the integration of new types of aircraft or services, and other preparations . . ."[15] The costs in this account are subject to periodic amortization. Deferred charges that represent costs incurred to be charged against income of future periods are nonmonetary.[16] The balance in the developmental and preoperating costs account at each balance sheet date was analyzed using the gross additions to the account and the annual amortization to expense. Additions were assumed to have been made at the average price index for the year. For example, if the conversion factor applicable to the beginning balance of $1,000 was 1.10 and the conversion factor for the year's addition of $2,000 was 1.07, then the conversion factor that was applied to the annual amortization figure was computed as follows:

	Amount	Conversion Factor	Adjusted
Beginning balance	$1,000	1.10	$1,100
Addition	2,000	1.07	2,140
	$3,000		$3,240
Amortization	(500)	$\frac{3,240}{3,000}$	(540)
Ending balance	$2,500		$2,700

[15]Civil Aeronautics Board, USAR, p. 39.

[16]Accounting Principles Board, SAPB No. 3, p. 28.

The new conversion factor of 1.08 (3,240/3,000) also determines the adjustment for the ending balance in this account.

Property acquisition adjustments were not frequently encountered and were analyzed by year of origin as a nonmonetary asset.

Other deferred charges were adjusted by assuming that the balance at any year end was acquired at the average price index for the previous two years. Due to the immateriality of amounts involved, amortization of this account to operating expense was adjusted using the average price index for the current year. This approach was also used for the small amounts of other deferred credits that will be discussed in a later section. See Table 10 to determine the relative size of other deferred charges.

2.8 Current liabilities

The CAB Form 41 current liabilities caption includes the following individual accounts:[17]

1. Current notes payable
2. Accounts payable-general
3. Collections as agent-traffic
4. Collections as agent-other
5. Associated companies
6. Accrued personnel compensation
7. Accrued vacation liability
8. Accrued Federal income taxes
9. Other accrued taxes
10. Dividends declared
11. Air travel plan liability
12. Unearned transportation revenue
13. Other current liabilities

---

[17] Civil Aeronautics Board, USAR, p. 24.

TABLE 10

OTHER DEFERRED CHARGES STATED AS A PER CENT OF TOTAL ASSETS
BOTH ON A HISTORICAL COST BASIS AT DECEMBER 31

Air Carriers	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	Mean
American Airlines	0.0	0.3	0.2	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.1
Braniff Airways	2.2	1.3	1.1	1.3	0.9	1.3	1.6	1.7	0.5	0.5	1.2
Continental Airlines	0.7	0.4	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.1
Eastern Air Lines	0.6	0.1	0.4	0.4	0.5	0.2	0.3	0.4	0.2	0.2	0.3
Northeast Airlines	0.1	0.2	0.3	0.7	0.5	0.6	0.7	0.3	0.3	0.2	0.4
Northwest Airlines	0.2	0.4	0.6	0.6	0.5	0.5	0.5	0.4	0.3	0.4	0.4
Trans World Airlines	1.0	0.8	0.5	0.7	0.7	0.7	0.6	0.5	0.4	0.4	0.6
United Air Lines	0.2	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.2
Western Air Lines	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1

Source: Air Carrier Annual Reports.

Most of these accounts are clearly monetary in nature. However, two of the accounts require further comment at this time concerning their dichotomous classification as monetary or nonmonetary.

Air travel plan liability according to USAR represents "the air carrier's liability for deposits received under air travel plan contracts."[18] These refundable deposits have been made by individuals and companies to facilitate credit purchases of airline tickets, and generate a significant amount of interest-free working capital. According to SAPB No. 3, such refundable deposits were classified as a monetary liability.[19]

Unearned transportation revenue, which represents "the value of transportation sold, but not used or refunded, for travel over the air carrier's own lines,"[20] is clearly a nonmonetary liability since "the obligation will be satisfied by delivery of goods that are nonmonetary."[21] Since there are no CAB Form 41 schedules that indicate activity in this account, an assumption was made to facilitate the adjustment of this nonmonetary item. Being classified as a current liability, it is logical to assume that the related services will be performed during the immediately following year. It was assumed that this liability at any year end was incurred at the average price index for that year and was liquidated at the average price index for the following year. Accordingly, the portion of operating revenues arising from the amortization of this

---

[18] Ibid., p. 42.

[19] Accounting Principles Board, SAPB No. 3, p. 28.

[20] Civil Aeronautics Board, USAR, pp. 42-43.

[21] Accounting Principles Board, SAPB No. 3, p. 28.

account was adjusted using the average annual price index for the year prior to the year of assumed amortization. Table 11 shows the relative significance of this account in the financial statements.

2.9 Long-term liabilities

According to SAPB No. 3, bonds payable, convertible bonds payable, and other long-term debt were properly classified as monetary liabilities. Convertible bonds payable were treated as monetary liabilities until converted and then, beginning with the date converted, the capital stock (and related surplus) accounts were treated as nonmonetary items.[22]

2.10 Deferred Federal income taxes

Under the philosophy of the deferred method for accounting for deferred Federal income taxes as espoused in Accounting Principles Board Opinion No. 11, this item is clearly nonmonetary in nature. Deferred taxes under the deferred method represent "cost savings deferred as a reduction of expenses of future periods" and therefore are properly classifiable as nonmonetary.[23]

CAB Form 41 Schedule B-3 shows for deferred Federal income taxes the beginning balance, provisions, applications, adjustments and ending balance. This schedule provided the necessary information required to make the appropriate price-level adjustments. In summary, the balance at each balance sheet date was aged by year of origin and the appropriate

---

[22] Ibid., p. 29.

[23] Ibid.

TABLE 11

UNEARNED TRANSPORTATION REVENUE STATED AS A PER CENT OF TOTAL ASSETS
BOTH ON A HISTORICAL COST BASIS AT DECEMBER 31

Air Carriers	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	Mean
American Airlines	2.2	2.0	1.8	1.6	1.5	1.5	1.8	1.7	1.6	1.4	1.7
Braniff Airways	4.1	3.6	2.8	2.8	1.6	1.8	1.9	1.9	0.8	0.4	2.2
Continental Airlines	0.4	0.5	0.3	0.4	0.4	0.4	0.5	0.5	0.4	0.3	0.4
Eastern Air Lines	2.1	3.1	2.3	2.6	2.6	3.8	4.5	4.3	4.1	2.9	3.2
Northeast Airlines	3.2	2.5	2.4	3.4	4.1	6.6	7.7	8.0	4.5	4.7	4.7
Northwest Airlines	1.0	0.8	0.6	0.5	0.6	0.9	1.0	0.8	0.9	0.9	0.8
Trans World Airlines	2.2	2.9	1.6	1.4	1.5	2.0	2.0	2.1	2.2	2.2	2.0
United Air Lines	2.9	2.3	2.1	2.1	2.2	2.5	2.5	2.3	2.2	2.0	2.3
Western Air Lines	1.8	2.1	2.0	1.8	1.6	1.7	1.6	1.4	1.4	1.5	1.7

Source: Air Carrier Annual Reports.

conversion factor was applied. For all applications, a first-in, first-out assumption was employed.

2.11 Other deferred credits

Deferred credits other than deferred Federal income taxes consisted of unamortized investment credits, reserves for self-insurance, deferred gains from installment sales of surplus aircraft, and miscellaneous deferred credits.

The unamortized investment credit account, being nonmonetary in nature, was analyzed by year of origin.[24] Additions to this account were assumed to have been made at the average price index for the year considered. The adjustments to amortization and to the ending balance were determined using the methodology employed for developmental and pre-operating costs discussed in a previous section.

Reserve for self-insurance was analyzed as a nonmonetary account. All other deferred credits were adjusted by assuming that the balance at each year end originated at the average price index for the two previous years. Due to the immateriality of the amounts involved, the portion of operating expenses attributable to this account was adjusted using the average price index for the current year. This approach was also used for other deferred charges. See Table 12 to determine the relative size of other deferred credits.

2.12 Capital stock and additional paid-in capital

Preferred stock, common stock, treasury stock, and additional paid-in capital are nonmonetary items and were therefore analyzed by

---

[24] Ibid.

TABLE 12

OTHER DEFERRED CREDITS STATED AS A PER CENT OF TOTAL ASSETS
BOTH ON A HISTORICAL COST BASIS AT DECEMBER 31

Air Carriers	1958	1959	1960	1961	1962	1963	1964	1965	1966	1967	Mean
American Airlines	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.1
Braniff Airways	0.3	0.2	0.2	0.3	0.6	0.6	0.3	0.3	0.1	0.6	0.4
Continental Airlines	1.4	1.8	1.1	1.2	1.3	1.0	2.7	8.3	9.5	6.8	3.5
Eastern Air Lines	2.1	1.9	1.7	0.4	0.5	0.4	1.3	1.1	1.5	1.3	1.2
Northeast Airlines	0.0	0.0	0.0	2.3	0.0	0.0	3.5	0.0	0.0	0.0	0.6
Northwest Airlines	0.0	0.0	0.0	0.6	0.7	1.4	3.3	3.9	4.4	4.2	1.9
Trans World Airlines	0.0	0.8	0.9	1.9	2.4	0.3	0.4	0.4	0.3	0.3	0.8
United Air Lines	0.6	0.7	0.5	0.3	0.6	0.8	1.0	0.4	0.4	0.9	0.6
Western Air Lines	0.0	0.0	0.6	1.8	0.5	0.9	2.2	3.0	3.4	3.1	1.6

Source: Air Carrier Annual Reports.

date of investment.[25] The adjustment methodology was similar to that employed for property and equipment; that is, the balance at each year end was aged and the appropriate conversion factor was applied.

Amounts that represented a capitalization of retained earnings (for example, a stock dividend) were segregated and restored to retained earnings. This action was necessary to facilitate the adjustment of the capital stock (and related surplus) accounts. In analyzing these accounts by date of origin so that the corresponding general purchasing power could be determined, amounts that represented the capitalization of retained earnings could not be traced to their theoretical date of origin. This theoretical date of origin is not simply the date of the transfer from retained earnings, but actually is the date or year that this amount of retained earnings arose. So, rather than making an arbitrary assumption as to this date of origin, this amount was restored to retained earnings, and total retained earnings were adjusted as described in the next section.

Only three of the air carriers studied held any treasury stock during the time periods analyzed, and in all three instances the amounts were very insignificant. Treasury stock is nonmonetary in nature and was used by the three air carriers to provide a temporary source of shares to be issued under various stock option plans. In none of the situations did the treasury shares represent a permanent contraction of invested capital. Amounts used to acquire treasury shares and amounts received from their reissue were adjusted using the average price index during the year of the transaction.

---

[25] Ibid., p. 30.

2.13 Retained earnings

Being a residual, retained earnings did not have to be classified as either monetary or nonmonetary.[26] In the price-level adjusted balance sheet, the balance for this account was that amount necessary to equate total assets with the sum of total liabilities plus capital stock and additional paid-in capital. The change in adjusted retained earnings from year to year was equal to adjusted net income (including purchasing power gains or losses due to holding monetary items) minus adjusted cash dividends plus or minus any miscellaneous retained earnings credits or charges (for example, a prior period adjustment) also adjusted for changes in the general price-level.

2.14 Operating revenues, expenses and income before taxes

With the major exception of depreciation and amortization, it was assumed that all operating revenues and operating expenses were earned or incurred at the average price index for the year in question. Minor exceptions to this assumption were noted in the previous sections entitled flight equipment--expendable parts and miscellaneous materials and supplies, prepaid expenses and unearned transportation revenue.

Due to the seasonality of certain air carriers' operations, it was initially felt that the use of quarterly adjustments might result in a significantly more accurate net income amount. To test this a priori belief, two air carriers were selected at random and a price-level adjusted operating income before depreciation and amortization figure was determined using both the quarterly and annual average adjustment

---

[26] Ibid.

technique. This figure was computed for the five consecutive years in which inflation was the greatest. The detail results are presented in the following table.

TABLE 13

PERCENTAGE BY WHICH ANNUALLY ADJUSTED OPERATING INCOME BEFORE DEPRECIATION IS (GREATER) LESS THAN QUARTERLY ADJUSTED OPERATING INCOME BEFORE DEPRECIATION

Carrier	1963	1964	1965	1966	1967
American	(0.032%)	(0.068%)	(0.028%)	(0.097%)	(0.006%)
Eastern	0.386%	(0.050%)	0.066%	0.422%	0.216%

As a result of the foregoing test, it was concluded that the marginal precision gained by using quarterly adjustments is not justified by the additional effort involved to make such adjustments. Therefore, this study assumed that all operating revenues and expenses except as previously noted were earned or incurred at the annual average price index for the year under consideration and were adjusted accordingly.

Price-level adjusted operating income (before income taxes) was determined by subtracting adjusted operating expenses including depreciation and amortization from adjusted operating revenues. In other words, each element used in the determination of unadjusted operating income was adjusted for changes in the general price-level by applying the appropriate conversion factor. This approach was not used in the determination of price-level adjusted net income as will be described in the next section.

2.15 Net income

The determination of price-level adjusted net income, using price-level adjusted operating income as a starting point (income statement approach), would require the adjustment of the following items:

1. Nonoperating income and expense
   a. interest expense
   b. gain or loss from disposition of property and equipment
   c. miscellaneous income and expense
2. Income tax expense
   a. current provision
   b. deferred portion
   c. investment tax credit
3. General price-level gain or loss from holding monetary items (purchasing power gain or loss)

The adjustment of all income statement items to determine price-level adjusted net income was endorsed by Statement of the Accounting Principles Board No. 3.[27] However, the adjustment of these items for changes in the general price-level was not considered feasible in this study for the following reasons:

1. The necessary information was not readily available for several of these items (for example, total proceeds from disposition of property and equipment).
2. Several additional assumptions would be required (for example, the computation of purchasing power gain or loss that was discussed in Section 2.2).
3. An alternative technique (balance sheet approach) requiring far less time was available that should yield the same final answer (price-level adjusted net income). This technique is outlined in the next paragraph.

---

[27] Ibid., pp. 36-37.

Very simply, the "balance sheet" approach in determining price-level adjusted net income merely compares beginning and ending adjusted retained earnings. However, it is normally not quite that easy. As was discussed in the section on retained earnings, the change during any period in price-level adjusted retained earnings can be accounted for as (1) price-level adjusted net income (including any purchasing gain or loss),[28] (2) price-level adjusted dividends, and (3) miscellaneous retained earnings charges or credits also adjusted for changes in the general price-level. Accordingly, price-level adjusted net income was determined in the following manner (balance sheet approach):

1. Adjust dividends and any miscellaneous retained earnings charges or credits for changes in the price-level.
2. Compute the net change in adjusted retained earnings during the period.
3. To the amount computed in step 2, add price-level adjusted dividends and add (subtract) any miscellaneous price-level adjusted retained earnings charges (credits).

The amount computed in step 3 is price-level adjusted net income. The balance sheet approach has two minor drawbacks. First, the amount of the purchasing power gain or loss is not computed. However, this element of information was not required as a model input for any segment of this study. Second, the accuracy of the adjusted net income amount determined in the above manner (balance sheet approach) depends upon the assumptions that were used to adjust each balance sheet account (except retained earnings which is a balancing figure). In order to check the

---

[28]The APB recommended in SAPB No. 3 that any purchasing power gain or loss be included in the final adjusted net income figure.

above accuracy, price-level net income was computed for one year for each of the nine air carriers using the methodology outlined at the start of this section (income statement approach). In other words, adjustments were approximated for nonoperating items and income tax expense, and the purchasing power gain or loss was estimated. Then, using these amounts and adjusted operating income, price-level adjusted net income was computed. This set of income values (one for each air carrier) was compared to the set of income values computed employing the methodology described above that relied upon the change in adjusted retained earnings (balance sheet approach). The small differences noted were attributed primarily to the crudeness of the assumptions that were required under the income statement approach due to the lack of certain needed information.

Comments upon the accuracy of the resulting price-level adjusted balances are contained in the next section.

2.16 Accuracy of price-level adjustment methodology

The foregoing sections have outlined in detail the actual procedures that were used to determine the price-level adjusted values for the specific financial statement accounts. An attempt was made throughout the adjustment process to minimize the number of simplifying assumptions as the relative materiality of the account balance increased. In other words, for accounts such as property and equipment that represented a significant percentage of total assets, the adjustment procedure relied on detailed adjustments with few, if any, simplifying assumptions. For accounts such as prepaid expenses that were insignificant in relation to

total assets, less detailed analysis was performed and more assumptions were used. In this manner, a proper balance hopefully was achieved between the precision of the price-level adjustments made and the relative materiality of the various accounts involved without expending an unnecessary amount of time and energy.

In evaluating the relative significance of the various accounts that were adjusted, account balances were related to total assets and some of these measurements were presented in tabular form in the previous sections. In addition, though not presented in tabular form, the materiality of the account was also viewed by evaluating its relationship to net income. In other words, an account could be an immaterial percentage of total assets, but have a significant effect on net income thereby justifying a more detailed price-level adjustment procedure.

In conclusion, based upon the price-level adjustment methodology outlined in this chapter, the resulting price-level adjusted financial statements should closely approximate the results that would have been obtained by employing the guidelines set forth in Statement of the Accounting Principles Board No. 3 and no simplifying assumptions (that is, detailed analysis would be performed for every account regardless of materiality).

CHAPTER III

FORECAST MODEL: METHODOLOGY AND FINDINGS

3.1 Overview

In sub-section 1.6.1, a simple linear time series forecasting model was briefly described. It is the purpose of this chapter (1) to describe that model in detail, (2) to present the empirical findings from implementation of such model, and (3) to statistically evaluate these empirical findings. A discussion of the importance of these findings and the resulting implications for contemporary accounting theory and practice is deferred to Chapter V.

As was stated in Chapter I, the purpose of this thesis is to gather evidence of an empirical nature to test the proposition that financial data adjusted for changes in the general price-level are more useful to investors than unadjusted financial data. Usefulness has been defined as predictive capacity. In this chapter, relative predictive capacity has been evaluated by comparing the accuracy of a forecasting model using data inputs that have been adjusted for changes in the general price-level and the same model using unadjusted data inputs. Recall that unadjusted financial data or unadjusted data inputs refer to the financial data or data inputs that have not been adjusted for changes in the general price-level.

3.2 A forecast model

Sub-section 1.6.1 indicated the justification of the usefulness to investors of predicting income values. The emphasis on earnings prediction does not imply that it is the only important investor decision variable. Of course, there are others, but this study assumed that the other factors are held constant so that the reliability of two sets of earnings predictions (one based on adjusted input data and the other on unadjusted input data) could be evaluated.

A simple linear regression model was employed to forecast income values based upon the four income measures presented in Figure 2. The selection of a simple linear regression model was based upon the assumption that the "average investor", in forecasting future income values, visually or graphically plots the most recent income values and uses a trend line fitted to these points to estimate the next income value. The use of a simple linear regression model should approximate closely the results that would be obtained using the assumed model of the "average investor."

FIGURE 2

FOUR INCOME MEASURES

	As Reported	Price-level Adjusted
Operating Income before income taxes	OI	AOI
Net Income after income taxes	NI	ANI

Each income measure was used to predict future values of itself and each adjusted income measure was used to predict the related unadjusted income measure. Accordingly, there were six combinations of input data and forecast objective (Figure 3).

FIGURE 3

COMBINATIONS OF INPUT DATA
AND FORECAST OBJECTIVE

Combination	Input Data	Forecast Objective
1	OI	OI
2	AOI	AOI
3	AOI	OI
4	NI	NI
5	ANI	ANI
6	ANI	NI

Codes Used:
OI = Operating Income before income taxes, as reported
AOI = Operating Income before income taxes, price-level adjusted
NI = Net Income after income taxes, as reported
ANI = Net Income after incomes taxes, price-level adjusted

The investor's decision model is based upon unadjusted income values; this information was provided by four combinations of input data and forecast objective in Figure 3 (combinations 1, 3, 4, and 6). Two of the combinations (2 and 5 in Figure 3) produced adjusted income values. Accordingly, it was necessary to assume that the investor could adapt his decision model in such a way as to use this information just as efficiently as he used the unadjusted income values.

Though not presented in Figure 3, the unadjusted income measures were used to predict future adjusted income values. These results are

not presented separately as they were similar to results obtained using unadjusted income measures to forecast themselves.

For each of the six combinations of input data and forecast objective, five forecasts were made for each air carrier. Each forecast was based upon the four immediately preceding annual income values as it was assumed that the investor relied only upon the four most recent income values to predict the next income value. This methodology is outlined in Figure 4.

FIGURE 4

SCHEMATIC OF FORECAST MODEL

Periods:	1959	1960	1961	1962	1963	1964	1965	1966	1967
Forecast									
1	I	I	I	I	F				
2		I	I	I	I	F			
3			I	I	I	I	F		
4				I	I	I	I	F	
5					I	I	I	I	F

Codes Used: I = represents input value in forecast model.
F = represents income value forecast by input values.

In other words, five forecasts were made for each of the nine companies, and thus a total of 45 forecasts were made for each of the six combinations of input data and forecast objective.

To illustrate, the first forecast for an air carrier using the last combination of input data and forecast objective presented in Figure 3 was determined by using the four adjusted net income values for the years 1959 through 1962 to yield a least squares time series regression line. This regression line was then used to forecast unadjusted net

income for 1963.

3.3 Forecast error measures

For each forecast, a measure of forecast error was required so that various forecasts could be compared. One measure of forecast error used was the signed difference between the forecast amount and the actual amount expressed as a signed percentage of the absolute value of the actual amount. More precisely, the percentage forecast error, FE, for company i in forecast period j was:

$$FE_{ij} = \frac{F_{ij} - A_{ij}}{|A_{ij}|}$$

where F_{ij} = forecast amount for company i in forecast period j

A_{ij} = actual amount for company i in forecast period j

A positive value for FE_{ij} would indicate an overforecast while a negative value would correspond to an underforecast.

In the computation of percentage forecast errors, a difficult problem is encountered when the actual amount is negative or near zero. For example, consider the hypothetical cases presented in Figure 5. Obviously, in ranking the above forecasts case 1 is clearly the best. But for the cases where the actual value is near zero or negative, the ranking becomes very difficult. This problem has been recognized and discussed by Brown and Niederhoffer[1] and others.[2] Various solutions

---

[1]Philip Brown and Victor Niederhoffer, "The Predictive Content of Quarterly Earnings," Journal of Business, Vol. XLI (October, 1968), pp. 488-497.

[2]For example, see David Green, Jr. and Joel Segal, "The

FIGURE 5

HYPOTHETICAL CASES WHERE ACTUAL AMOUNTS ARE NEAR ZERO OR NEGATIVE

Case	Forecast	Actual	Forecast less Actual	Percentage Forecast Errors
1	10	10	0	0
2	10	1	9	900
3	10	0	10	undefined
4	10	-1	11	1100
5	10	-10	20	200

have been proposed, but even the best of these has serious limitations, and it is questionable that they are much better than using the "raw" percentage forecast errors as described previously. In their recent study, Brown and Niederhoffer used a 100% limit on percentage forecast errors where the actual value was near zero or negative.[3] They reasoned that all forecast errors exceeding 100% were equally bad in predictive accuracy.

In this study there were several situations where the actual income amounts were near zero or negative. Accordingly, the descriptive statistics reported in this chapter include both raw percentage forecast errors and percentage forecast errors subject to a plus or minus 100% limit.

Predictive Power of First-Quarter Earnings Reports," Journal of Business, Vol. XL (January, 1967), pp. 44-55.

[3]Brown and Niederhoffer, "The Predictive Content of Quarterly Earnings," p. 481.

For each forecast period, the mean absolute percentage forecast error, $\overline{AFE}$, was determined using the formula that follows:

$$\overline{AFE}_j = \frac{\sum_{i=1}^{N} |FE_{ij}|}{N}$$

where N = 9, number of companies

FE_{ij} = percentage forecast error for company i in forecast period j

The related empirical findings are presented in Table 14. Note that the means of the raw absolute percentage forecast errors appear before the semi-colon in each cell while the means of the same errors subject to a 100% limit appear after the semi-colon.

TABLE 14

MEAN ABSOLUTE PERCENTAGE FORECAST ERRORS ALL COMPANIES

Input Data/ Forecast Objective	Forecast Periods					
	1963	1964	1965	1966	1967	1963-67
OI/OI	60;50	183;53	81;40	89;45	64;47	95;47
AOI/AOI	61;52	1033;54	58;42	166;46	73;54	278;50
AOI/OI	72;52	216;52	89;42	98;45	66;47	108;48
NI/NI	78;61	145;61	83;47	169;45	93;52	114;53
ANI/ANI	75;56	186;66	97;49	168;45	72;49	120;53
ANI/NI	77;54	167;63	82;48	288;48	109;57	145;54

The means of the raw absolute percentage forecast errors appear before the semi-colon in each cell while the means of the same errors subject to a 100% limit appear after the semi-colon.

Codes Used: OI = Operating Income, as reported
AOI = Operating Income, price-level adjusted
NI = Net Income, as reported
ANI = Net Income, price-level adjusted

Observations relating to the empirical findings presented in Table 14 are included in Section 3.7 while their statistical evaluation commences in Section 3.8.

3.4 Mean absolute deviation

The mean absolute percentage forecast error is a measure of the average reliability of a group of forecasts. For example, the average forecast error might have been 30%. But what about the dispersion of the individual forecast errors around this average? Were they all near 30% or were they widely scattered? In other words, the reliability of a group of forecasts depends not only upon the average forecast error, but also upon the dispersion about this average of the individual forecast errors. To measure this dispersion, the mean absolute deviation of the percentage forecast errors, $\overline{AD}$, was computed for each forecast period using the following formula:

$$\overline{AD}_j = \frac{\sum_{i=1}^{N} |AFE_{ij} - \overline{AFE}_j|}{N}$$

where AFE_{ij} = absolute percentage forecast error for company i in forecast period j

$\overline{AFE}_j$ = mean absolute percentage forecast error in forecast period j

The related empirical findings are presented in Table 15 and are commented upon in Section 3.7. Note that in Table 15 the deviations of the raw absolute percentage forecast errors appear before the semi-colon in each cell while the deviations of the same errors subject to a 100% limit appear after the semi-colon.

TABLE 15

MEAN ABSOLUTE DEVIATIONS OF THE
PERCENTAGE FORECAST ERRORS

Input Data/ Forecast Objective	Forecast Periods					
	1963	1964	1965	1966	1967	1963-67
OI/OI	40;26	223;24	88;27	94;37	53;30	100;29
AOI/AOI	36;26	1606;24	50;29	210;38	57;31	392;30
AOI/OI	53;26	277;25	96;30	107;37	54;28	117;29
NI/NI	44;23	148;18	79;23	217;36	88;32	115;26
ANI/ANI	52;31	202;20	98;25	211;37	59;30	124;29
ANI/NI	58;32	179;21	76;29	390;38	97;28	160;30

The deviations of the raw absolute percentage forecast errors appear before the semi-colon in each cell while the deviations of the same errors subject to a 100% limit appear after the semi-colon.

Codes Used: OI = Operating Income, as reported
AOI = Operating Income, price-level adjusted
NI = Net Income, as reported
ANI = Net Income, price-level adjusted

3.5 Ordinal rankings of means and deviations

Table 16 was prepared to assist the reader in his analysis of Tables 14 and 15. This table shows by period and for each combination of input data and forecast objective used in this study the relative ordinal rank of the means and deviations of the percentage forecast errors. The rank of 1 was used for the lower value and 2 for the higher value. The four comparisons set forth in the Table 16 correspond to the four comparison models outlined in Figure 6 of Section 3.8 that follows. In the final column of Table 16, the sums of the ranks for all periods are indicated; they range in value from five, which is equivalent to

the rank of one in each of the five periods, to ten which is equivalent to the rank of two in each of the five periods.

The purpose of Table 16 is twofold. First, for the indicated comparisons of adjusted and unadjusted input data, the "better" forecasts, as measured by the ordinal ranks of the mean absolute percentage forecast error and the related mean deviation, are summarized by forecast periods. Second, the relationship between the two forecast error measures is presented. For example, the two one's contained in the 1963 column for comparison 2 indicate that both forecast error measures that resulted from using unadjusted operating income to predict unadjusted operating income were lower than the forecast error measures obtained using adjusted operating income to predict unadjusted operating income.

Note that the rankings presented in Table 16 are based upon the means and deviations of raw percentage forecast errors. The analogous rankings were determined for percentage forecast errors subject to a 100% limit. These rankings are not presented separately as they were not significantly different from those presented in Table 16.

The empirical findings contained in Table 16 are commented upon in Section 3.7.

TABLE 16

ORDINAL RANKINGS OF MEANS AND DEVIATIONS AS SHOWN IN TABLES 14 AND 15: NO LIMITS ON PERCENTAGE FORECAST ERRORS

Comparison	Input Data/ Forecast Objective	Forecast Periods 1963		1964		1965		1966		1967		Sums	
1	OI/OI	1	2	1	1	2	2	1	1	1	1	6	7
	AOI/AOI	2	1	2	2	1	1	2	2	2	2	9	8
2	OI/OI	1	1	1	1	1	1	1	1	1	1	5	5
	AOI/OI	2	2	2	2	2	2	2	2	2	2	10	10
3	NI/NI	2	1	1	1	1	1	2	2	2	2	8	7
	ANI/ANI	1	2	2	2	2	2	1	1	1	1	7	8
4	NI/NI	2	1	1	1	2	2	1	1	1	1	7	6
	ANI/NI	1	2	2	2	1	1	2	2	2	2	8	9

First (second) digit in each cell indicates rank of mean (deviation) with 1 for lower value and 2 for higher value.

Codes Used:
OI = Operating Income, as reported
AOI = Operating Income, price-level adjusted
NI = Net Income, as reported
ANI = Net Income, price-level adjusted

3.6 Percentage of overforecasts

Table 17 indicates for each period and for the total five year period examined the percentage of companies for which each of the various combinations of input data and forecast objective resulted in an overforecast of the associated income value.

TABLE 17

PERCENTAGE OF OVERFORECASTS FOR
ALL COMPANIES BY PERIOD

Input Data/ Forecast Objective	Forecast Periods					
	1963	1964	1965	1966	1967	1963-67
OI/OI	33	0	22	78	89	44
AOI/AOI	33	0	22	56	89	40
AOI/OI	22	0	33	78	89	44
NI/NI	11	0	33	56	89	38
ANI/ANI	11	0	33	67	89	40
ANI/NI	0	0	33	67	89	38

Codes Used:
OI = Operating Income, as reported
AOI = Operating Income, price-level adjusted
NI = Net Income, as reported
ANI = Net Income, price-level adjusted

The findings summarized in Table 17 are indicative of the relative conservatism of each of the six combinations of input data and forecast objective. In other words, an investor might suffer a greater monetary penalty from an overforecast than from an underforecast of future income values. Therefore, ceteris paribus, an input data / forecast objective combination that consistently resulted in more overforecasts would be judged inferior to a combination that resulted in fewer overforecasts.

3.7 Comments on empirical findings

Tables 14 through 17 have presented the descriptive statistics of the empirical findings. An evaluation of the statistical significance

of these findings, in accordance with the formal research hypothesis, follows in the next section. However, prior to this evaluation, the following comments are appropriate:

1. Though the results are mixed, there appears to be a slight advantage for the two unadjusted income measures in forecasting values of the same unadjusted series; that is, lower forecast errors and lower deviations of these errors were observed (see Tables 14 and 15).

2. As indicated in Tables 14 and 15, the imposition of a 100% limit on forecast errors resulted in lower mean absolute percentage forecast errors and mean deviations. However, there were no material changes in the ordinal rankings of the related means and deviations.

3. In general, it appears in Table 14 that there is a greater relationship between the mean absolute forecast errors and changes in time periods than between the mean absolute forecast errors and changes in input data and forecast objectives.

4. As evidenced in Table 16, in comparing the capacity of unadjusted operating income to predict itself with the capacity of adjusted operating income to predict itself, the unadjusted concept resulted in the lower mean absolute forecast error and lower mean deviation in each period studied.

5. Using the sums of the ordinal ranking of means and deviations for all periods, only one case was observed in Table 16 that favored the predictive capacity of adjusted input data. Adjusted net income used to predict itself produced a lower mean absolute forecast error in three out of the five periods than did unadjusted net income used to predict itself.

6. An important relationship between the ordinal ranks of the means and the ordinal ranks of the related deviations was observed in Table 16. The rank of the mean was the same as the rank of the deviation in 34 of the 40 cases. In other words, if the mean of a group of forecasts was lower than another group, then it was quite likely that the first group would also have a lower mean deviation.

7. No material differences were observed in Table 17 in the percentage of overforecasts among the combinations of input data and forecast objective. However, there was an important relationship between percentage of overforecasts and changes in time periods. In summary, for all periods studied and all combinations of input data and forecast objectives, there were a total of 270 forecasts made; 110 of these were overforecasts.

3.8 Statistical evaluation of empirical findings

In the preceding sections, certain descriptive statistics have been presented to summarize the overall empirical findings. It is the purpose of this section and the two sub-sections that follow to delineate in detail the statistical tests that were employed to test the research hypothesis stated in Chapter I and to present the related statistical results.

The four comparison models indicated in Figure 6 were employed to test the proposition that the use of adjusted input data should result in better forecasts (therefore, adjusted data are more useful) of future income values than would be obtained using unadjusted input data. The notion of a better forecast will be defined in the two sub-sections that follow as it applies to each of statistical tests that were employed.

It is important to note that all comparisons made were between forecast error measures for the same company and same period. For example, for any of the comparison models indicated in Figure 6, two absolute percentage forecast errors were compared for each air carrier in forecast period one (same also holds for forecast periods two, three, four, and five). Accordingly, for each of the comparison models, there were five comparisons (one for each forecast period) for each of the nine air

FIGURE 6

OUTLINE OF FOUR COMPARISON MODELS
USED TO TEST RESEARCH HYPOTHESES

Comparison Model	Unadjusted Input Data/ Forecast Objective	Adjusted Input Data/ Forecast Objective
1	OI/OI	AOI/AOI
2	OI/OI	AOI/OI
3	NI/NI	ANI/ANI
4	NI/NI	ANI/NI

Codes Used: OI = Operating Income, as reported
AOI = Operating Income, price-level adjusted
NI = Net Income, as reported
ANI = Net Income, price-level adjusted

carriers. In total, there were 180 comparisons made (4 comparison models, 5 forecast periods, 9 air carriers).

As was indicated in Chapter I, the inferences that resulted from the statistical tests employed to examine the research hypothesis must be prefaced with one qualification. This qualification relates to the validity of the assumption that the sample of nine air carriers studied (though not randomly selected) is representative of some larger population of companies (for example, all commercial air carriers or possibly all medium and large industrial companies). In other words, inferences and generalizations made from the statistical results are valid only to the extent that these nine air carriers are representative of some larger population.

As was indicated in the preceding paragraph, each sample examined was of size nine. Certain problems arise when small samples are

used as a basis for statistical inference. For instance, estimates of population parameters tend to become unreliable as the sample size is decreased.[4] However, statistical inferences can still be made providing that certain additional assumptions or different techniques of analysis are employed. Spurr and Bonini[5] suggest one method for situations where it can be assumed that the sample was drawn from a population having a normal distribution. However, it was not reasonable in this study to assume normally distributed populations as evidenced in the following statement by Peatman:[6]

> The satisfaction of the normal distribution assumption is difficult to assess inasmuch as the populations in question are usually unknowns. The distributions of large random samples can be tested for their possible divergence from the normal. However, such appraisals cannot be effectively made with small samples.

The use of small samples and the inability to assume normally distributed variables makes the use of parametric statistical tests very difficult. However, nonparametric (distribution-free) methods can be applied when the above situation arises.[7] Accordingly, the statistical evaluation in this chapter (and Chapter IV) has relied entirely on nonparametric statistical techniques.

---

[4]George W. Snedecor, Statistical Methods (Ames, Iowa: The Iowa State College Press, 1946), p. 151.

[5]William A. Spurr and Charles P. Bonini, Statistical Analysis for Business Decisions (Homewood, Illinois: Richard D. Irwin, Inc., 1967), p. 300.

[6]John G. Peatman, Introduction to Applied Statistics (New York: Harper & Row, Publishers, 1963), p. 12.

[7]Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill Book Company, 1956), pp. 32-33.

Prior to the application of a statistical test, it is usually necessary to specify a significance level (indicating a probability of falsely rejecting the null hypothesis). However, the following approach recommended by Siegel was used for the statistical tests employed in this chapter and Chapter IV:[8]

> In contemporary statistical decision theory, the procedure of adhering rigidly to an arbitrary level of significance, say .05 or .01, has been rejected in favor of the procedure of making decisions in terms of loss functions . . . Although the desirability of such a technique for arriving at decisions is clear, its practicality in most research in the behavioral sciences at present is dubious, because we lack information which would be basic to the use of loss functions.
>
> A common practice, which reflects the notion that different investigators and readers may hold different views as to the "losses" or "gains" involved in implementing a social scientific finding, is for the researcher simply to report the probability level associated with his finding, indicating that the null hypothesis may be rejected at that level.

Accordingly, the statistical results of this study were summarized for several different significance levels.

Sub-section 3.8.1 deals with ordinal comparisons of individual absolute percentage forecasts errors by company and by period. Sub-section 3.8.2 involves comparisons based upon the relative size of the differences of individual absolute percentage forecast errors.

3.8.1 Statistical evaluation based upon ordinal comparisons of absolute percentage forecast errors

In order to operationalize the research hypothesis that the use of adjusted input data (in the forecasting model described earlier in this chapter) should result in better forecasts of future income values

---

[8] Ibid., p. 8.

than would be obtained using unadjusted input data, the notion of a "better forecast" must first be defined. In this sub-section, a "better forecast" was defined as the forecast that resulted in the lower absolute percentage forecast error. The size of the difference in the absolute percentage forecast errors is not important. For example, a forecast error of 10% is better than a 12% forecast error just as a 2% forecast error is better than a 70% forecast error. In sub-section 3.8.2, the notion of "better" is defined to encompass not only the direction of the difference in the forecast errors but also the magnitude of this difference.

Having defined the notion of a better forecast, it is possible to formulate the research hypothesis in terms of a null and alternative hypotheses:

> Null hypothesis: For a given forecast period and comparison model, there is no difference in the expected number of lower absolute percentage forecast errors associated with (1) the adjusted input data and (2) the unadjusted input data, and accordingly any observed differences are merely due to sampling errors.
>
> Alternative hypothesis: The use of input data adjusted for changes in the general price-level should result in a significantly greater number of lower absolute percentage forecast errors than would result from the use of unadjusted input data.

In other words, the null hypothesis seeks to determine if each sample were drawn from a population with a specified distribution (equal number of better forecasts resulting from the use of adjusted and unadjusted input data). Twenty samples (four comparison models with five forecast periods) were examined for this goodness-of-fit relationship.

In testing a relationship of this type, Siegel states:[9]

> . . . the investigator may use one of three goodness-of-fit tests: the binomial test, the X^2 one-sample test, or the Kolmogorov-Smirnov one-sample test. His choice among these three tests should be determined by (a) the number of categories in his measurement, (b) the level of measurement used, (c) the size of the sample, and (d) the power of the statistical test.

The X^2 one-sample test was inapplicable as the sample size (nine) in this study was too small.[10] The Kolmogorov-Smirnov one-sample test was also rejected as it assumes that the variable being considered (number of better forecasts) has a continuous distribution.[11] However, the binomial test can be used for small samples and for variables that have discrete distributions.[12] Accordingly, the binomial test was selected to test the above null hypothesis.

The following description is provided to briefly summarize the methodology of the binomial test:[13]

> The probability of obtaining x objects in one category and N - x objects in the other category is given by
>
> $$p(x) = \left(\frac{N!}{x!\ (N-x)!} \right) P^x\ Q^{N-x}$$
>
> where P = proportion of cases expected in one of the categories
> Q = 1 - P

---

[9] Ibid., p. 59.

[10] Ibid.

[11] Ibid.

[12] Ibid.

[13] Ibid., pp. 37-39.

> The probability of obtaining values greater than or equal to x is given by the sampling distribution of the binomial which is
>
> $$\sum_{i=x}^{N} \left(\frac{N!}{i!\ (N-i)!} \right) P^{i}\ Q^{N-i}$$
>
> In other words, we sum the probability of the observed value with the probabilities of values even more extreme. A one-tailed test is used when we have predicted in advance which of the categories will contain the smaller number of cases.

Under the null hypothesis previously stated, the assumed population parameters, P and Q, both equal ½. In other words, we expect the use of adjusted input data in the forecast model to result in the lower absolute percentage forecast error 50% of the time as stated in the null hypothesis. Similarly, the same statement is true for unadjusted input data.

To facilitate the application of the binomial test, Table 18 was prepared. For each of the four comparison models outlined in Figure 6 and for each forecast period, Table 18 presents the percentage of comparisons that resulted in a lower absolute percentage forecast error when using adjusted input data in the simple linear forecasting model. Each of the twenty interior cells of this table are based upon nine observations (one comparison for each company). For example, the 67 in row one and column one represents the percentage of lower absolute percentage forecast errors that were obtained for the 1963 forecast period using the indicated comparison model (OI/OI with AOI/AOI). That is, six of the nine comparisons indicated a better forecast when using adjusted input data.

TABLE 18

PERCENTAGE OF FORECASTS HAVING LOWER ABSOLUTE PERCENTAGE FORECAST ERROR WHEN USING ADJUSTED INPUT DATA

Forecast Period	Comparison Models: Input Data/Forecast Objective				All Four Comparison Models
	OI/OI with		NI/NI with		
	AOI/AOI	AOI/OI	ANI/ANI	ANI/NI	
1963	67[a]	67[a]	33	44	53
1964	22	44	33	44	36
1965	33	67[a]	56	44	50
1966	56	22	44	56	44
1967	56	11	22	33	31
1963-67	47	42	38	44	43

Codes Used: OI = Operating Income, as reported
AOI = Operating Income, price-level adjusted
NI = Net Income, as reported
ANI = Net Income, price-level adjusted

[a]Statistically significant at .25 level (binomial test; one-tailed).

Under the methodology of the binomial test, the null hypothesis would be rejected at the .09 level of significance for any of the percentages in Table 18 greater than or equal to 78. Accordingly, the null hypothesis was not rejected at the .09 level as all of the percentages in Table 18 are less than 78. Only three cases of a possible twenty were noted where the null hypothesis would have been rejected at the .25 level of significance.

Therefore, for any reasonable level of significance, the null hypothesis was not rejected for the majority of the twenty possible combinations of comparison model and forecast period. Accordingly, the

following inference can be made based upon these results: the use of adjusted input data in the forecasting model specified does not result in better forecasts than would be obtained using unadjusted input data. Therefore in terms of the research hypothesis, input data adjusted for changes in the general price-level are not more useful than input data unadjusted for these changes.

3.8.2 Statistical evaluation based upon the size of differences in absolute percentage forecast errors

The definition of a better forecast will be expanded from that used in sub-section 3.8.1. For the statistical test to be employed in this sub-section, a "better forecast" is defined as the lower absolute percentage forecast error only if the difference in the forecast errors is statistically significant. For example, an absolute percentage forecast error of 10.2% is probably not better than one of 10.3% using the above definition of a "better forecast." However, an absolute percentage forecast error of 10% is probably better than one of 70%. The statistical significance of this difference depends primarily on sample size and the significance level chosen for the appropriate statistical test.

Given the above definition of a better forecast, it is possible to operationalize the research hypothesis in terms of the following null and alternative hypotheses:

> Null hypothesis: For a given forecast period and comparison model, there are no significant differences between the set of absolute percentage forecast errors resulting from the use of unadjusted input data and the set of errors resulting from the use of adjusted input data and accordingly any significant differences observed are merely due to sampling errors.

Alternative hypothesis: The set of absolute percentage forecast errors produced by the use of adjusted input data are significantly lower than the set resulting from the use of unadjusted input data.

In other words, for a given forecast period and comparison model, two sets of absolute percentage forecast errors were compared. Each set contained nine elements (one for each air carrier); one set was based on adjusted input data while the other set was based on unadjusted input data. The two sets were compared element by element (in other words, company by company).

In order to evaluate the significance of the differences in the two sets of forecast errors, it was necessary to select the appropriate statistical test. Siegel describes five nonparametric two-sample statistical tests that "are used when the researcher wishes to establish whether two treatments are different, or whether one treatment is 'better' than another."[14] In essence, the results of the forecasting model used in this chapter can be viewed as two samples (two sets of absolute percentage forecast errors) that were produced by two treatments (adjusted input data and unadjusted input data).

The five nonparametric tests that follow are all applicable to two-sample, two treatment situations:[15]

1. McNemar test for significance of changes
2. Sign test
3. Wilcoxon matched-pairs signed-ranks test
4. Walsh test
5. Randomization test for matched pairs

---

[14] Ibid., p. 61.

[15] Ibid., pp. 63-94.

The randomization test for matched pairs was selected for two reasons: (1) all of the assumptions required for this test are satisfied, and (2) the power-efficiency of this test is higher than the maximum possible for the first four tests listed above.[16] Siegel, in comparing the relative applicability of these five nonparametric tests, stated:[17]

> The randomization test should be used whenever N is sufficiently small to make it computationally feasible and when the measurement of the variable is at least in an interval scale. The randomization test uses all the information in sample and thus is 100 per cent efficient . . .

Therefore, the randomization test for matched pairs was selected to test the null hypothesis. The exact probability under the null hypothesis associated with the observed data can be determined without requiring any assumptions about normality or homogeneity of variance.[18] This test has one important advantage over the binomial test in that it evaluates the size of the differences in the absolute percentage forecast errors, and because of this has a greater power-efficiency.

The following description is provided to briefly summarize the methodology of the randomization test for matched pairs.[19]

---

[16]The randomization test for matched pairs has a power-efficiency of 100% while the maximum for the other nonparametric tests considered is 95%. Power-efficiency of 95% means that if all the conditions of the parametric test are satisfied the appropriate parametric test would be just as effective with a sample which is five per cent smaller than that used in the nonparametric analysis. For references, see Siegel, Nonparametric Statistics, pp. 33, 93-94.

[17]Siegel, Nonparametric Statistics, pp. 93-94.

[18]Ibid., p. 88.

[19]Ibid., p. 92.

1) Observe the values of the various d_i's (deviations) and their signs. For example, in comparing the absolute percentage forecast errors of unadjusted operating income used to predict itself and of adjusted operating income to predict itself, the following deviations were observed for 1963:
d_i = 9, 38, 7, 3, 1, 13, -1, -37, -8
where i = 1 . . . 9 (one for each company)

2) Determine the number of possible outcomes under H_o for these values: 2^N. In our example, N = 9 which corresponds to the number of companies. Therefore, 2^N = 512 possible outcomes.

3) Determine the number of possible outcomes in the region of rejection: $(\alpha)\ (2^N)$. If α = .05, then the region of rejection consists of only the 25 most extreme outcomes since (.05) (512) = 25.6.

4) Identify these possible outcomes which are in the region of rejection by choosing from the possible outcomes those with the largest $\Sigma\ d_i$'s. For a one-tailed test, the outcomes in the region of rejection are all in one direction. In our example, the most extreme positive outcome is:
d_i = 9, 38, 7, 3, 1, 13, 1, 37, 8; $\Sigma\ d_i$ = 117.

5) Determine whether the observed outcome is one of those in the region of rejection. If it is, reject H_o in favor of H_A. In our example, the observed outcome (9, 38, 7, 3, 1, 13, -1, -37, -8) is not in the rejection region. Therefore, in this case, the null hypothesis has <u>not</u> been rejected at the .05 level.

The randomization test for matched pairs was applied to the twenty combinations of the five forecast periods and four comparison models. In none of the twenty individual combinations was the null hypothesis rejected in favor of the alternative hypothesis at the .20 level of significance or less. The distribution of significance levels at which the null hypothesis was rejected included one combination in the .20's, one in the .30's, four in the .40's with the remaining fourteen all over .50.

Based upon the above statistical evaluation, the evidence supports the conclusion that input data adjusted for changes in the general price-level are not more useful to investors than unadjusted input data.

3.9 Observations concerning statistical evaluation of empirical findings

The statistical tests employed in sub-sections 3.8.1 and 3.8.2 were also applied to absolute percentage forecast errors subject to a 100% limitation that was described in Section 3.3. These results are not presented separately as they were almost identical to the statistical evaluation of the absolute percentage forecast errors not subject to a limitation.

In summary, the two statistical tests employed in the foregoing sections failed to support the research hypothesis that adjusted input data are more useful than input data that have not been adjusted for changes in the general price-level. As the null hypothesis was not rejected at a reasonable significance level for most of the combinations of comparison model and forecast period, it was inferred that input data adjusted for changes in the general price-level are not more useful than unadjusted input data.

CHAPTER IV

CORRELATION MODEL: METHODOLOGY AND FINDINGS

4.1 Overview

It is the purpose of this chapter to determine the relative predictive capacity of financial ratios based upon (1) conventional unadjusted financial data and (2) financial data adjusted for changes in the general price-level. The relative capacity of the two sets of financial ratios to predict return to the investor will be evaluated through the use of a multiple linear correlation model.

In making an investment decision, a measure of expected return would be considered by most investors to be the ultimate information to facilitate their decision. Accordingly, the correlation model described in this chapter seeks to measure the predictive capacity of financial ratios used to forecast return to the investor. This approach differs from the forecast model (Chapter III) in that the forecast model predicted an income value which then would be used as an input to the investor's decision model. The use of return to the investor as the dependent variable in the correlation model by-passed this intermediate approach.

Recall that the purpose of this thesis is to gather evidence of an empirical nature to test the proposition that financial data adjusted for changes in the general price-level are more useful to investors than unadjusted financial data with useful being defined as predictive capacity.

This chapter will describe in detail the multiple linear correlation model employed, the related empirical findings, and a statistical evaluation of those findings. The importance of these findings and their implications for contemporary accounting theory and practice will be discussed in Chapter V.

4.2 Financial ratios

Seven financial ratios were selected to represent the independent or explaining variables in the multiple linear correlation model described later in this chapter. The dependent or explained variable is returned to the investor which is discussed in Section 4.3. For reasons stated in the next two paragraphs, the following seven financial ratios were selected:[1]

1. net income to average total assets
2. operating income to average total assets
3. cash flow to average total assets
4. cash flow to average total debt
5. total revenues to average total assets
6. net income to total revenue
7. operating income to total revenue

Cash flow was defined as net income plus depreciation and amortization while total debt included all current and long-term liabilities.

These seven financial ratios were selected for several reasons. First, Beaver demonstrated that these ratios are better than other financial ratios in predicting future success or failure, and, more importantly, that they have a significant amount of predictive capacity.[2] Although

---

[1]This study was concerned with the relative predictive capacity of two sets of financial data. Accordingly, it was not necessary to select the seven most predictive financial ratios, but only to use ratios having known or assumed predictive capacity.

[2]William H. Beaver, "Financial Ratios as Predictors of Failure," Empirical Research in Accounting: Selected Studies, 1966 (Baltimore: Institute of Professional Accounting, Graduate School of Business, University of Chicago, 1967), p. 102.

"success" is defined in a different manner in this study, it is not unreasonable to assume that these ratios will behave in a similar fashion. In addition, these financial ratios are currently popular with financial analysts and investors so that it is reasonable to assume that they are of some positive value in market decisions.

Some financial ratios such as the working capital ratio would be virtually unchanged after being adjusted for changes in the general price-level. Accordingly, the few ratios of this type were not considered for possible selection.

These financial ratios were used in various combinations as independent variables in the correlation model. More specifically, the seven ratios were employed in all the possible combinations of using two at a time, three at a time, four at a time, five at a time, six at a time, and finally all seven at a time. The total number of possible combinations of the seven financial ratios used X at a time is presented in Table 19.[3]

TABLE 19

POSSIBLE COMBINATIONS OF SEVEN FINANCIAL RATIOS USED X AT A TIME

X	Possible Combinations
2	21
3	35
4	35
5	21
6	7
7	1
Total	120

[3]The formula for the number of possible combinations of N objects taken X at a time is: $N! / (X! (N-X)!)$.

In other words, there were 120 total possible combinations of seven financial ratios used two at a time through finally seven at a time.

The seven financial ratios were computed for both sets of data for each air carrier for the 14 periods outlined in Figure 7. These ratios were the independent variables in the multiple correlation model and return to the investor during the immediately following period was the dependent variable.

FIGURE 7

SUMMARY OF PERIODS STUDIED

	One-Year Periods								
	1	2	3	4	5	6	7	8	9
Financial Ratios For Year	1959	1960	1961	1962	1963	1964	1965	1966	1967
Return For Year	1960	1961	1962	1963	1964	1965	1966	1967	1968

	Three-Year Periods				
	1	2	3	4	5
Financial Ratios For Years	1959-61	1960-62	1961-63	1962-64	1963-65
Return For Year	1962-64	1963-65	1964-66	1965-67	1966-68

4.3 Return to the investor

To ascertain the predictive capacity of each financial ratio pairing (adjusted and unadjusted), a measure of investor success (forecast objective) was necessary. Success in this study was defined from the viewpoint of a common stock investor as the percentage change in the market value of a common share from the beginning to the end of a period plus any

cash dividend received during the period stated as a percentage of market value of a share at the beginning of the period. This was more rigorously defined in Sub-section 1.6.2. In other words, success was the percentage return to the common stock investor before the effects of commissions and personal income taxes.

Return was computed for each air carrier for the 14 following periods:

1. One-year periods: 1960 through 1968.
2. Three-year periods: 1962-64 through 1966-68.

As depicted in Figure 7, the financial ratios of one period were the independent variables in the correlation model while investor return of the immediately following period was the dependent variable.

Because of the lag in the timeliness of the published annual reports at year end, the return period employed was not the calendar year or the three calendar years immediately following. Instead, the return period was pushed forward one quarter so that, for example, the "1960" return period was the year from March 31, 1960, to March 31, 1961, and the "1962-64" return period was the three-year period from March 31, 1962, to March 31, 1965.

To eliminate the possible effect of market fluctuations around a specific date, the market value of a share of common stock at the end of a return period was defined as the simple arithmetic average of the last ten stock prices during that period. For example, the market value of a share at March 31, 1961, would be the average of the last ten stock prices in March 1961.

In summary, to determine the return to the investor for say 1968, the percentage change in the market value of a share of stock during 1968

was added to the cash dividend received during 1968 stated as a percentage of beginning market value per share. Remember that the return period 1968 was defined as the year ending March 31, 1969. So, assuming that average market price per share for the last ten prices in March 1968 was 100 and in March 1969 was 110, this segment of return would be (110-100) / 100 = 10%. If cash dividends per share amounted to $2.00 for the period March 31, 1968, to March 31, 1969, then the dividend segment of return is 2/100 = 2%. Accordingly, total return to the investor for this period is 12%.

In the determination of cash dividends and market value per share, adjustments were made for all stock splits and stock dividends. The procedure employed involved stating all cash dividends and market values in terms of a common share for each company at December 31, 1958.

Relative success was defined in nominal terms; that is, no adjustment was made to return to the investor for changes in the general price-level. In other words, a 12% nominal return during a period of a 4% rise in the general price-level leaves the investor only 8% better off in a real purchasing power sense as measured in dollars at the end of the period. The failure to adjust investor returns to real terms will have no effect on the results of the correlation model to be described. For example, if a least squares regression line were plotted on a scatter diagram with financial ratios on the horizontal axis and relative nominal success on the vertical axis, the failure to adjust return to real terms would only change the value of the intercept on the vertical axis. The slope of the line and the correlation coefficient would remain unchanged in value.

Also for the same reason indicated in the previous paragraph, it

was not necessary or beneficial to adjust the percentage changes in market values by some index of general stock market activity such as the New York Stock Exchange Composite Index.

4.4 A multiple linear correlation model

Multiple correlation and regression analysis are statistical tools developed to determine the mathematical relationships between a dependent variable and a group of independent variables. Once this relationship is established, the independent variables can be used to predict (with varying degrees of accuracy) the dependent variable. The coefficient of multiple correlation and related coefficient of multiple determination (which is the square of the coefficient of multiple correlation) describe the average relationship between the dependent variable and the independent variables. The coefficient of multiple determination[4] indicates the percentage of the variation in the dependent variable that can be attributed to the independent variables. This measure of predictive capacity was selected to evaluate the relative usefulness of adjusted and unadjusted financial data. The remainder of this section delineates the various components of the multiple linear correlation model that was used to obtain two sets of coefficients of multiple determination, one set based on financial ratios adjusted for changes in the general price-level and the other set on unadjusted financial ratios.

The independent variables used in the multiple linear correlation model were the various combinations of the seven financial ratios described in Section 4.2. The dependent variable was the return to the investor for

---

[4]The coefficient of multiple determination was computed using the customary Pearson product-moment interpretation.

the period immediately following the computation period of the financial ratios. For each of the 14 periods outlined in Figure 7 and for each of the 120 possible combinations of financial ratios, two coefficients of multiple determination were computed based upon the two sets of financial data. Recall that one set of financial data has been adjusted for changes in the general price-level while the other set has not been adjusted for these changes.

Section 4.5 discusses the empirical findings generated by the implementation of the correlation model described in this section while Section 4.6 evaluates their statistical significance.

4.5 Empirical findings

The implementation of the correlation model delineated in the previous sections of this chapter resulted in the computation of 3,360 coefficients of multiple determination as 14 periods were examined using 120 possible combinations of seven financial ratios as explaining variables. One-half of these coefficients were based upon price-level adjusted financial ratios while the other half were based upon unadjusted financial ratios. All of the 1,680 comparisons made were between "unadjusted" coefficients of multiple determination and "adjusted" coefficients of multiple determination for the same period and same combination of financial ratios. The related empirical findings are summarized in Tables 20, 21, and 22.

Table 20 summarizes the results of the 1,680 comparisons of "unadjusted" and "adjusted" coefficients of multiple determination. The data contained in this table indicate the percentage of comparisons by period and for each group of financial ratios that resulted in a larger

TABLE 20

PERCENTAGE OF COEFFICIENTS OF MULTIPLE DETERMINATION THAT WERE GREATER BASED ON ADJUSTED FINANCIAL RATIOS

One-Year Periods	Number of Financial Ratios Used at a Time						
	Two	Three	Four	Five	Six	Seven	Mean*
1	48	54	54	52	71	100	54
2	38	51	54	38	43	100	48
3	10	34	37	29	14	100	29
4	76	46	40	52	57	100	52
5	62	71	80	95	71	100	77
6	33	20	6	14	43	100	19
7	19	23	20	29	29	0	22
8	57	34	23	24	29	0	32
9	62	54	77	81	86	0	68
Mean	45	43	43	46	49	67	45
Three-Year Periods							
1	29	71	57	71	71	100	60
2	48	51	51	67	86	100	56
3	62	43	54	67	71	100	56
4	43	6	20	5	0	0	16
5	48	11	43	0	0	0	24
Mean	46	37	45	42	46	60	42

*weighted average.

"adjusted" coefficient of multiple determination than "unadjusted" coefficient. For example, in period four of the one-year periods, 76% of the "adjusted" coefficients of multiple determination were greater in value than the corresponding "unadjusted" coefficients when using all the possible combinations of seven financial ratios taken two at a time. The means of these percentages are presented by period and for each group of financial ratios. In summary, 45% of the 1,080 comparisons made for

the one-year periods and 42% of the 600 comparisons for the three-year periods favored (that is, resulted in larger coefficients of multiple determination) the use of adjusted financial ratios. Note that the means presented in the last column are weighted averages of the related row percentages. The weights employed were the number of possible combinations for each group of financial ratios.

Table 21 presents the mean coefficient of multiple determination, stated as a percentage, for each period studied and for each financial ratio group. The mean for each period was determined by averaging all the possible combinations for each financial ratio group. For example, there were 21 coefficients of multiple determination for each period computed using two financial ratios at a time. The grand mean for all the one-year periods and three-year periods is also indicated.

For each financial ratio group, the coefficient of multiple determination for some of the individual combinations of financial ratios was higher and for others lower than the mean value presented in Table 21. Accordingly, since some of these financial ratio combinations were more predictive than others, it was deemed necessary to investigate these results further. In other words, was there a tendency for the more predictive financial ratio combinations to result in higher coefficients of multiple determination when adjusted or when unadjusted? And were these adjusted coefficients higher or lower for the less predictive financial ratio combinations? As a result of the investigation[5]

---

[5]The investigation consisted of the following: for each financial ratio group, the overall mean coefficient of multiple determination (CMD) based upon the individual CMD's for all periods and both sets of data was computed for each financial ratio combination. These overall means were then divided into three approximately equal categories (high third, middle third, and low third). The high third would correspond

TABLE 21

MEAN COEFFICIENT OF MULTIPLE DETERMINATION BY PERIOD AND FOR EACH GROUP OF POSSIBLE COMBINATIONS (STATED AS PERCENTAGES)

One-Year Periods	Number of Financial Ratios Used at a Time											
	Two		Three		Four		Five		Six		Seven	
	U	A	U	A	U	A	U	A	U	A	U	A
1	21	21	44	41	54	54	61	61	68	72	76	97
2	10	10	12	12	18	16	29	24	51	48	72	100
3	49	44	56	51	66	59	75	67	82	73	88	99
4	38	38	45	44	55	55	63	66	74	76	81	98
5	14	18	20	27	26	35	32	42	49	58	99	100
6	65	62	76	71	83	75	87	80	90	90	93	93
7	28	25	32	29	36	33	42	38	55	54	97	97
8	19	21	37	37	54	49	68	62	80	76	96	88
9	16	18	28	32	42	54	56	71	73	90	98	93
Mean	29	28	39	38	48	48	57	57	69	71	89	96
Three-Year Periods												
1	39	38	49	51	58	63	68	73	73	84	80	95
2	33	35	42	44	48	49	53	55	62	69	78	100
3	24	26	32	35	41	44	48	53	62	72	90	94
4	30	28	40	31	54	34	71	40	83	52	95	79
5	27	25	38	34	56	43	73	54	81	65	85	72
Mean	31	31	40	39	51	47	63	55	72	68	86	88

Codes used: U = Unadjusted data
A = Adjusted data

to answer the above questions, no significant relationships were discovered. In other words, it was just as likely that a financial ratio combination with high (low) predictive capacity would yield a higher

---

to the individual financial ratio combinations possessing better than average predictive capacity as measured by the CMD's (and visa versa for the low third). For each of these categories, the results of the comparison of the individual adjusted and unadjusted CMD's were summarized. The results are not presented in tabular form as no consistent or significant relationships were observed.

adjusted coefficient of multiple determination than a financial ratio combination with low (high) predictive capacity.

Finally, Table 22 summarizes the frequency distributions for the 120 combinations of financial ratios for all periods studied. Each combination involves nine periods when each period is defined in terms of one year and five periods when each period is in terms of three years. Each period for each financial ratio group involves one comparison of an "adjusted" and "unadjusted" coefficient of multiple determination. Therefore, for each combination based on one-year periods, nine comparisons were made, and, for each combination based on three-year periods, five comparisons were made. These results are summarized in Table 22. For example, there are 21 combinations of seven financial ratios used two at a time. For the one-year periods, three of these combinations resulted in a greater "unadjusted" coefficient of multiple determination for seven of the nine periods, five combinations resulted in a greater "unadjusted" coefficient for six of the nine periods, and five combinations produced greater "unadjusted" coefficients in five of the nine periods. On the other hand, the "adjusted" coefficient of multiple determination was greater in (1) five of nine periods for six financial ratio combinations, (2) six of nine periods for one combination, and (3) eight of nine periods for one combination.

Note that a horizontal line has been placed in the middle of the two parts of Table 22 to facilitate its interpretation. Frequencies above the line indicate the number of financial ratio combinations that produced a higher "unadjusted" coefficient of multiple determination in over half of the periods. Frequencies below the line indicate the same relationship for "adjusted" coefficients.

TABLE 22

FREQUENCY DISTRIBUTION FOR COEFFICIENT OF MULTIPLE DETERMINATION (CMD) COMPARISONS FOR EACH OF THE 120 POSSIBLE COMBINATIONS OF FINANCIAL RATIOS

Possible Combinations of Greater CMD's		Number of Financial Ratios Used at a Time						
		Two	Three	Four	Five	Six	Seven	Total
One-Year Period								
A	U							
0	9	0	0	0	0	0	0	0
1	8	0	2	0	0	0	0	2
2	7	3	8	4	3	0	0	18
3	6	5	5	10	3	1	0	24
4	5	5	5	10	7	3	0	30
5	4	6	8	7	5	2	0	28
6	3	1	6	4	2	1	1	15
7	2	0	1	0	1	0	0	2
8	1	1	0	0	0	0	0	1
9	0	0	0	0	0	0	0	0
Total		21	35	35	21	7	1	120
Three-Year Period								
A	U							
0	5	0	0	0	0	0	0	0
1	4	7	9	12	5	0	0	33
2	3	4	15	18	9	5	0	51
3	2	7	7	4	7	2	1	28
4	1	3	1	1	0	0	0	5
5	0	0	3	0	0	0	0	3
Total		21	35	35	21	7	1	120

Codes used: U = Unadjusted
A = Adjusted

The following observations are appropriate based on the empirical findings summarized in Tables 20, 21, and 22:

1. In Table 20, 28 of the 54 cells in the one-year period section and 15 of the 30 cells in the three-year period section indicate that the "unadjusted" coefficient of multiple determination was greater than the "adjusted" coefficient. However, these results are misleading to some extent as the combinations of each financial ratio group varies from one combination (when used seven at a time) to 35 combinations (when used either three or four at a time). The above comparisons give equal weight to each financial ratio group.

2. The means in the last column of Table 20 are weighted averages and do not suffer from the above deficiency. Six of these means (including the grand mean) for the one-year periods and three (including the grand mean) for the three-year periods indicate that the "unadjusted" coefficient was higher than the "adjusted" coefficient.

3. The means for all periods for each financial ratio group in Table 20 indicate a slight advantage for the unadjusted data set except when the financial ratios are used seven at a time.

4. In comparing the 54 sets of mean coefficients of multiple determination in the upper part of Table 21, the "unadjusted" mean coefficient was greater than the "adjusted" 25 times and there were ten ties. The six comparisons of grand means resulted in no overall advantage for either set of data.

5. For the 30 sets of mean coefficients of multiple determination in Table 21 based on three-year periods, 17 of the "adjusted" mean coefficients were greater. There were no ties. However, four of the six comparisons of the grand means resulted in greater "unadjusted" mean coefficients. There was one tie.

6. As was expected, the addition of financial ratios to the correlation model resulted in a larger percentage of the variation in the dependent variable to be explained by the independent variables. This is evident in Table 21.

7. Table 22 indicates that most of the 120 combinations of financial ratios resulted in only a slight advantage for one of the two sets of data. For example, for the one-year periods, 58 of the 120 resulted in a 5-4 or 4-5 advantage, while for the three-year periods, 79 of the 120 resulted in the same small advantage.

8. Though the advantage appeared to be slight, 74 of the 120 combinations for the one-year periods and 84 of the 120 for the three-year periods favored the unadjusted financial ratios.

In summary, these observations fail to demonstrate that adjusted financial ratios are better predictors than unadjusted financial ratios. Section 4.6 investigates the statistical significance of the empirical findings.

4.6 Statistical evaluation of empirical findings

The purpose of this section is to determine the statistical significance of the empirical findings summarized in Section 4.5. However, prior to the formulation of the hypotheses that were tested and the description of the statistical tests that were employed, the following paragraphs are presented to explain the rationale for the methodology adopted.

Each coefficient of multiple determination was based upon nine observations (one for each air carrier). Each observation consisted of values for one dependent variable (return to the investor) and from two to seven independent variables (financial ratios). Due to the inordinate amount of time involved for an external analyst to make general price-level adjustments to financial data, the scope of this study was necessarily limited to a small number of companies and hence a small number of observations. Though the observations were made for several time periods, it could not be assumed that the observations from period to period were independent of one another. Accordingly, the number of independent observations could not be multiplied by the number of time periods studied thereby resulting in a larger sample.

The consequences of small sample size were discussed in Section

3.8. The major conclusion from this discussion was that nonparametric statistical tests should be employed if sample size is small and it is not possible to assume normally distributed variables. The dependent variable in the correlation model (return to the investor) is not normally distributed primarily due to the fact that its values are limited to minus 100% (ignores effect of cash dividends) with no corresponding limit in the positive direction. For example, ignoring the return from cash dividends, the worst that an investor could do in any period would be a 100% loss (market price declines to zero). However, there is no corresponding finite percentage limit on gains, and several three-year period returns to investors were observed that were well in excess of 100%. This limitation would result in a skewness in the related distribution. In both the case of the return to the investor and the financial ratios, the precise shape of their individual distributions is not known.[6]

The major implication of being unable to assume normally distributed variables and working with small samples is that the statistical significance of individual coefficients of multiple determination cannot be evaluated. That is, the absolute predictive capacity of either set of financial ratios cannot be statistically evaluated due to the absence of the normality assumption. This is a limitation of the correlation model as formulated in this study.

However, Spurr and Bonini recommend nonparametric methods be applied when the above situation (small sample size and nonnormality)

---

[6] In an attempt to normalize the dependent variable, a logarithm transformation was used. The resulting set of coefficients of multiple determination were slightly higher in value; both the adjusted set and the unadjusted set were increased by comparable small amounts. Accordingly, the results presented are based upon untransformed data.

arises.[7] Fortunately, nonparametric tests are available that can be used to evaluate whether one set of data is relatively more useful (a better predictor) than another set. Accordingly, the statistical evaluation in this chapter relied entirely on nonparametric statistical techniques.

As the sample of nine air carriers examined was not randomly selected from a larger population, the statistical results are subject to a qualification which was discussed in Section 3.8. Also the justification for not selecting a significance level in advance was indicated in Section 3.8. In place of this approach, the statistical results were summarized by several different significance levels. The above rationale will not be duplicated here as the discussion of these points in Section 3.8 applies fully to the statistical methodology of Chapter IV.

The two sub-sections that follow describe the hypotheses that were tested and evaluate the significance of the empirical results.

4.6.1 Statistical evaluation based upon ordinal comparisons of coefficients of multiple determination

The following research hypothesis was stated in Sub-section 1.6.2: financial ratios based upon financial data adjusted for changes in the general price-level are more useful in predicting future return to investors than are financial ratios based upon unadjusted data. The coefficients of multiple determination produced by the correlation model outlined previously were used to examine the above proposition.

---

[7] William A. Spurr and Charles P. Bonini, Statistical Analysis for Business Decisions (Homewood, Illinois: Richard D. Irwin, Inc., 1967), p. 310.

For each of the 14 periods studied (nine one-year periods and five three-year periods) and for each of the 120 possible combinations of financial ratios, two coefficients of multiple determination were computed (one was based upon adjusted financial ratios while the other was based upon unadjusted financial ratios). These coefficients were compared and the higher of the two was determined to be more useful (predictive).

For each of the 120 possible financial ratio combinations, there were two sets of coefficients of multiple determination. Each set included nine coefficients for the one-year periods (as there were nine one-year periods) and five coefficients for the three-year periods (as there were five three-year periods). Accordingly, there were nine comparisons of coefficients of multiple determination for the one-year periods and five comparisons for the three-year periods. The correlation results were evaluated in 120 sets of nine comparisons (one-year periods) and 120 sets of five comparisons (three-year periods).

In this sub-section, in comparing two sets of coefficients of multiple determination, the more useful or more predictive set was defined as that set containing the greater number of higher coefficients when the sets were compared element by element. This definition ignores the size of the individual differences in adjusted and unadjusted coefficients as it is concerned solely with the direction of each difference. The above definition will be expanded in Sub-section 4.6.2 to include both the size and direction of these differences.

Using the above definition, the research hypothesis can be formulated in terms of the following null and alternative hypotheses:

Null hypothesis: For any given financial ratio combination, there is no significant difference in the expected number of greater coefficients of multiple determination associated with the two sets of financial ratios (one set based upon adjusted financial ratios while the other set was based upon unadjusted ratios), and accordingly any observed differences are merely due to sampling error.

Alternative hypothesis: The use of financial ratios based upon data that have been adjusted for changes in the general price-level should result in a significantly greater number of comparisons where the adjusted coefficient of multiple determination is larger than the unadjusted coefficient.

The binomial test[8] was selected to examine the above null hypothesis that involved ordinal comparisons of two sets of coefficients of multiple determination (adjusted and unadjusted). The characteristics of this test and the rationale for selecting this test in preference to other nonparametric tests were discussed in Sub-section 3.8.1 and will not be repeated here as that discussion is fully applicable to the statistical evaluation of the empirical findings presented in this sub-section.

The results of the binomial test can best be described by referring to Table 22. For the one-year periods, an 8-1 advantage is statistically significant at the .02 level of significance, a 7-2 advantage is significant at the .09 level, and a 6-3 advantage is significant at the .25 level. Thus, there were only three of 120 total combinations of financial ratios that resulted in the rejection of the null hypothesis in favor of the alternative hypothesis at the .09 level of significance or lower.

For the three-year periods, a 5-0 advantage is statistically

---

[8]Sidney Siegal, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill Book Company, 1956), pp. 36-42.

significant at the .03 level while a 4-1 advantage is significant at the .19 level. Only 3 of the 120 total combinations of financial ratios rejected the null hypothesis at the .03 level of significance.

To summarize the results of the binomial test, the null hypothesis was not rejected for the vast majority of the financial ratio combinations at a reasonable level of significance. Based upon these results and stated in terms of the research hypothesis, financial ratios adjusted for changes in the general price-level are not more useful (predictive of future investor return) than unadjusted financial ratios.

4.6.2 Statistical evaluation based upon the size of differences in coefficients of multiple determination

The research hypothesis stated in Sub-section 1.6.2 involved the relative predictive capacity of adjusted and unadjusted financial ratios. This hypothesis was operationalized in the Sub-section 4.6.1 and was evaluated by examining the direction of the differences in the two sets of coefficients of multiple determination.

In this sub-section, the research hypothesis was examined by evaluating both the direction and the size of the differences in the same two sets of coefficients. In other words, more predictive was defined as the set resulting in the higher coefficients only if those coefficients were significantly higher than the other set.

The research hypothesis was formulated in terms of the following null and alternative hypotheses:

> Null hypothesis: For any given financial ratio combination, there is no significant difference in the sets of coefficients of multiple determination based upon the adjusted and unadjusted financial ratios, and any observed differences are merely due to sampling error.

Alternative hypothesis: For any given financial ratio combination, the set of coefficients of multiple determination based upon price-level adjusted financial ratios will be significantly greater than those based upon financial ratios unadjusted for changes in the general price-level.

The randomization test for matched pairs[9] was selected to examine the above null hypothesis. The description of this test appeared previously in Sub-section 3.8.2 and will not be repeated here. The rationale for its selection over other nonparametric tests (also discussed in Sub-section 3.8.2) applies fully to the statistical evaluation presented in this sub-section. In summary, the randomization test is a nonparametric test that evaluates the significance of the differences in two matched sets of data. As applied to the results of the correlation model, there were nine pairs of coefficients of multiple determination for each financial ratio combination based upon one-year periods and five pairs for each combination based upon the three-year periods. For each matched pair of coefficients of multiple determination, one coefficient was based upon price-level adjusted financial data while the other was based upon data unadjusted for changes in the general price-level.

The results of the randomization test for matched pairs are presented in Table 23. For the one-year periods, the null hypothesis was rejected in favor of the alternative hypothesis at the .10 level of significance for only three of the 120 combinations of financial ratios. With a significance level as high as .20, still only 13 of the 120 combinations rejected the null hypothesis in favor of the alternative

---

[9] Ibid., pp. 88-94.

hypothesis. For the three-year periods, the results similarly fail to reject the null hypothesis for the majority of the combinations at reasonable level of significance. For example, for a significance level as high as .30, only 17 of the 120 combinations rejected the null hypothesis in favor of the alternative hypothesis.

Based upon the results of the randomization test for matched pairs, it was concluded that financial ratios adjusted for changes in the general price-level are not more useful than unadjusted financial ratios in predicting future return to the investor.

TABLE 23

NUMBER OF FINANCIAL RATIO COMBINATIONS REJECTING THE NULL HYPOTHESIS FOR EACH SIGNIFICANCE INTERVAL AND EACH TYPE OF PERIOD BASED UPON RANDOMIZATION TEST FOR MATCHED PAIRS

Interval for Level of Significance	Number of Financial Ratio Combinations Rejecting the Null Hypothesis	
	One-Year Periods	Three-Year Periods
0 - .05	1	2
.06 - .10	2	2
.11 - .20	10	2
.21 - .30	9	11
.31 - .40	11	4
.41 - .50	13	7
over .50	74	92
	120	120

4.7 Observations concerning statistical evaluations of empirical findings

In summary, both statistical tests employed in this chapter to examine the corresponding null hypotheses failed to demonstrate a

significant difference in the predictive capacities of financial ratios based upon (1) price-level adjusted financial data and (2) financial data unadjusted for changes in the general price-level. It was therefore concluded that financial ratios adjusted for changes in the general price-level are not more useful than unadjusted financial ratios.

The significance of these results and their implications for contemporary accounting theory and practice will be discussed in Chapter V.

CHAPTER V

SUMMARY AND CONCLUSIONS

5.1 Overview

Let us now restate the purpose of this dissertation and briefly summarize the research design that was employed to gather empirical evidence to examine the research proposition stated in Chapter I. In addition, the limitations of the methodology used and the related empirical findings will be summarized and the corresponding conclusions presented. Finally, the implications of this study for contemporary accounting theory and practice are discussed, and directions for future research in the price-level area are suggested.

5.2 Purpose of research and summary of research design

As was stated in Chapter I, the purpose of this study was to gather evidence of an empirical nature to examine the proposition advanced in Accounting Research Study No. 6 that financial statements adjusted for changes in the general price-level are more useful (to investors) than the conventional historical cost financial statements that are not adjusted for such changes. "Useful" was defined as predictive capacity. In other words, to be useful to an investor, a set of past data should facilitate the prediction of future data of interest.

The research design of this thesis relied on two models to evaluate the relative usefulness (predictive capacity) of price-level adjusted

financial data and unadjusted financial data.

First, a simple linear forecasting model described in Chapter III was employed to predict future income (net income and operating income) values. Past income values for the preceding four periods were used as data inputs for this model. Past income values were of two types: (1) values adjusted for changes in the general price-level and (2) values unadjusted for these changes. The income values forecast were compared to the actual income values, and a percentage measure of forecast error was determined. The forecast errors produced by price-level adjusted input data were compared with those resulting from unadjusted input data. This comparison was used to determine whether the price-level adjusted input data were more useful (in that lower percentage forecast errors were produced) than the unadjusted input data.

Then a multiple linear correlation model outlined in Chapter IV was used to evaluate the relative predictive capacity of two sets of financial ratios (one set was price-level adjusted and the other set unadjusted). The financial ratios were the independent variables in the correlation model while the dependent variable was investor return stated as a percentage. The correlation model produced two sets of coefficients of multiple determination. The sets of coefficients based upon financial ratios adjusted for changes in the general price-level was compared to the set of coefficients based upon unadjusted financial ratios. This comparison was used to determine whether the price-level adjusted financial ratios were more useful than the unadjusted ratios in the sense of having a greater predictive capacity. Greater predictive capacity was indicated by a higher coefficient of multiple determination.

5.3 Summary of empirical findings and related evaluation

The empirical findings produced by the forecast model (Chapter III) and correlation model (Chapter IV) and their related statistical evaluation failed to support the research proposition advanced in Accounting Research Study No. 6 that financial statements adjusted for changes in the general price-level are more useful (to investors) than unadjusted statements. In addition, there was virtually no difference in the usefulness (as defined in this study) of the two sets of financial statements (adjusted and unadjusted). The empirical evidence produced by both models strongly agreed with the above findings.

5.4 Major limitations of this study

The empirical results of this study are subject to important limitations which were discussed in detail in the prior chapters of this dissertation. Let us briefly summarize those limitations; the detailed discussions will not be repeated here.

1. Sample limitation - the sample was necessarily small (nine independent observations) and non-random (only one industry was examined).

2. Time period studied - results were somewhat dependent on the level of inflation and general economic stability encountered.

3. Definition of usefulness - defined as predictive ability; also choice of input variables to predict variables of interest to investors.

4. Statistical models employed - use of correlation and regression models and required assumptions.

5. Unavailability of adjusted financial data to directly influence stock market decisions (that is, all market-related data were influenced by published unadjusted data but not by adjusted data).

5.5 Conclusions and implications for contemporary accounting

Given the research methodology employed in this thesis and subject to the limitations set out in the preceding section, the following major conclusions are appropriate:

1. Income values adjusted for changes in the general price-level are not more useful (better predictors) than unadjusted income values when used to forecast future income values.

2. Financial ratios adjusted for changes in the general price-level are not more useful (better predictors) than unadjusted financial ratios when used to predict future return to the investor.

In summary, the empirical evidence contained herein failed to demonstrate that price-level adjusted financial statements were more useful to investors than unadjusted financial statements.

This result is contrary to (1) the a priori position espoused in Accounting Research Study No. 6 and (2) theoretical arguments for price-level adjustments (some of which were listed in Chapter I). How can the empirical evidence presented in this study be explained in light of the a priori and theoretical evidence? The following paragraphs examine this question.

One of the theoretical arguments for general price-level adjustments states that price-level adjusted data are closer to the "truth" in that they are better reflections of economic reality than are unadjusted data. The apparent conflict of this argument with the empirical results of this thesis can be explained as follows. A concept or theory can be theoretically more "correct" than another concept or theory without implying that the more "correct" will also be the more predictive. For example, in the current operating income versus

all-inclusive income controversy, one concept (current operating) is more predictive while the other (all-inclusive) is theoretically the better measure of income.

Another argument for general price-level adjustments is the contention that it is unrealistic in accounting to assume that changes in the value of the dollar may be ignored. In other words, the level of inflation warrants the presentation of price-level adjusted financial statements. The empirical evidence gathered in this thesis does not support the above position. The level of inflation in the United States since 1945 was apparently so small that only a negligible difference in the usefulness of the two sets of financial statements was produced. Presumably, if the level of inflation had approached the rate that existed during the last two decades in some South American countries, the unadjusted financial statements would have completely lost their meaning and usefulness.

Table 24 presents the levels of inflation and deflation (as measured by the GNP Implicit Price Deflator) for the years affecting the empirical results of this study. The vast majority of the dollars adjusted were converted using the GNP Implicit Price Deflator for the years 1951 through 1967 which had an annual average rate of inflation of 2%. Despite this "low" level of inflation, there were "material" differences between various items in the adjusted and unadjusted financial statements. For example, total adjusted fixed assets at December el, 1967, for all air carriers were 10% greater than the total unadjusted balance. Also for 1967, adjusted net income for all carriers was 12% greater than unadjusted net income with a range of from 2% to 86% for

the individual carriers.

TABLE 24

ANNUAL LEVELS OF INFLATION AND DEFLATION IN THE UNITED STATES AS MEASURED BY THE GROSS NATIONAL PRODUCT IMPLICIT PRICE DEFLATOR (STATED AS A PER CENT)

Year	Inflation (Deflation)	Year	Inflation (Deflation)	Year	Inflation (Deflation)
1945	2.6	1953	0.9	1961	1.3
1946	11.7	1954	1.5	1962	1.1
1947	11.8	1955	1.5	1963	1.3
1948	6.7	1956	3.4	1964	1.7
1949	(0.6)	1957	3.7	1965	1.8
1950	1.4	1958	2.6	1966	2.7
1951	6.7	1959	1.6	1967	3.0
1952	2.2	1960	1.7		

Source: United States Department of Commerce, Survey of Current Business, issued monthly.

In summary, the price-level adjustments made in this study were affected by a relatively low level of inflation. It can be argued that because of this factor there was no observed difference in the usefulness of the two sets of financial statements. This interpretation of the empirical results would support the position of many groups who oppose price-level adjusted data on the grounds that, among other things, the level of inflation (as measured by any index of general purchasing power) in the United States during the past two decades has been relatively low.

A factor that could account for the lack of difference in usefulness as measured in the correlation model was the availability of unadjusted financial statements to influence stock prices. Since price-level adjusted financial statements are not directly available to

influence stock prices, the unadjusted financial statements would be expected to show a greater relationship to investor return (ceteris paribus). However, given the theoretical arguments that price-level adjusted data should be more useful, especially where extreme inflation or deflation exist, the unavailability of adjusted data might negate this expected advantage. Indeed, it may be significant that the unadjusted rate did not prove to be the distinctly better predictor. In any event, no meaningful difference in usefulness would be observed. Unfortunately, both sets of financial statements were not available to influence market decisions so that relative usefulness could be evaluated without this limitation.

5.6 Directions for future research

This thesis represents a small but significant step in the determination of an empirical solution of the price-level controversy. The findings presented herein were subject to two related limitations: (1) the number of companies was small due to the time and data required to make actual price-level adjustments and (2) price-level adjusted financial data were not directly available to influence investors' decisions. The removal of these two limitations should produce more meaningful results that would have greater generalizability. Hopefully, companies will begin to follow the recommendations of Statement of the Accounting Principles Board No. 3 so that future studies of this type will not be faced with the above limitations. In other words, adjusted data will be available to influence investors' decisions and a greater number of companies will be able to be examined.

The models employed in this thesis defined usefulness as

predictive capacity as viewed by the investor. Future research using different definitions of usefulness could be undertaken to gather more empirical evidence to be used to answer the price-level question. For example, usefulness might be defined from the viewpoint of management as a measure that results in efficient and profitable internal decisions.

This study was concerned only with the relative usefulness of financial data adjusted for changes in the general price-level. As part of the broad price-level controversy, it has been argued that "current cost" data should be more useful than either conventional or general price-level adjusted statements. Empirical evidence needs to be obtained to support (or fail to support) the above position.

One final suggestion for potentially rewarding research in the price-level area will be mentioned. Sensitivity analysis applied to empirical results can be employed to answer some very interesting questions. In general, sensitivity analysis is a technique that demonstrates the changes that are caused in the solution of a model by hypothetical changes in parameter values which underlie the model. As applied to the price-level controversy, sensitivity analysis could be used to determine the level of inflation that would be required at which price-level adjusted data are clearly more useful than unadjusted data. Of course, this assumes that such a level exists. Other parameters such as the composition of a firm's assets or expenses, depreciable lives, turnover periods, etc., could also be varied.

Sensitivity analysis can also be applied to the hypothetical results of simulation models. These models attempt to represent the empirical results that would be produced by the actual observation of

the data of interest. The financial statements of a number of hypothetical firms could be simulated and then adjusted for changes in the general price-level. The usefulness of the two sets of financial statements could be evaluated using methodology similar to that used in this thesis. Sensitivity analysis could then be applied to the simulated results.

In conclusion, most unresolved accounting controversies at the theoretical level can be attributed to our failure to agree upon fundamental accounting objectives, assumptions and principles. The price-level controversy is no different. Emphasis on predictive capacity to some extent avoids the pitfalls of the theoretical approach. In other words, is it more important for a measure or concept to be "theoretically correct" or for it to be "useful", specifically, in the predictive sense? If the latter criterion is more important, then it can be argued that future accounting research should rely heavily on predictive methodology.

SELECTED BIBLIOGRAPHY

Reference Works

American Accounting Association, Committee to Prepare a Statement of Basic Accounting Theory. A Statement of Basic Accounting Theory. Evanston, Illinois: American Accounting Association, 1966.

American Institute of Certified Public Accountants, Accounting Principles Board. Financial Statements Restated for General Price-Level Changes - Statement No. 3. New York: American Institute of Certified Public Accountants.

Beaver, William H. "Financial Ratios as Predictors of Failure," Empirical Research in Accounting: Selected Studies, 1966. Baltimore: Institute of Professional Accounting, Graduate School of Business, University of Chicago, 1967.

Chambers, Raymond J. Accounting, Evaluation and Economic Behavior. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1966.

Civil Aeronautics Board. Uniform System of Accounts and Reports for Certificated Air Carriers. U. S. Government Printing Office, 1965.

Friedman, Milton. "The Methodology of Positive Economics," Essays in Positive Economics. Chicago: University of Chicago Press, 1953.

Hendriksen, Eldon S. Accounting Theory. Homewood, Illinois: Richard D. Irwin, Inc., 1965.

_____. Price-Level Adjustments of Financial Statements. Washington State University, 1961.

Jones, Ralph C. Effects of Price Level Changes on Business Income, Capital, and Taxes. American Accounting Association, 1956.

_____. Price-Level Changes and Financial Statements -- Case Studies of Four Companies. American Accounting Association, 1955.

Mason, Perry. Price-Level Changes and Financial Statements -- Basic Concepts and Methods. American Accounting Association, 1956.

Moody's Industrial Manual. New York: Moody's Investor Service, Inc., 1945 through 1956.

Moody's Transportation Manual. New York: Moody's Investor Service, Inc., 1957 through 1967.

Siegel, Sidney. Nonparametric Statistics for the Behavioral Sciences. New York: McGraw-Hill Book Company, 1956.

Spurr, William A. and Bonini, Charles P. Statistical Analysis for Business Decisions. Homewood, Illinois: Richard D. Irwin, Inc., 1967.

Staff of the Accounting Research Division of the American Institute of Certified Public Accountants. Accounting Research Study No. 6 - Reporting the Financial Effects of Price-Level Changes. New York: American Institute of Certified Public Accountants, 1963.

Sweeney, Henry W. Stabilized Accounting. New York: Harper & Brothers, 1936; New York: Holt, Rinehart and Winston, Inc., 1964.

Periodical Literature

Beaver, William H. "Alternative Accounting Measures As Predictors of Failure." Accounting Review, XLIII (January, 1968).

_____. "Market Prices, Financial Ratios, and the Prediction of Failure." Journal of Accounting Research, VI (Autumn, 1968).

_____; Kennelly, John W.; and Voss, William M. "Predictive Ability as a Criterion for the Evaluation of Accounting Data." Accounting Review, XLIII (October, 1968).

Chambers, R. J. "Prospective Adventures in Accounting Ideas." Accounting Review, XLII (April, 1967).

Horrigan, James O. "Some Empirical Bases of Financial Ratio Analysis." Accounting Review, XL (July, 1965).

Jones, Ralph C. "Effects of Inflation on Capital and Profits: The Record of Nine Steel Companies." The Journal of Accountancy, LXXXVIII (January, 1949).

Paton, W. A. "Observations on Inflation from an Accounting Stance." Journal of Accounting Research, VI (Spring, 1968).

Spencer, Charles H. and Barnhisel, Thomas S. "A Decade of Price-Level Changes - The Effect on the Financial Statements of Cummings Engine Company." Accounting Review, XL (January, 1965).