INFORMATION TO USERS

The most advanced technology has been used to photograph and reproduce this manuscript from the microfilm master. UMI films the original text directly from the copy submitted. Thus, some dissertation copies are in typewriter face, while others may be from a computer printer.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyrighted material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each oversize page is available as one exposure on a standard 35 mm slide or as a 17" × 23" black and white photographic print for an additional charge.

Photographs included in the original manuscript have been reproduced xerographically in this copy. 35 mm slides or 6" × 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

U·M·I
Accessing the World's Information since 1938

300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA

Order Number 8728023

The information content of cash flow measures in regard to enterprise dividend policy

Jensen, David Edward, Ph.D.

The Pennsylvania State University, 1987

U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

The Pennsylvania State University

The Graduate School

College of Business Administration

The Information Content of Cash Flow Measures in Regard to Enterprise Dividend Policy

A Thesis in

Business Administration

by

David Edward Jensen

Submitted in Partial Fulfillment
of the Requirements
for the Degree of

Doctor of Philosophy

August 1987

David Edward Jensen
David Edward Jensen

We approve the thesis of David Edward Jensen.

Date of Signature:

June 29, 1987

J. Edward Ketz

J. Edward Ketz, Associate Professor
of Accounting and Management
Information Systems, Thesis Advisor

June 29, 1987

Charles H. Smith

Charles H. Smith, Peat Marwick
Professor of Accounting, Chairman
of Accounting and Management
Information Systems

June 29, 1987

Robert P. Crum

Robert P. Crum, Assistant Professor
of Accounting

June 29, 1987

Mark J. Roberts

Mark J. Roberts, Associate
Professor of Economics

June 29, 1987

J. Randall Woolridge

J. Randall Woolridge, Associate
Professor of Finance

ABSTRACT

The reporting of cash flows as a component part of the external reporting package is presently at the forefront of accounting. At the same time, there is little empirical research supporting the usefulness of the measure. This thesis provides some empirical evidence of the usefulness of cash flow. The empirical domain is the area of dividend policy.

Litner's [1956] dividend policy model is used to test the statistical significance of several asset flow measures, of which cash flow is one. Before the asset flow measures are tested, the structural form of the model is determined empirically to be firm specific. The primary results are that cash flow from operations supplies no information beyond operating income and working capital from operations, but operating income and working capital from operations supply signifcant information beyond cash flow. Operating income was determined to be the strongest contributor to the explanation of a firm's dividend policy, which is consistent with prior research in the area.

TABLE OF CONTENTS

Chapter

LIST OF TABLES

LIST OF FIGURES

ACKNOWLEDGEMENTS

I would like to express my deepest thanks to my dissertation chairman, Dr. J. Edward Ketz. It is without a doubt, without his genuine caring and constant guidance, I would not have been able to complete this dissertation and therefore the doctoral program.

I would like to thank the other members of my committe, Dr. Robert Crum, Dr. Mark Roberts and Dr Randall Woolridge. The suggestion and timely input are very much appreciated. I feel special mention of Dr. Robert Crum's contribution needs to be made. I thank him for his personal interest in me and my topic. His hard work has made this a much better project than it would have been without his help.

Of course, throughout the long process of obtaining advanced education, those who wait at home and lend the most important degree of support are the one's most often forgotten. The graduate receives all of the recognition, when in reality it is a team effort. My wife, Sue, is a part of this accomplishment, every bit as much as I am. My two children, Kristi and Kelli, who were born while I attended Penn State, gave to me a better reason to complete the program.

Finally, I would like to thank God for the ability he gave to me and the opportunities he made available to me throughout my life that allowed me to achieve the completion of a doctoral program.

Chapter 1

INTRODUCTION

1.1 Background and Nature of The Problem

The reporting of cash flows as a component part of the external reporting package is presently at the forefront of accounting. The private sector regulatory body in accounting, the Financial Accounting Standards Board (FASB), has determined that

> Since neither earnings nor comprehensive income measured by accrual accounting is the same as cash flow from operations, cash flow statements provide significant information about amounts, causes, and intervals of time between earnings and comprehensive income and cash receipts and outlays. [1984, para. 53]

The above paragraph makes two separate and distinct assertions. First that earnings and cash flows are different, and second, cash flow is useful. Within the same document the FASB concludes that a statement of cash flows should be a component of the external reporting package. The Board has sought to operationalize this contention through the exposure draft issued in July 1986, which if adopted in 1987 will require companies to present a statement of cash flows.

The above conclusions and recommendations have been reached without a good empirical base to substantiate the claim of additional information content. Several studies have demonstrated that the statistic cash flow is statistically different from income [Gombola and Ketz, 1982 and 1983, and Bowen, Burgstahler, and Daley, 1984]. However, the same studies do not demonstrate that the statistic is useful as asserted by the FASB. In order to be useful, the statistic must be part of someone's information base and have the ability to influence decisions made by the user of the information [Beaver, Kennelly, and Voss, 1968].

Several studies [Ball and Brown, 1968; Beaver and Dukes, 1972] have purported to investigate the relative information content of earnings and cash flow in the realm of the stock market. The variables of interest were determined to have information if a statistical dependency between the variable and stock price changes was observed. Both studies reported results that favored earnings; however, cash flow was operationalized as earnings plus depreciation. Therefore, the results cannot be used to support the FASB's contention because the authors did not really test the information content of cash flow.

The primary objective of this study is to determine if cash flow or a cash flow surrogate has incremental information content beyond accounting earnings. The empirical domain in which this study will proceed is within the dividend policy area. Litner's [1956] autoregressive model will serve as the primary evaluation tool. Several researchers [Fama and Babiak 1968; Fama 1974; Hagerman and Huefner 1980; and Watts 1973] have used the model to test empirical dividend policy questions. Using the model with different asset flow measures as independent variables, Fama and Babiak [1968] and Hagerman and Huefner [1980] determined that historical cost net income was superior to "cash flow" as an asset flow measure. However, both studies used income plus depreciation to proxy for cash flow. Gombola and Ketz [1983] and Bowen, Burgstahler, and Daley [1984] have shown that income and income plus depreciation are practically the same statistic. Therefore, cash flow as an information input into a dividend policy model has not been tested. Such a test, using appropriate cash flow statistics, is the subject of this research.

1.2 Research Question

As alluded to in section 1.1, a refined cash flow statistic has not been tested empirically. The primary purpose of this research is to examine the earnings versus cash flow issue using more refined cash flow measures as deveoped by researchers such as Gombola and Ketz [1983].

Because accounting is an artifact of an exchange economy, the testing of asset flow measures to determine which have information content requires a model describing a phenomenon of importance to a particular constituency. The majority of prior research has used the equity markets and a variation of the market model or the capital asset pricing model to assess information content of accounting numbers. This research is going to use common equity as its focal point, but in place of stock price movements, it is going to determine which asset flow measures describe a firm's dividend policy better. Litner's [1956] dividend policy theory provides an empirical vehicle from which to make inferences concerning the information content of various asset flow measures.

Accounting earnings has performed well in prior studies. Several recent studies [Kolb 1981; Baker, Farrelly and Edelman 1985] have indicated the addition of a liquidity variable maybe an important determinant of a firm's dividend policy. In order to pay a cash dividend, a firm naturally needs enough net cash inflow to support operations and cover the dividend. Bowen, Burgstahler, and Daley [1984] have shown that income and cash flow do not covary together very closely. Therefore, in any accounting period, income may increase, but cash flow from operations can decrease for any of a number of reasons. One possible reason for such a phenomenon to occur is to generate increased sales through the granting of more liberal credit policies. The net result is to increase current income (assuming costs are controlled), but decrease current cash inflow from operations (holding other functions such as the accounts payable function constant). This results in the two asset flow measures, income and cash flow from operations, providing divergent signals and which signal management does use when setting dividend policy is exactly the question this research is addressing.

The specific statistical hypotheses are designed to determine if an earnings measure, an earnings measure plus depreciation, working capital from operations, quick flow from operations, or cash flow from operations describe a firm's dividend policy individually or collectively.

The primary analysis is performed by comparing a more general, less restricted model to a model containing a number of linear restrictions. The restricted model will be nested within the unrestricted model, meaning that the only difference between the two models will be one asset flow measure. The test statistic will determine if the additional asset flow measure in the unrestricted model adds significant information.

A second look at the research question will be taken using discriminant analysis. Firms are classified as either dividend increasing, decreasing, or not changing and a discriminant function using various asset flow measures is estimated to classify the firms into the proper group. The statistical analysis concentrates on the classification power of each model and which asset flow measures achieve the best discrimination.

1.3 Structure of the Thesis

The remainder of this research is organized in the following manner. Chapter 2 presents a discussion of the issues between earnings and alternative asset flow measures. It is determined that the basic issue surrounds the degree of aggregation desired. Conceptual arguments, primarily from the practitioner literature arguing for a cash based reporting statement are presented, followed by a review of the empirical studies which in some manner have addressed the question of the incremental information content of various asset flow measures. The findings of this research regarding the information content of cash flow are inconclusive.

Chapter 3 defines the variables of interest, identifies the data sources, presents a discussion of the relevant econometric issues and develops the necessary research hypotheses to achieve the aforementioned objective. The Litner dividend policy model is an autoregressive distributed lag model that requires very special care in estimating.

Chapter 4 discusses the proper structure for the dividend policy model for testing the asset flow measure hypothesis. It is determined that a firm specific model, rather than a simpler economy or industry model, is needed to describe dividend policy.

Chapter 5 proceeds with the asset flow measure hypothesis testing. The most important explanatory variable is determined to be operating income, followed by last year's dividend and working capital from operations. Operating net income plus depreciation is found to offer statistically significant information beyond income and working capital, but it is concluded this is more a result of the rather large sample size than of any substantive reason. Cash flow from operations falls out of the analysis and is determined not to have information content beyond operating income and working capital from operations.

Chapter 6 extends chapter 5 by employing a cross sectional technique, discriminant analysis, in an attempt to mitigate a possible limitation of chapter 5. The limitation chapter 6 seeks to eliminate is the possible lack of data points available for dividend decreasing firms compared to the abundance of data points for dividend increasing or stable dividend companies. The results of chapter 6 are very similar to chapter 5's: operating income is determined to be the most important explanatory variable.

Chapter 7 summarizes the empirical results and presents several limitations and possible extensions for future work.

Chapter 2

LITERATURE REVIEW

2.1 Earnings vs. Cash Flow

Income and cash flow are members of a broader group of accounting statistics termed asset flow measures. Asset flow measures indicate the net inflow or outflow of a specified group of assets over a particular time period.

The most primitive asset flow measure is cash flow which is simply the change in cash from one accounting period to the next. At present, the most complex asset flow measure supplied as a component part of the financial reporting package is accounting earnings determined under an accrual accounting system.

The difference between any two asset flow measures is due to the number of different asset flows being aggregated into one number. Cash flow is a change in cash from year to year. All noncash flows are aggregated by their effects on cash. Quick asset flow is the change in the summation of cash, accounts receivable, and marketable securities from one year to the next. All nonquick asset flows are aggregated by their effects on quick assets. This analysis can be continued through the necessary expansion of net flows considered until net income is arrived at.

Therefore, the basic difference among all possible asset flow measures is the degree of aggregation of underlying transactions and events that are used to derive the reported statistic.

The highest degree of aggregation occurs when all flows are summarized in one specific asset flow (*e.g.*, cash flow). The total void of aggregation occurs when all source documents are placed in the public domain.

Following the above description is the question of the effectiveness and efficiency of the reported statistic and the system used to generate it. A cash-based system is the simplest: all flows are reported based upon their effects on cash. No special rules are needed to provide guidance for the timing of event and transaction recognition. When cash is affected by operating activities, it is simply reported in the flow statement.

As one moves away from a cash-based statement, rules must be developed to provide guidance about when events and transactions should be reported in the flow statement. Obviously, as rules and requirements are added to a system, the system becomes more complex. Therefore, a cash-based system is simpler than an accrual-based system. The question becomes one of analyzing the efficacy of competing systems.

The remainder of this chapter is organized as follows: First, the position and philosophy of the private sector regulatory body in accounting, the Financial Accounting Standards Board (FASB), are examined as they existed at the inception of the FASB and in the current regulatory environment. Second, a review of the literature that questions the efficacy of the Board's position is presented, followed by a review of the empirical literature that examines the differences between various asset flow measures. A summary of the accounting issues will then be presented. The last section of this chapter provides a review of the pertinent dividend policy literature. The purpose of this review is to establish the dividend policy models as a valid empirical vehicle to study the main accounting questions. It is not intended to be an exhaustive review of the dividend policy area in the finance literature.

2.2 Philosophy of the Financial Accounting Standards Board

The FASB [1978] has determined that a primary purpose of financial accounting is to lower the uncertainty associated with the amounts and timing of uncertain cash flows from debt and equity investments. According to the FASB, earnings calculated using accrual accounting concepts provide "a better indicator of an enterprise's present and continuing ability to generate cash flows than information limited to the financial aspects of cash receipts and payments" (p. ix). For this reason, the FASB asserts that earnings is the primary focus of accounting.

In 1980 the FASB softened the above position. In a discussion memorandum on reporting funds flow they state, "Information about past receipts and payments when combined with information about the activities of an enterprise, may be useful as a basis for making assessments of future funds flows (ultimately cash flows)" [FASB, 1980 (p. 26)]. In a subsequent exposure draft, the FASB [1981] acknowledged that past cash flow information may be useful in predicting future cash flows.

In SFAC #5 [FASB, 1984], a statement of cash flows is identified as a necessary part of the financial reporting package. The FASB believes such information will be useful in "helping to assess factors such as the entity's liquidity, financial flexibility, profitability, and risk" (p. 19). Finally, the FASB [1986] has issued an exposure draft that, if adopted, will require firms to prepare the statement of changes in financial position on the cash basis. In essence, this would require a statement of cash inflow and outflows.

The above historic account of a gradual shift in the Board's basic philosophy concerning a statement of cash flows should not be construed to mean that the Board has lowered the importance of accrual-determined earnings. It simply indicates that the Board feels the earnings statistic can be supplemented and be made more useful by examining the relationships between earnings and cash flows. Net income is still the focus of accounting according to the Board.

The elevation of accrual-determined earnings to the central focus of accounting may be due to the potentially richer set of information contained in this measure as opposed to a simpler cash-based system. Accruals may serve as surrogates for management's expectations of future cash flows. For example, the estimation of uncollectable accounts and the subsequent recognition in the accounting records should communicate management's estimation of cash flow from existing receivables. Other examples of additional informational content can be easily observed and the number is limited only by the number of required accruals. The greater the number of required accruals, the greater the potential additional information being communicated to users. However, the price paid for this additional information content is that the number of required accruals increases the complexity of the whole system.

2.3 The Efficacy of Accounting Earnings

Despite the FASB's continued reliance on earnings, the conclusions it has reached are not universally accepted. In arguing for a cash-based system of financial reporting, Ijiri [1978] takes issue with the level of complexity of accrual accounting versus a more primitive cash basis. He grounds his arguments on the principle of Occam's razor; the simplest method should be used until the more complex method proves that it has something more to offer.

In addition to the unproven efficacy of accrual earnings, Ijiri [1978, 1979, 1980] believes much of accounting information is too arbitrary, soft and open to management manipulation. In addition, Ijiri [1980] asserts investment decisions by firms managers are made using cash flow data, while they are being evaluated on earnings data. This results in a "serious discrepancy between the way in which investment decisions are made and the way in way in which the results are evaluated."(p. 54) If the firm's value is maximized by basing investment decisions on an analysis of cash flows, then the evaluation system should also be so based. It should be noted that decisions are made using the total project's cash flow over its expected life. In most cases, the project's life extends beyond one year which is the traditional accounting period. Therefore the asset flow measures supply evaluative information on a subset of the total project's life and the question becomes which asset flow measure provides a better evaluation of the subset of flows from the project. To have an uncommon denominator invites incongruent behavior and/or false signals being emitted by the information system.

Thomas [1969] holds many of the same beliefs as Ijiri. He bases his arguments on the arbitrariness and incorrigibility of the allocations accountants make. He uses historical cost depreciation as an example of the arbitrariness of the host of allocations accountants make. If the estimated useful life, salvage value, or depreciation technique chosen are arbitrary, as Thomas asserts is frequently the case, the information conveyed by the income statement is questionable.

Hawkins [1977], Hawkins and Campbell [1978], and Stern [1974] base a shift in security analysts focus from earnings to cash flow on many of the same arguments presented by Ijiri and Thomas. In addition, they assert that the market values cash flow, not earnings. Stern further suggests that the market totally ignores earnings.

Hawkins [1978] maintains that earnings and cash flow were once related, but recent developments in accounting have put a gap between the two. At the same time, the source of dividends (cash) remains the same. Therefore he advises investors to pay less attention to earnings and closer attention to cash flow when examining a company's dividend-paying ability.

2.4 Review of Empirical Research

The arguments presented in section 2.3 by financial analysts has some conceptual appeal. Most investors agree that the value of debt or equity securities at any point in time is the discounted value of future expected cash receipts. For equity securities, the discounted value is the same whether dividends (flows to the investors) or operating cash flows (flows to the firm) are the object of measurement [Fama and Miller 1971]. The role of accounting reports in an uncertain world with incomplete markets is to serve as signals of values (not as measures of value) by enabling investors to better predict future cash flows from debt and equity investments [Beaver 1981]. What better surrogate for cash flow then cash flow?

This is an empirical question that has not escaped the attention of accounting researchers. The ability of an asset flow measure to enable investors to better predict the future cash flows from investments depends on the amount of information conveyed to the marketplace by the asset flow statistic. For an asset flow measure to have information content, there must be a perceived relationship between the asset flow measure and the attributes that are assumed to give rise to value, i.e., future cash flows. In other words, a statistical dependency must exist between the asset flow measure and future cash flow.

The relative information content of various asset flow measures has been tested empirically, either directly or indirectly, by the following methods:

1. Examining the differences between cash flow and the earnings measures relationship with stock prices.
2. Examining the use of cash flow and earnings information by users of accounting information.
3. Directly examining the similarity of various asset flow measures.

The remainder of this section, will proceed in the above order, to review the relevant literature.

2.4.1 The Relationship Between Asset Flow Measures and Stock Prices

The most frequently used method in prior empirical studies to examine the informational content of various asset flow measures is to measure the strength of the statistical relationship between various asset flow measure changes and stock price changes. A change in value is assumed to be the result of a revision in the expected uncertain cash flow. If the asset flow measure has information content, there must be an observable dependency between stock price movements and asset flow measure movement[1].

Staubus [1965] examined the correlation between four asset flow measures and discounted common stock values. He found that current flows (earnings plus depreciation, depletion and amortization) were more closely related with the discounted values than were earnings.

Ball and Brown [1968] studied the market's reaction to various asset flow measures. They developed several asset flow measure expectation models and compared expected results with actual. If forecast errors were positive, unsystematic security returns were predicted to be positive. The opposite was expected for negative differences. They found that cash flow (measured by net income plus

---

[1] This is a necessary, but not sufficient condition to establish that the asset flow measure is serving as a signal for the future expected cash flows which are discounted at the markets rate for securities of like risk.

depreciation) was less successful than accrual determined net income in predicting the sign of the stock return residual.

Beaver and Dukes [1972] performed a study similar to Ball and Brown. They examined the association between unsystematic security returns and three alternative asset flow measures: (1) earnings after tax accruals, (2) earnings before tax accruals, and (3) cash flow defined as earnings before tax accruals plus depreciation, depletion and amortization. For each firm included in the study, the sign of the forecast error was determined and used as a partitioning variable. The abnormal performance index was calculated for each partition and the Mann Whitney U test for association was determined. The researchers found that both earnings measures have a closer relationship with market price behavior than the cash flow measure.

Patell and Kaplan [1972] investigated directly the relative information content of earnings and cash flow by examining security prices. They formulated a regression equation relating stock prices to earnings and reported that the addition of a cash flow variable (defined as working capital from operations) was not significant in the equation.

Harmon [1984] examined the relative importance of three earnings variables and six fund flow variables by examining their relationship with market reaction. Similar to earlier studies, Harmon also found a closer relationship between income and market movements than between income and cash flow. He defined cash flow as working capital from operations.

Wilson [1985] hypothesized that earnings do not have informational content beyond cash flow and that cash flows do not have informational content beyond earnings. The results of the study indicate that income possesses informational content beyond cash flow, but tests of the reverse hypothesis were inconclusive. Wilson operationalized cash flow from operations as working capital from operations adjusted for the effects of all operating short-term accruals such as the changes in inventories, receivables, and payables.

Charitou [1986] examined which of several asset flow measures capital market participants valued more by using various asset flow measures as explanatory variables in different valuation models. He reported that earnings have information content beyond cash flow, but cash flows have no information content beyond earnings. Charitou operationalized cash flows similar to Wilson [1985].

Beaver [1966, 1968] and Casey and Bartczak [1984] examined the ability of the various asset flow measures to predict financial distress. Beaver [1966] reported cash flow to total debt misclassified 13% of the firms in his sample one year before failure. In his 1968 study, Beaver reported that cash flow to total debt and net income to total assets out-performed eleven liquid asset ratios in predicting financial distress. In both the 1966 & 1968 studies, cash flow was measured by net income plus depreciation, depletion and amortization.

Casey and Bartczak [1984] examined the predictive power of cash flow and six accrual accounting ratios (net income/total assets, cash/total assets, current assets/current liabilities, net sales/current assets, current assets/total assets and total liabilities/ owners' equity). The authors reported that cash flow predicted 60% of bankrupt firms correctly and 53% of non bankrupt firms correctly one year before failure. Prediction based on a multiple discriminant model using the previously listed accrual measures predicted 83% of the bankrupt companies and 87% of the nonbankrupt companies correctly one year before failure. They also included the cash flow statistics in the multiple discriminant model, to determine if cash flow could marginally improve the accrual prediction models. They found that cash flow statistics do not have marginal information content beyond the six accrual measures. The authors attributed cash flow's relatively poor performance to the fact that it ignores off balance sheet financing, the liquidity of other assets and the borrowing capacity of the firm.

2.4.2 Studies Examining the Information Utilized by Analysts

This section reviews research that has examined the use of various asset flow measures by users of external financial reports.

Abdel-khalik and Keller (AK) [1979] investigated the use of earnings and cash flow by examining the investment decisions of 61 security analysts using various sets of accounting data. The primary objectives of the investigation were to determine how the decision makers would react to a switch from the FIFO to the LIFO inventory valuation methods and to examine the implications of the results for earnings and cash flow.(p. 21) The researchers reported that even though the analysts indicated a good understanding of the favorable effect on cash flow by switching inventory valuation methods, they still estimated lower expected returns for sample firms when they were using LIFO than when they were using FIFO. AK concluded the user's judgments are consistent with a fixation hypothesis on accounting-determined earnings.

Gynther [1968] interviewed approximately 30 security analysts from Australia in conjunction with a study of the computations of cash flow and of the funds statement. He concluded that cash flow appears to be regarded by some of the analysts interviewed as the best indicator of future growth. He went on to develop several theoretical models to determine when this would be the case. The major implication of Gynther's study for this study is the security analysts use a cash flow statistic in their predicting of future growth. Cash flow was defined by Gynther and the analysts interviewed as net income plus depreciation.

2.4.3 Informational Content of Different Asset Flow Measures Is the Relevant Issue

The studies that either directly or indirectly examined the relative informational content of earnings and cash flow involve two assumptions. First, the studies assume that earnings and cash flow are fundamentally different, *i.e.*, they measure different aspects of firm performance. Second, the studies that use a proxy for cash flow such as earnings plus depreciation or working capital from operations, assume the proxy and cash flow covary together.

Foster [1986] states that many studies have used the aforementioned proxies for cash flow primarily on the grounds of simplicity. However, Foster suggest that a major draw-back of this practice is that this definition of cash flow excludes many items that affect cash flow and earnings differently. This is a necessary, but not sufficient condition for earnings and cash flow to satisfy the first assumption mentioned above, *i.e.*, that earnings and cash flow be calculated differently. Furthermore, after the items differentially affecting cash flow and earnings are accounted for, the resulting series should not be a linear transformation of the unadjusted series, *i.e.*, the two series should not be statistically dependent. If statistical dependency is not present, the two series of measures can be interpreted as characterizations of different phenomenon.

If the proxies for cash flow are appropriate, the opposite must be true. The proxies should be a linear transformation of cash flow, i.e., a statistical dependency should exist.[2]

The above hypothesized relationships have been examined by empirical researchers. Bowen, Burgstahler, and Daley (BBD) [1984] examined distributions of the coefficient of determination (R^2) for changes between:

1. Net income before extraordinary items [NI].
2. Net income before extraordinary items plus depreciation [NIPD].
3. Net cash flow [CFFO].

Separate regressions on the changes in the above variables were run for each firm over the 1971-1981 period. The authors reported that the mean R^2 for pairs 1 and 2 was 0.98, for pair 1 and 3 was 0.13 and for pair 2 and 3 was 0.15. The reported median R^2 s were similar to the mean. These results indicate that assumption one is satisfied, i.e., the earnings and cash flow are not statistically dependent in the short run.

In regard to assumption two, the authors concluded by simply adding depreciation to net income produces a variable

---

[2] It should be noted that in the long run net income and cash flow are equal in total.

that contains very little if any different or for that matter incremental information that was not already present in the raw earnings variable. However when sophisticated adjustments are made to reported earnings numbers, the resultant series is much less correlated with the original, thus potentially containing new and/or incremental information.

Gombola and Ketz (GK) [1983] examined the impact of a cash flow measure on the classification of financial ratios. Their work addresses results reported by Pinches, Mingo and Caruthers [1973] which indicated that profitability measures and cash flow measures capture, or contain, the same information on firm performance.

Gombola and Ketz used factor analysis to reduce a large set of variables to a smaller set of explanatory factors. Each explanatory factor captures a different underlying characteristic of the original set of variables. In 18 out of the 19 years examined, a cash flow factor emerged from the underlying variable set as a unique factor separate and distinct from earnings and working capital from operations.

The authors concluded that their results indicate there are "distinct differences between profitability measures and cash flow measures."

The results from the above two studies suggest the following: (1) cash flow from operations does measure an aspect of firm short run performance not captured by earnings or working capital from operations, and (2) simple proxies for cash flow are highly correlated with the original unadjusted series, i.e., earnings. This latter result suggests that studies utilizing a simple proxy for cash flow may have an internal validity problem, i.e., the researchers may not have examined the relationships they set out to examine. For example, Patell and Kaplan stated that they compared earnings and cash flow information but cash flow was operationalized by working capital from operations. In the light of the above studies, this is clearly not correct.

2.4.4 Summary

To this point, this chapter has examined the basic differences between asset flow measures and has determined them to be: (1) the desired level of data aggregation and (2) the complexity of the system needed to compute the statistic.

The FASB has maintained that accrual-determined earnings should be the focus of accounting. The empirical market-based research generally tends to support this contention based on the demonstrated relationship between earnings and stock prices.

However, many security analysts do not support the conclusion reached by the FASB or the accounting researchers. They feel cash flow data is a necessary input into the analysis of any security.

Studies examining the information used by analysts yields mixed signals. However, the tendency is to accept the view that analysts do not use cash flow information but instead concentrate on earnings. Even in the Gynther study, by defining cash flow as net income plus depreciation, the analysts were effectively looking at earnings.

The above conclusion is supported by the research results reported in section 2.3.3. Researchers have demonstrated that earnings, and earnings plus depreciation, are very closely related to one another as well as to working capital from operations. In addition, cash flow statistics have been demonstrated to capture a different aspect of firm performance. Therefore it seems prudent to continue on with this study. By correctly measuring cash flows and examining the ability of the two asset flow measures to describe a firm's dividend policy, further insight into the earnings vs. cash flow issue will result.

The remainder of this chapter will review the relevant dividend policy literature.

2.5 Dividend Policy Literature

The seminal work performed in the area of dividend policy was carried out in 1956 by John Litner. His original paper is comprised of two sections. In Litner's first section he claimed that current earnings were almost always the starting point in management's consideration of whether dividends should be changed from their levels of the previous year. Once the decision is made to change dividends, the next question to be addressed is by how much should dividends be changed. Litner reports that the change was predominantly based on a payout rate, i.e., how much of current earnings should be paid out as dividends. Once a dividend rate was established, management exhibits a reluctance to reduce dividends. For this reason Litner concluded that management rarely increased the dividend level all at once for a given change in earnings. Rather they would establish a target dividend and only partially adjust in any given year to this level.

From this,the following model was hypothesized to represent dividend policy.

$$D_{it}-D_{i,t-1}=a_i+c_ir_iNI_{it} - c_iD_{i,t-1} + u_{it} \qquad [2.1]$$

where,

D_{it} and $D_{i,t-1}$ = Dividends per share for firm i in year t and year t-1.

a_i=Ordinary least squares estimated intercept term.

c_i=The percentage of the difference between last years dividend and the target dividend which the company expects to payout this year (speed of adjustment to the target dividend).

r_i=the target payout ratio.

NI_{it}=Net income for firm i in year t.

u_{it}=residuals

Equation 2.1 can be further simplified by adding $D_{i,t-1}$ to both sides and collecting terms.

$$D_{it} = a_{it} + c_i r_i NI_{it} + (1-c_i) D_{i,t-1} + u_{it} \qquad [2.2]$$

Parameters for equation 2.2 above were estimated using aggregate data from 1918 to 1941 (therefore the i subscripts were dropped). When this model was used to predict aggregate dividends in the years 1942-1951 it underestimated actual average dividends by only 2.2%. Therefore Litner concluded it represented aggregate reality fairly well.

Fama and Babiak [1968] extended Litner's work by first applying the model specified in equation 2.1 to data for individual firms. They further extended Litner's work by examining the impact of additional explanatory variables such as depreciation and previous year's earnings. Depreciation was included as an add-back to earnings in an attempt to proxy cash flow and as a separate explanatory variable. Additional lagged independent variables were also tried, the most successful of which is a lagged earnings variable. The lagged earnings variable was included with a constant and without.

In all models tested, lagged dividends and current net income are important variables in explaining dividend changes.

When depreciation is added to earnings, adjusted R^2 drops compared to the original model, leading the authors to conclude that cash flow (defined as net income plus depreciation) does not aid in the prediction of cash dividends. Overall, the model that achieved the highest R^2 includes a constant, a lagged dividends term, and a lagged earnings variable. The model that yields the best quality of predictions on data not in the estimation period[3], is the model that achieved the highest adjusted R^2 without the constant term.

Watts [1973] utilized a variation of the model developed by Litner and extended by Fama and Babiak to separate expected dividend changes from unexpected changes. The unexpected changes were employed as an independent variable to predict earning changes in an analysis designed to investigate the information content of dividends. Watt's concludes that there is little evidence to support the dividend signaling hypothesis. The primary implication Watt's study has for this study is that annual dividends are a function of annual earnings, not quarterly dividends a function of quarterly earnings. He bases this conclusion on the distribution of dividend changes by quarter reported by Michael Laub [1970].

QUARTER	1	2	3	4	TOTAL
Regular dividend changes	31.8	15.9	34.2	34.2	100
Extra dividend declaration	12.2	5.4	6.8	75.6	100

---

3. Quality of prediction was defined as the standardized prediction error, which is equal to the the prediction error divided by the standard deviation of dividend changes for the particular firm.

The above reported changes are averages expressed in percentages over the years 1946 to 1965. Watts argues that if a quarterly function is appropriate, one would expect changes to be uniformly distributed over the four quarters. If an annual function is appropriate, one expects the changes to be concentrated in the first and/or fourth quarter. Because the latter distribution is the observed distribution, Watts concludes an annual function is most appropriate. Based on the above results, an annual function will also be used in this study[4].

Fama [1974] again utilized Litner's partial adjustment model by empirically examining the extent dividend and investment policies are interdependent. Specifically, he estimated regressions for several variations of Litner's dividend model and the Chenery [1952] and Koyck [1954] model of target capital stock and selected the variation of each model that yields the best prediction on two years of data outside the estimation periods. Fama concluded the hypothesis of complete independence of investment and dividend decision cannot be rejected.

Fama's results have two primary implications for this study. First, the Litner model without an intercept term yields the highest quality of predictions, indicating that

---

4. This important conclusion is supported either directly or indirectly through the use of an annual dividend by Kolb [1981], Litner [1956], Fama and Babiak [1968], Fama [1974], and Black and Scholes [1974].

again it is well specified. Second, the conclusion of independence between dividend and investment decisions indicates the partial adjustment model is not misspecified by omitting an investment variable as an explanatory variable. Based on this, it is determined that an investment variable will not be included in any model tested by this study.

A recent sample survey study by Baker, Farrelly, and Edelman [1985] serves to update Litner's field work. They report that across three industries (utility, manufacturing and wholesale/retail), the highest ranking determinants of dividend policy are the anticipated level of a firm's future earnings and the pattern of past dividends. Both are consistent with and are explicitly included in Litner's model. A third factor in determining dividend policy that was also noted as important is the availability of cash. This translates into liquidity considerations. Litner's model does not address this determinant directly, although other authors note that liquidity is an important managerial consideration when determining dividend policy (see Weston and Bringham [1979] and Brigham [1982]).

The implications of Baker, Farrelly, and Edelman's study for this research is that it suggests the dividend policy model may be improved by either replacing the earnings variable with a liquidity based variable[5] or by adding a liquidity based variable to the Litner model.[6]

Kolb [1981] developed a genuinely predictive model of dividend changes[7]. He used discriminant analysis to develop a multiple discriminant model to classify firms as either dividend increasing, decreasing, or remaining unchanged. Models were developed for the years 1970, 1971, 1972, 1973, and 1974 to predict dividend changes in years 1971, 1972, 1973, 1974, and 1975 respectively. Twenty four independent variables were made available to a step-wise discriminant function. The twenty four variables were intended to be surrogates for four broad factors that Kolb postulated to drive dividend decisions. They are: (1) the ability of the company to pay dividends, (2) internal and external constraints on the sources of funds (3) the perceived riskiness of the firm and (4) managerially imposed constraints. The model was estimated five times for each of the five years prior to the prediction years. The best

---

5. A variable more closely associated with cash flow or quick assets or current assets.

6. The success of a cash flow variable depends on the variable containing the same information already inherent in earnings plus additional explanatory power (thus a cash flow variable would be included in the model without an earnings variable) or containing information in addition to that contained by earnings (thus a cash flow variable would be included in the model along with an earnings variable).

7. Kolb's model uses variables that were available one year prior to the first dividend payment in the year he predicts the change in dividends. Hence, his model is genuinely predictive whereas the Litner model uses this years earnings to predict contemporaneous dividend changes.

models from each year were used to predict next year's dividend changes. The variables the step wise discriminant function determined to be important in all five years were profitability and a measure of the cash available to pay dividends. Kolb concluded, "the single most important factor in predicting dividends is earnings." p.223 The variables measuring managerial attitude were relatively unimportant. Kolb concluded that dividend decisions are driven by the basic economic position of the firm. The implications of the Kolb study for this study is again the importance of a liquidity variable.[8]

Hagerman and Huefner [1980] used the Litner model to test directly usefulness of different asset flow measures to predict dividends. They collected a sample of 288 companies with data over the nineteen year period beginning with 1954 and ending with 1972. Five income constructs were examined on the distribution of R^2 criterion and on the predictive ability of the equations. The income constructs tested are (1) cash flow from operations before interest taxes, (2) income from operations, before interest and taxes, (3) income before extraordinary items, (4) net income, and (5) cash flow available to common stockholders. Cash flow was defined as operating income before depreciation, taxes, and interest. The researcher reported results similar to Fama

---

8. The Kolb study did not test the information content of various asset flow measures directly. The best model developed by a step wise discriminant function was used to predict dividends. In order to test asset flow measures information content, competing models for the same year must estimated and there classification power compared.

and Babiak [1968]. The model achieving the highest R^2 used income before extraordinary items. Cash flow (both one and five above) achieved a slightly lower R^2. The prediction tests returned the same results as the R^2 criterion above. The authors concluded that the results were so close that the definition of income does not materially matter.

The significance of Hagerman and Huefner's study for this study is that it clearly establishes the use of the Litner dividend policy model as vehicle to study the information content of different asset flow measures (the Kolb [1981] study did not directly incorporate Litner's [1956] model). It should be noted that their definition of cash flow incorporates the same threats to the internal validity of the study as it does to the studies previously reviewed. Therefore, they really did not study the relationships between cash flows and dividend policy.

2.6 Summary

This chapter started by delineating the differences between several asset flow measures and concluded the basic difference to be the level of aggregation of the accounting for underlying transactions and events.

The philosophy of the private sector regulatory body was reviewed and a gradual shift from a complete reliance on accrual-determined earnings to the recognition of the possible incremental information content of a cash based statement was documented.

Empirical studies with the objective of examining the information content of various asset flow measures were then reviewed. The majority of the studies reported income to be superior to a cash flow variable.

Several studies examining the similarity of different asset flow measure directly were also reviewed. The results across all studies were very similar. Income and cash flow measure two different aspects of firm performance. They also concluded that income and the simple surrogates for cash flow are highly collinear. This result allows us to question the prior research conclusions that income is superior to cash flow because much of the early research used simple surrogates. However, not all studies used the simple surrogates. Wilson [1985] and Charitou [1986] used more complex surrogates and the results are still in favor of income. All of the studies reviewed in some way or another used equity market participants reactions or the equity market reactions to determine information content.

Litner's [1956] partial adjustment dividend policy model was than presented. The validity of this model was established through the review of studies that both extended it and/or used it as an empirical vehicle to isolate information content whether it be information in dividends themselves [Watts, 1973] or various income constructs [Hagerman and Huefner, 1980]. The validity of the model was evidenced further through the results of a recent sample survey [Baker, Farrelly, and Edelman, 1985] and the results of a multiple discriminant analysis concluding that income is the most important variable in predicting next years dividend change [Kolb, 1981].

Chapter 3

SAMPLE SELECTION, DATA ITEMS AND METHODOLOGY

3.1 Introduction

The purposes of this chapter are to describe the sample selection procedures, operationalize the variables, and present the methodology employed to study the basic research hypothesis.

To reiterate, the basic question being examined by this research is what asset flow measures describe a firm's dividend policy. Accounting earnings has performed well in prior studies, but with the present focus of the FASB on the cash flow reporting issue and the lack of empirical evidence supporting the incremental information content of a cash flow statistic, this study provides some empirical evidence as to the usefulness of a cash flow statistic.

This chapter is organized as follows. First the sample selection criterion are presented, followed by the definition of the variables. After the variables are operationalized, various econometric issues are explored including a brief development of the theoretical explanations underlying the dividend policy model. Possible statistical estimation procedures are then presented, followed by a delineation of the research method to be used by this study. The development of the statistical hypotheses conclude the chapter.

3.2 Sample Selection

Corporations whose dividend announcements are public information comprise the population relevant to this study. The common stock of the firms within this population is generally publicly traded. To maximize the sample size analyzed, this research used firms listed on Standard and Poors Compustat Annual Industrial Tape for the years 1971 to 1984. A total of fourteen years of data is needed for each firm (the 1985 version of the tape is being used).

The time period under study begins with 1971 because this is the first year firms were required by generally accepted accounting principles (GAAP) to supply a Statement of Changes in Financial Position as part of the external reporting package [APB, 1971]. This study uses data made available by this report.

For a firm to be admitted to the sample, all the necessary data to derive the asset flow measures and dividend variables must be available for all fourteen years. Banks and utility companies were excluded from the sample because of the unavailability of the needed data (classified balance sheets are not reported). One thousand, one hundred , eighteen firms meet all the requirements to be in the sample.

3.3 Data Definitions

As discussed in chapter 2, the different asset flow measures can be viewed on a continuum ranging from inclusion of no accruals to the inclusion of a lot of accruals (see Figure 3.1). The asset flow measures to be used in this study are:

1. Net Income (NI).
2. Net Income Plus Depreciation (NIPD).
3. Income From Continuing Operations (OPNI).
4. Income From Continuing Operations Plus Depreciation (OPNIPD).
5. Working Capital From Operations (WCFO).
6. Quick Flow From Operations (QFFO).
7. Cash Flow From Operations (CFFO).

The above seven asset flow measures were chosen because of their use in prior research and general acceptance in practice as useful indicators of various aspects of a firm's performance. The definitions of the above asset flow measures are:

1. Net income is typically denoted as the bottom line. It is the measure after all expenses are deducted from all revenues of the accounting period. For this study it is defined as:

NI=OPNI plus or minus extraordinary items and discontinued operations.

NI will be determined by adding Compustat data items 18 and 48. Data item 18 is income from continuing operations and item 48 is extraordinary items and the effects of discontinued operations.

2. Net income plus depreciation and amortization is defined as:

$$NIPD = NI + DEP$$

Where NI is defined in one above and DEP stands for depreciation, depletion, and amortization (data item number 14).

3. Income from continuing operation is defined as Compustat data item number 18 and denoted OPNI.

4. Income from continuing operations plus depreciation is defined as:

$$OPNIPD=OPNI + DEP$$

where OPNIPD is income from continuing operations plus depreciation, depletion, and amortization. OPNI and DEP are the same as previously established.

5. Working capital from operations is defined as:

$$WCFO = OPNIPD + LTA$$

where LTA is equal to changes in long term accruals such as deferred taxes and parent company's portion of subsidiary earnings accounted for using the equity method. WCFO is available from Compustat directly and is data item number 110.

6. Quick flow from operations is defined as:

$$QFFO = OPNI + DEP + LTA + NQSTA$$

where OPNI, DEP, and LTA are as defined above. NQSTA is the effects of nonquick asset accruals. Quick asset accruals are changes in accounts receivable, short term marketable securities, and cash. Nonquick asset accruals include, the change in inventories and changes in all other nonquick operating current assets. QFFO is determined by starting with WCFO (OPNI + DEP + LTA), which is compustat data item number 110, and subtracting the change in current assets from year t-1 to year t from it (data item number (4,t) and (4, t-1)). The change in quick assets are now added to this difference. They are the change in cash and short-term investments (data items (1,t)-(1,t-1)), the change in accounts receivable (data items (2,t)-(2,t-1)), the change in current liabilities (data item (5,t)-(5,t-1)) less the change in the current portion of long-term debt maturing in the next year (data items (44,t)-(44,t-1)).

7. Cash flow from operations is defined as:

$$CFFO = OPNI + DEP + LTA + STA$$

$$CFFO = WCFO + STA$$

where OPNI, DEP, LTA, and WCFO are as defined above. STA is the effects of short term accruals such as the changes in all non-cash current operating asset and liabilities. CFFO is determined by subtracting the change in accounts receivable (data items (2,t)-(2,t-1)) from QFFO. Therefore cash plus marketable securities will be generically referred to as cash.

Each of the above asset flow measures will be converted to a per share basis by dividing each measure by the common shares outstanding adjusted for stock splits and stock dividends. Converting the asset flow measures to an adjusted per share basis is a form of standardization for possible size effects. It also allows the conversion of all variables to a common point in time and allows comparisons with prior work in the area. The adjusted shares outstanding figure is arrived at by multiplying the number of common shares outstanding (data item number 25) by the cumulative adjustment factor (data item number 27).

The dependent variable in this study is the change in cash dividends per share from year t-1 to year t. Annual cash dividends per share is data item number 26. Cash dividends per share is also adjusted for the effects of stock dividends and stock splits. This is accomplished by dividing data item number 26 by the adjustment factor (number 27).

3.4 Econometric Issues

The Litner dividend model reviewed and discussed in chapter 2 is, for econometric purposes, classified as an autoregressive model. An autoregressive model is defined as a distributed lag model with a lagged dependent variable as an independent variable [Gujarati, 1978, p. 255].

The most popular form of the distributed lag model is a geometric lag characterized by:

$$Y_t=A+B_0(X_t+\acute{o}X_{t-1}+\acute{o}^2X_{t-2}+\ldots)+e_t \qquad [3.1]$$

where $0 < \acute{o} <= 1$ and is known as the rate of decline of the distributed lag.

Equation 3.1 posits the effect of X on Y extends into the past an indeterminate amount of time. However the effect of each lagged X is reduced to the point where a distant X has an insignificant effect on Y.

Koyck [1954] has proposed a method to estimate distributed lag models that reduces the infinite geometric series to the following:[1]

$$Y_t-\acute{o}Y_{t-1}=A(1-\acute{o})+B_0X_t+(u_t+\acute{o}u_{t-1}) \qquad [3.2]$$

Or, by rearranging equation 3.2, the following equation results:

$$Y_t=A(1-\acute{o})+B_0X_t+\acute{o}Y_{t-1}+v_t \qquad [3.3]$$

where $v_t=(u_t-\acute{o}u_{t-1})$

Note that by using the Koyck method, a distributed lag model is turned into an autoregressive model.

The Koyck model is purely ad hoc; derived through an algebraic process devcid of any theoretical foundation. This void has been filled by two rationalizations for the model. They are:

1. Partial Adjustment.
2. Rational Expectations.

---

[1] For a good explanation of the algebra underlying the development of the model, see Koyck's original paper or in addition to the derivation of the model, a good discussion and review of autoregressive models can be found in Gujarati [1978, pp. 261-263] and Kmenta [1986, pp. 528-529].

At this point the derivation and the economic justification for the two above models will be discussed. This is necessary in order to understand the correct statistical methods to be used in estimation and hypothesis testing.

3.4.1 Partial Adjustment Model

The partial adjustment model begins by assuming there is an optimal, desired long run value for the dependent variable. It is further assumed the optimal value is a linear function of the independent variables.

In the spirit of this research, the following equilibrium condition has been proposed [Litner, 1956]:

$$D_t^* = A + rAFM_t \tag{3.4}$$

where,

D_t^*=Optimal dividends per share in time period t.

AFM_t=A specified asset flow measure in time period t.

r=portion of the asset flow measure desired to be paid out.

Equation 3.4 indicates there is a desired level of dividends, D_t^*, for a given value of the asset flow measure. Note there is no error term in equation 3.4. This is due to the fact that it represents an equilibrium condition, leaving no room for an error term. The AFM used by Linter is current year's profit. For the purposes of this study, the profit measure will be stated in more general terms and specified in detail latter.

Litner further specified the dividend decision pattern of firms as being described by the following equation:

$$D_t - D_{t-1} = c(D_t^* - D_{t-1}) \qquad [3.5]$$

where,

D_t=Actual dividends per share in time period t.

D_{t-1}=Actual dividends per share in time period t-1.

D_t^*=the optimal or target dividend in time period t.

c=the speed management wishes to adjust the dividend to the optimal or target dividend.

$0 < c < 1$

Equations 3.4 and 3.5 both have an unobservable variable, D_t^*. In order to empirically use the theory, equation 3.5 is solved for D_t^* yielding equation 3.6.

$$D_t^* = (D_t - D_{t-1})/c + D_{t-1} \qquad [3.6]$$

Replacing D_t^* in equation 3.4 with equation 3.6 yields

$$D_t - D_{t-1} = Ac + rcAFM_t - cD_{t-1} + u_t \qquad [3.7]$$

Interpretation extends easiest from equation 3.5 with equation 3.4 substituted for D_t^*:

$$D_t - D_{t-1} = c[(A + rAFM_t) - D_{t-1}] + u_t \qquad [3.8]$$

The amount within the brackets in equation 3.8 is the change in dividends management would like to make this year, but because of other considerations (to be elaborated on shortly), they choose not to fully adjust to the target change, but to move part way to the desired level by the fraction represented by c. 'c' has been called the speed of adjustment coefficient [Fama & Babiak, 1968] That is, management only partially adjusts dividends to the target level, and c is the speed to which they move.

In general, the reasons given for only partial adjustment include ignorance, inertia, the cost of change, technological constraints, institutional rigidities, and persistence of habit [Johnston, 1972, p. 300; Kmenta, 1986 p. 528]. Specifically, management chooses not to fully adjust because of perhaps a desire for steady growth in dividends, a desire not to reduce dividends once they are increased, uncertainty of future levels of the asset flow measure, or possibly any combination of the above reasons [Litner, 1957; Ang, 1974].

Myers and Majluf [1984] propose that firms management may only partially adjust dividends for a given level of earnings in order to provide management with the flexibility needed to adjust the firms cash flows to its investment opportunities. They drop the assumption of perfect markets, and assume information asymmetries exist between management and shareholders. This indicates that management knows more than shareholders and finds it costly to communicate the informantion to the market. If the firm with profitable investment opportunities must go to the external markets for funds to support it's investment plans, the securities sold would most likely be underpriced until the profits of the investments are made obvious. This would shift wealth form the existing shareholders to the new shareholders once the market fully valued the additional investments. In order to avoid this, firms may build up financial slack. Financial slack is basically a pool of internally generated funds used to finance investments.

3.4.2 Rational Expectations

An alternative derivation of the distributed lag model used to represent the dividend policy of a firm is the rational expectations model. This model specifies that the actual value of the dependent variable in time period t is a function of the expected value of the independent variable (AFM_t^*) in time period t.

$$D_t = A + B\ AFM_t^* + u_t \quad [3.8]$$

A common assumption is that the rational expectations of the independent variable can be represented as [Johnston, 1972, p. 301]:

$$AFM_t^* - AFM_{t-1}^* = c(AFM_t - AFM_{t-1}^*) \quad [3.9]$$

Equation 3.9 states that expectations are updated each period by a fraction, c, of the difference between last periods expected level of the asset flow measure and this period's actual value.

Equations 3.8 and 3.9 are at present not estimable because several of the variables are not observable. To make them empirically usable, equation 3.9 can be rewritten as:

$$cAFM_t = AFM_t^* - zAFM_{t-1}^* \quad [3.10]$$

where $z = (1-c)$.

Using a delay operator, D, such that $DX_t=X_{t-1}$, $D^2X_t=X_{t-2}$, etc. [Grillches, 1967, pp 16-49] equation 3.10 can be rewritten as:

$$cAFM_t=(1-zD)AFM_t^* \qquad [3.11]$$

Rearranging equation 3.11 yields

$$AFM_t^*=[c/(1-Dz)]AFM_t \qquad [3.12]$$

Substituting 3.12 into 3.8 yields

$$D_t=A + [Bc/(1-Dz)]AFM_t + u_t \qquad [3.13]$$

Multiplying equation 3.13 through by 1-zD and rearranging

$$D_t=A(1-z)+B(1-z)AFM_t+zD_{t-1}+(u_t-zu_{t-1}) \qquad [3.14]$$

Substituting (1-c) back into equation 3.14 for z yields

$$D_t=A(1-1+c)+B(1-1+c)AFM_t+(1-c)D_{t-1}+(u_t-(1-c)u_{t-1}) \qquad [3.15]$$

After simplifying equation 3.15, the following form evolves:

$$D_t=Ac+BcAFM_t+(1-c)D_{t-1}+(u_t-(1-c)u_{t-1}) \qquad [3.16]$$

Comparing equation 3.16 and 3.7, you will note they are the same except for the error term. This difference requires different estimation techniques to estimate the parameters. Hence, the importance of the theory underlying the model.

3.4.3 Estimation Techniques for the Partial Adjustment Model

Assuming the error term, u_t, in equation 3.10 is a normally distributed random disturbance with a mean of zero and variance S^2, ordinary least squares (OLS) will provide consistent and efficient estimates of the parameters [Kmenta, 1986, pp 535-536, Johnston, 1972, p 305].

Therefore, estimation and hypothesis testing can proceed as usual.

If the assumption of a serially uncorrelated error term is relaxed, the parameter estimates become biased and inefficient[Johnston, 1972, p. 305].

Kmenta [1986 pp.535-536] suggests a transformation of the data to account for the serial correlation before using a maximum likelihood technique to estimate the parameters. In general, serial correlation is not expected if the partial adjustment model holds. Therefore, further discussion of the possible methods to adjust for serial correlation in a distributed lag model will be addressed later.

3.4.4 Estimation of the Rational Expectations Model

Equation 3.16 does not lend itself to such an easy estimation technique even if the residuals do not demonstrate serial correlation. The reason is due to the error term and a lagged value of the dependent variable. The lagged dependent variable is correlated with the error term, which is a violation of one of the basic assumptions underlying the validity of OLS estimation. If OLS is used, the parameter estimates are biased estimates [Kmenta 1986, p. 532].

Estimation techniques espoused by Kmenta are:

1. Method of instrumental variables.
2. Maximum likelihood estimation.

Johnston [1972, pp. 315-316] suggests the use of the Zellner-Geisel[1968] technique but warns the estimation is "..computationally burdensome and one would only embark on them if one felt convinced about the specification of the disturbance term." (p 316)

3.4.5 Estimation of a more general model

Johnston [1972, p.317] develops an estimation technique for an autoregressive model that does not tie it to any theoretical scheme. It is much more general in that it allows for a lagged dependent variable and an autocorrelated disturbance term.

The basic model is:

$$D_t - D_{t-1} = A + B_1 D_{t-1} + B_2 AFM_t + u_t \qquad [3.17]$$

where,

$D_t - D_{t-1}$=The change in dividends form time period t-1 to period 1.

AFM_t=Value of the asset flow measure in time t.

$u_t = e_t + pe_{t-1}$=The first order autoregressive error term.

p=a measure of the degree of correlation (commonly termed termed rho) between periods t and t-1.

Before equation 3.17 can be estimated, the significance of p must be determined. If p is determined to be not significantly different from zero, the error term is already only "white noise". Estimation and hypothesis testing can proceed using OLS. However, if p is determined to be significantly different from zero, before equation 3.17 can be estimated, the disturbance must be turned into only white noise, i.e., take out the autoregressive part (pe_{t-1}). This can be accomplished by obtaining a value for p and then estimating the following equation:

$$[(D_t-D_{t-1})-p(D_{t-1}-D_{t-2})]=A(1-p)+B_1(D_{t-1}-pD_{t-2})+ B_2(AFM_t-pAFM_{t-1})+(u_t-pu_{t-1}) \qquad [3.18]$$

In order to carry out the above transformation, a value for p must be obtained. If p is unknown one could usually estimate it using the Cochrane-Orcutt (CO) two-step iterative method [Kmenta, 1986, pp. 314-315]. However, because model 3.18 includes a lagged dependent variable, this method would produce a biased estimate of p [Kmenta, 1986, p.536]. Johnston [1972] details three methods to estimate p under such conditions.

The first method requires a little rearranging of equation 3.18 into the following form:

$$D_t-D_{t-1}=A(1-p)+(B_1+p)D_{t-1}-(B_1+p)D_{t-2}+B_2AFM_t -B_2pAFM_{t-1}+e_t \qquad [3.19]$$

Johnston suggests fitting equation 3.19 by OLS without any restrictions on the coefficients and to then estimate p as

$$p=-(\text{coefficient of } AFM_{t-1}/\text{coefficient of } AFM_t) \qquad [3.20]$$

The above value for p is used to transform the variables in equation 3.17 to those in 3.18. Then OLS cam be used to estimate the parameters.

A second method is to estimate an instrumental variable for the lagged dependent variable; replace the lagged dependent variable with the instrumental variable; then use OLS to calculate the parameters.

A third and more powerful technique suggested by Wallis [1967] is to replace the lagged dependent variable with an instrumental variable and estimate the parameters using OLS. Take the residuals from this estimation and calculate a first-order serial correlation coefficient making an adjustment for the bias being introduced by the presence of a lagged dependent variable. Using this estimate for p, transform the data and use a generalized least squares procedure to estimate the parameters.

The first method has as its main strength the fact it does not use instrumental variables. The use of instrumental variables can introduce multicollinearity into the model that was not present at first.

The second approach has as its primary strength simplicity. A two stage regression and the coefficients are estimated. The major drawback is there is no adjustment for autocorrelation. As mentioned above, this will yield inefficient variance estimates that may lead to acceptance of a null hypothesis for a parameter when in fact it should be rejected. However, the parameters are no longer biased by virtue of the instrumental variable replacing the lagged dependent variable.

The third procedure extends the second procedure by using the instrumental variables regression to estimate the residuals. The residuals are then used to estimate a corrected autocorrelation coefficient which is used to adjust for autocorrelation. The parameters are then estimated using a generalized least squares procedures.

3.5 Research Methods

At this point it should be clear several decisions need to be made in order to estimate the parameters of the dividend policy models.

The proper rationalization, if any, for the dividend policy models must be first decided on or established. This choice drives the estimation techniques. The next issue involves the structural form of the model.

3.5.1 Model Selection

There are several previous studies which have addressed this question. As an incidental part of their paper, Fama and Babiak [1968, p. 1135] conclude that the adaptive expectations is an inappropriate specification if changes in the asset flow measure are independent. Ang [1974] specifically examined the question of what rationalization fits. He could not decisively show one rationalization was superior over the other. Litner [1957] originally espoused the partial adjustment rationalization based on his field work with 28 publicly traded companies. A recent sample survey study by Baker, Farrelly, and Edelman [1985] concludes that Litner's model still appears to describe reality fairly well.

Based upon the above evidence it would appear that assuming a partial adjustment rationalization would not be unjustified. There appears to be substantial support for this theory underlying the dividend policy of firms.

However, the primary objective of this research is to determine if a more sophisticated cash flow variable has information content beyond accounting earnings. If parametric statistics are to be used, the basic assumptions underlying the estimation procedure must be met. This indicates acceptance of any model without satisfying the underlying assumptions to achieve unbiased and efficient estimators could lead to false acceptance or rejection of the hypotheses. Therefore the more general approach presented by Johnston [1972] will be used.

3.5.2 Estimation Techniques

The estimation process will begin by estimating the basic dividend policy model using OLS[2]. The residuals from this model will be used to test for the presence of autocorrelation in the error term. Generally, the test statistic would be the Durbin-Watson statistic. However, in an autoregressive framework, the DW statistic has been demonstrated to be biased towards accepting the null hypothesis of no autocorrelation. To remedy this problem,

---

[2] A basic dividend model uses the change in cash dividend from time period t-1 to t as the dependent variable and includes an intercept, dividends from time period t-1, and one asset flow measure as independent variables.

Durbin [1970] has developed two additional test statistics, the H and M test. The H test has some restrictions[3], therefore the M test will be used in this research.

The M test requires a two stage regression. The residuals calculated from the first stage become the dependent variable in the second stage regression. The independent variables include all of the variables in the first stage plus a lagged residual. Therefore the second stage regression equation is:

$$e_t=B_0+B_1AFM_t+B_2LACD_{t-1}+B_3e_{t-1}+error$$

where,

e_t=The residual in time period t from the first stage regression.

AFM_t=The asset flow measure used as an independent.

$LACD_{t-1}$=The cash dividend in time period t-1 adjusted for stock dividends and stock splits.

e_{t-1}=The residual in time period t-1 from the first stage regression.

If B_3 is significant using a standard t test, autocorrelation is assumed to exist. However, if the coefficient is insignificant, autocorrelation is deemed not to be a problem.

If serial correlation is not detected in this sample, parameter estimation and hypotheses testing will proceed using OLS estimation techniques. If serial correlation is detected, one of the estimation procedures suggested by Johnston [1972], and previously detailed in the estimation section will be used.

---

[3] See Kmenta [1986] p. 333 for the specific cases where the use of the H test is restricted.

3.5.3 Structural Form of the Model-Statistical Hypotheses

A second question which must be addressed is the structural form of the model. Are the observed dividend changes economy wide, industry specific or firm specific?

Litner's [1956] original work was performed on aggregate economy data. Brittan [1966] used the Litner model on aggregate economy, aggregate industry, and on individual firm data, but did not specifically test for the proper structural form of the model.

To determine the proper structure of the models, the following equations will be estimated and tested for the proper parameterization.

$$D_{it}-D_{i(t-1)}=A+B_1D_{i(t-1)}+B_2AFM_{it}+u_{it} \qquad [3.21]$$

$$D_{it}-D_{i(t-1)}=A_j+B_{1j}D_{i(t-1)}+B_{2j}AFM_{it}+u_{it} \qquad [3.22]$$

$$D_{it}-D_{i(t-1)}=A_m+B_{1m}D_{i(t-1)}+B_{2m}AFM_{it}+u_{it} \qquad [3.23]$$

$$D_{it}-D_{i(t-1)}=A_p+B_{1p}D_{i(t-1)}+B_{2p}AFM_{it}+u_{it} \qquad [3.24]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{2i}AFM_{it}+u_{it} \qquad [3.25]$$

where, $i=1$ to N
$j=1$ to J
$m=1$ to M
$p=1$ to P
$t=1$ to T
J=total number of one digit SIC classifications.
M=Total number of two digit SIC classifications.
P=Total number of four digit SIC classifications.
N=total number of firms included in the study.
T=total number of years for each firm in the study.
$J < M < P < N$.

All other variables in the above four equations have the same meaning as previously established in this chapter.

The difference between the above five equations and those already developed in this research lies in the degree of aggregation across firms. This is labeled by the different subscripting.

Equation 3.21 holds all coefficients constant across time, industry, and individual firms. The disturbance term is assumed to capture all cross time, industry, and firm differences. It is necessary to estimate only one intercept and two slope parameters.[4]

Equation 3.22 allows the parameters to vary across a one digit SIC code industry classification. The disturbance term now captures only the differences due to finer industry definitions and or firm specific characteristics. It is necessary to estimate J intercepts and 2J slope parameters.

Equation 3.23 allows the parameters to vary by a two digit definition of industry. The disturbance term captures only the differences due to finer industry definitions and/or firm specific information. M intercepts and 2M slope parameters are estimated for equation 3.23.

Equation 3.24 allows the parameters to vary by a four digit SIC code industry definition. The disturbance term captures only the differences due to firm specific

---

[4] The disturbance term captures all variation not explained or accounted for by the independent variables. By allowing only one intercept and one slope parameter for the lagged value of the dependent variable and the asset flow measure, the equation explicitly forces the effects of the independent variables to be the same for all sample members. Therefore if there is any difference due to industry, time, or individual firms, it must be in the error term.

information. P intercepts and 2P slope parameters must be estimated for equation 3.24.

Equation 3.25 allows the parameters to vary by firm. The disturbance term captures only the random differences unexplained by the firm specific parameters. It can be assumed that the firm specific parameters contain industry information and economy wide information. By moving from equation 3.21 to 3.25, the tests will determine if the more refined equations convey statistically significant information not conveyed by a simpler system of equations.

The null hypotheses, in word form (they will be stated in parameter form in chapter 4), are:

H_1: Dividend changes are adequately explained by an economy wide model specification.

H_2: Dividend changes are adequately explained by a one digit industry specification.

H_3: Dividend changes are adequately explained by a two digit industry specification.

H_4: Dividend changes are adequately explained by a four digit industry specification.

The above four hypotheses proceed in sequential order. For H_1 to be rejected, dividend policy must be explained better by either a one, two, or four digit industry specification or a firm specific model. For H_2 to be rejected, dividend policy must be explained better by either a two or four digit industry specification or a firm specific model. For H_3 to be rejected, dividend policy must be explained better by a four digit industry specification or a firm specific model, and for H_4 to be rejected, dividend policy must be explained better by a firm specific model. The above narrative on hypothesis testing indicates that the actual number of statistical hypotheses tested will be greater than four. Seven null hypotheses will be formulated in parameter form in chapter 4.

The test statistic will be a basic Chow test [Gujarati, 1978, p. 305-306]. The Chow test views the null hypotheses as a set of linear restrictions on the coefficients. The relevant F statistic is written in the form of the restricted and unrestricted sums of squares.

$$F = [(SSE^* - SSE)/q)]/[SSE/(NT-I_u-S_u)] \qquad [3.26]$$

Where,

F has q degrees of freedom in the numerator and $NT-I_u-S_u$ degrees of freedom in the denominator.

SSE^*=the error sums of squares from the restricted model.

SSE=the error sums of squares from the unrestricted model.

$q=(S_u+I_u)-(S_r+I_r)$, the number of restricted parameters.

I_u=the number of intercept parameters in the unrestricted model.

I_r=the number of intercept parameters in the restricted model.

S_u=the number of slope parameters in the unrestricted model.

S_r=the number of slope parameters in the restricted model.

It should be noted equation 3.25 is the most general, unrestricted model presented. In fact, as one progresses from equation 3.21 to 3.25, the models become less restrictive and more general. Equation 3.21 forces the intercept and slope parameters to be the same for all firms where as 3.22 allows the parameters to change on a one digit industry membership basis. When comparing equations 3.21 and 3.22, the restrictions are equal to 3J - 3. That is equation 3.22 will have J - 1 more intercepts and 2J - 2 more slope parameters.

Equation 3.23 allows the intercept and slope parameters to vary by a two digit industry specification, a finer definition of industry. When comparing equation 3.22 to equation 3.23 the number of restrictions imposed by equation 3.22 is 3 (M - J). M - J is the number of added intercept parameters and 2(M - J) is the number of added slope parameters.

Equation 3.24 allows the parameters to vary by a four digit industry specification. When comparing equation 3.23 to 3.24, the number of restrictions is 3 (P - M). P - M is the number of added intercepts and 2(P - M) is the number of added slope parameters.

Equation 3.25 allows the parameters to vary by company. When equation 3.25 is compared to 3.21, the number of restrictions is 3N - 3. The number of restrictions falls to 3(N - J) when compared to equation 3.22, 3(N - M) when compared to equation 3.23, and 3(N - P) when compared to equation 3.24.

In each of the comparisons above, the test statistic determines if statistically significant information is added to the system of equations by the number of added parameters.

The estimation procedures can be operationalized in at least two ways. A dummy variable approach could be used where one equation is estimated with coefficients for each level of industry specification or for each firm. The next approach is to estimate a regression for each firm and pool the results.

The first method has as its primary strength the fact that one regression is estimated and the individual coefficients can easily be evaluated for significance by a standard t test. However, when the number of coefficients becomes large, the resulting matrix becomes very complex and writing the equation becomes very cumbersome. Estimating a regression for each sub-unit becomes much easier (the second approach). However, the ability to evaluate individual coefficients is lost. The coefficients must be tested jointly by the F test previously detailed. However, the loss of the ability to individually evaluate each coefficient may not be as much as a disadvantage as it first appears. Judge, et. al. [1982, p. 485] believe the joint test is actually preferred because the possible parameterization of the model is much clearer.

3.5.4 Asset Flow Measure-Statistical Hypotheses

Using the structural form of the model deemed appropriate from null hypotheses one through seven, the primary research question, "Does a cash flow variable aid in the interpretation of a firm's dividend policy?" can be addressed. This question can be further refined to include a comparative test between simple cash flow surrogates and those arrived at using much more complex algorithms.

Assuming that the structural form of the models should include intercept and slope parameters for each firm, the following equation will serve as the basis to derive all other test equations.

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{ki}AFM_{kit}+u_{it} \qquad [3.27]$$

The only difference between equation 3.25 and 3.27 is the possibility of multiple asset flow measures in the model. K will be the number of slope parameters fitted other than that fitted to the lagged dividend term. K will range from 2 to 8, or seven different asset flow measures will be tested.

The following 19 models will be estimated:

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+u_{it} \qquad [3.28]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{2i}OPNI_{it}+u_{it} \qquad [3.29]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_3NI_{it}+u_{it} \qquad [3.30]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_2OPNI_{it}+u_{it} \qquad [3.31]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_4NIPD_{it}+u_{it} \qquad [3.32]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_5OPNIPD_{it}+u_{it} \qquad [3.33]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{6i}WCFO_{it}+u_{it} \qquad [3.34]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{7i}QFFO_{it}+u_{it} \qquad [3.35]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{8i}CFFO_{it}+u_{it} \qquad [3.36]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{2i}OPNI_{it}+B_{5i}OPNIPD_{it}+u_{it} \qquad [3.37]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{2i}OPNI_{it}+B_{6I}WCFO_{IT}+u_{it} \qquad [3.38]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{2i}OPNI_{it}+B_{8I}CFFO_{it}+u_{it} \qquad [3.39]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{5i}OPNIPD_{it}+B_{6I}WCFO_{IT}+u_{it} \qquad [3.40]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{5i}OPNIPD_{it}+B_{8I}CFFO_{IT}+u_{it} \qquad [3.41]$$

$$D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{6i}WCFO_{it}+B_{8I}CFFO_{IT}+u_{it} \qquad [3.42]$$

$$\begin{aligned}D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{2i}OPNI_{it}+&\\ B_{5i}OPNIPD_{iT}+B_{6I}WCFO_{it}+u_{it}& \qquad [3.43]\end{aligned}$$

$$\begin{aligned}D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{2i}OPNI_{it}+&\\ B_{5i}OPNIPD_{iT}+B_{8I}CFFO_{it}+u_{it}& \qquad [3.44]\end{aligned}$$

$$\begin{aligned}D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{2i}OPNI_{it}+&\\ B_{6i}WCFO_{iT}+B_{8I}CFFO_{it}+u_{it}& \qquad [3.45]\end{aligned}$$

$$\begin{aligned}D_{it}-D_{i(t-1)}=A_i+B_{1i}D_{i(t-1)}+B_{2i}OPNI_{it}+B_{5i}OPNIPD_{it}+&\\ B_{5i}WCFO_{it}+B_{8i}CFFO_{it}+u_{it}& \qquad [3.46]\end{aligned}$$

Equations 3.28 and 3.29 are estimated in order to obtain some idea of the relative explanatory ability of the lagged dividend variable and the operating net income variable. The comparisons will be made using the distribution of adjusted R^2 and the resulting error sum of squares from each system of equations. It is expected that the adjusted R^2 from equation 3.29 will at all deciles be greater than the adjusted R^2 resulting from equation 3.28. This result is expected because of the contemporaneous relationship between the dividend change and operating net income, i.e., the accounting number is more current and therefore should contain more current, up to date information.

Equations 3.28 and 3.30 through 3.36 will be used to test the following hypotheses in null form:

H_8: OPNI does not have information content beyond LACD.

H_9: NI does not have information content beyond LACD.

H_{10}: NIPD does not have information content beyond LACD.

H_{11}: OPNIPD does not have information content beyond LACD.

H_{12}: WCFO does not have information content beyond LACD.

H_{13}: QFFO does not have information content beyond LACD.

H_{14}: CFFO does not have information content beyond LACD.

The above seven hypotheses are designed to determine if each different asset flow measure has information content beyond LACD individually. It is hypothesized that each will be significant. Equations 3.30 through 3.36 each reduce to equation 3.28 if the asset flow measure included as an independent variable is not significant. Therefore equation 3.28 is the reduced model for each of the above null hypotheses and it restricts 1,118 parameters to be equal to zero. The test statistic previously developed will be calculated and compared to its critical value. In addition the acceptance or rejection of each hypotheses individually, an examination of the distributions of adjusted R^2 will be made in order to yield some insight into which asset flow measure explains the observed dividend policy best.

Equations 3.37 through 3.42 will then be estimated. The purpose behind the estimation of the above six equations is to obtain some insight into the incremental information of each asset flow measure compared to all others left in the analysis.[5] The comparisons of equations 3.37 through 3.42 to their reduced counterparts in equations 3.30 through 3.36 results in the following four distinct sets of three null hypotheses each:

Set One

H_{15}: OPNI does not have incremental information content beyond OPNIPD.

H_{16}: OPNI does not have incremental information content beyond WCFO.

H_{17}: OPNI does not have incremental information content beyond CFFO.

Set Two

H_{18}: OPNIPD does not have incremental information content beyond OPNI.

H_{19}: OPNIPD does not have incremental information content beyond WCFO.

H_{20}: OPNIPD does not have incremental information content beyond CFFO.

Set Three

H_{21}: WCFO does not have incremental information content beyond OPNI.

---

[5] In chapter 5, a detailed analysis as to why NI, NIPD, and QFFO are dropped from the analysis is presented.

H_{22}: WCFO does not have incremental information content beyond OPNIPD.

H_{23}: WCFO does not have incremental information content beyond CFFO.

Set Four

H_{24}: CFFO does not have incremental information content beyond OPNI.

H_{25}: CFFO does not have incremental information content beyond OPNIPD.

H_{26}: CFFO does not have incremental information content beyond WCFO.

Each of the above null hypotheses will be tested using the test statistic developed earlier in this chapter. The distribution of adjusted R^2's for each equation will also be examined and compared for the equations 3.37 through 3.42. It is expected that OPNI paired with either WCFO or CFFO will be superior to the model pairing OPNI with OPNIPD. This expectation is based on prior studies which have determined that OPNI and OPNIPD are very similar.

At this point the best two asset flow measure model will be selected based upon the adjusted R^2 criterion. It is hypothesized that it will include OPNI and one of either WCFO or CFFO. Then, assuming that two variables are significant, equations equations 3.43 through 3.45 will be estimated and the following null hypotheses examined:

H_{27}: CFFO does not have incremental information content beyond OPNI and WCFO.

or

H_{27}: WCFO does not have incremental information content beyond OPNI and CFFO.

H_{28}: OPNIPD does not have incremental information content beyond OPNI and WCFO(CFFO).

If the best two asset flow measure model emerging includes OPNI and WCFO, then the first H_{27} will be tested. If the best two asset flow measure model emerging includes OPNI and CFFO, then the second H_{27} will be tested. Regardless, H_{28} will be examined. If the first H_{27} is examined, then equation 3.45 will be compared to equation 3.38. Notice that equation 3.45 reduces to equation 3.38 if CFFO does not add incremental information to 3.38. If the second H_{27} is examined, equation 3.45 will be compare to 3.39. Again, the larger equation, 3.45, reduces to the smaller equation, 3.39, if the added variable, WCFO, does not add incremental information. To test H_{28}, equations 3.43 or 3.44 will be compared to either 3.38 or 3.39 depending on the best two asset flow measure model selected after all pairs are examined.

It is expected that OPNIPD will fall out of the analysis at this point (H_{28} will be accepted). However, if this is not the case, then two additional hypotheses can be formulated. Because of the uncertainty and the many possible combinations that may emerge depending on the results, they are not formulated here. The basic idea will be to compare the larger model to a reduced counterpart and calculate the test statistic developed earlier and compare the calculated value to the critical value and either accept or reject the null hypotheses.

3.6 Summary

This chapter has delineated the firms that are to be included in the sample and defined the variables needed. The econometric issues pertinent to this study have been addressed. They are: identification of the model and theoretical and statistical properties. Stemming from this discussion is the selection of estimation techniques.

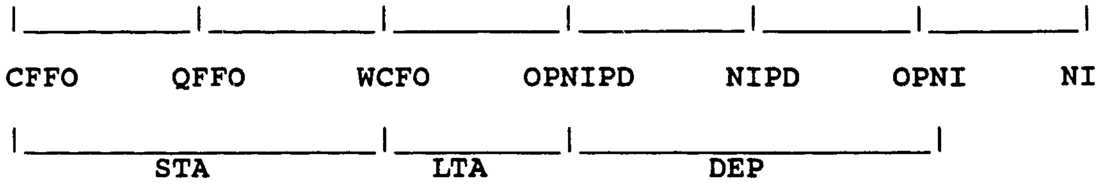
After discussing the possible estimation techniques, it was decided that accepting either theoretical base underlying the distributed lag model would not be prudent given the desire to use parametric statistics to test the incremental information content of various asset flow measures. A general approach suggested by Johnston [1972] was selected and the available statistical options discussed.

The chapter then turned to developing the proper structural form of the model. This part of the study is designed to determine if dividend policy as represented by a distributed lag model is economy wide, industry specific, or firm specific. The necessary equations and hypotheses were developed.

The last section specifies the necessary equation and hypotheses to test the information content of the asset flow measures. Of particular interest is the relationship among the cash flow surrogates.

Figure 3.1

Asset Flow Measures
in
Accrual Order



The above figure exhibits NI>OPNI. This is for the convience of exhibition only. It is possible for NI and OPNI to be equal or for OPNI to be greater than NI.

Chapter 4

STRUCTURAL FORM OF THE EQUATIONS--EMPIRICAL RESULTS

4.1 Introduction

The primary purpose of this chapter is to report the results of the statistical tests employed to determine the proper structure for the regression equations as detailed in chapter 3, section 5.3. The results of the structural statistical hypotheses developed to test for the proper form are presented in section 4.3.

Before presenting the results, section 4.2 will detail the selection of the estimation procedure employed to test for the proper structure and also used to test the asset flow measure hypotheses in chapter 5. Section 4.4 will summarize this chapter.

4.2 Estimation Technique Selection

Chapter 3 has dealt with this topic at great length. From the discussion in chapter 3, the following approach was decided on:

1. Determine if serial correlation is a problem.
2. If serial correlation is not a potential problem, proceed with hypotheses testing using ordinary least squares on the raw data.
3. If serial correlation is determined to be a potential problem, adjust the data for it in order to arrive at the most general results possible. Chapter 3 section 4.5 presents a discussion of three possible techniques to be used to estimate rho in an autoregressive framework.

4.2.1 Tests for Serial Correlation

The test for serial correlation will be performed at two levels; 1. On the sample as a whole with a two stage regression; 2. By company, requiring a two stage regression for each company with data meeting the requirements detailed in Chapter 3.

One thousand one hundred eighteen companies have all the data needed over the fourteen years starting with 1971 and ending with 1984 resulting in a total of 15,652 observations.

The test statistic for serial correlation will be Durbin's M statistic. The validity and power of this test in an autoregressive environment has been described in chapter 3.

The following form of the dividend policy model was estimated at the overall level and at the firm level.[1]

$$D_t-D_{t-1}=B_0+B_1D_{t-1}+B_2OPNI_t+e_t \qquad [4.1]$$

The residuals, e_t, were put into a temporary data set and used as dependent variables in the second stage regression as follows:

$$e_t=b_0+b_1OPNI_t+b_2D_{t-1}+b_3e_{t-1}+v_t \qquad [4.2]$$

The t statistics testing the hypothesis $b_3=0$ is the test statistic for serial correlation. If the null hypothesis is rejected, serial correlation is a problem and the data must

---

[1] The asset flow measure income from continuing operations was selected because of its performance at the firm specific level. This result is detailed in chapter 5.

be adjusted accordingly. If the null hypothesis is accepted, serial correlation is not a problem and estimation and hypotheses can proceed using the raw, unadjusted data.

For the overall regression, b_3 is not significant. The value of the t statistic is -.541. Therefore at the economy level of specification, serial correlation is not a problem.

The firm specific test for serial correlation required two regressions on each of the 1,118 firms included in the sample. Therefore, 1,118 t statistics must be examined. At the ten percent level of significance, 71 of the b_3 were statistically different from zero. That is 6.35% of firms in the sample exhibit serial correlation in their error terms. Because at the 10% level of significance, the null hypotheses $b_3=0$ can be expected to be rejected 10% of the time, when in fact they should be accepted, and the observed rejection rate is only 6.35%, serial correlation is determined not to be a problem in this sample. The 71 hypotheses rejections are assumed to be due to chance and not to significant serial correlation.[2]

Both the overall sample test and the firm specific test yield similar results: serial correlation is not a problem. Based on these results, estimation and hypotheses testing will proceed using the raw, unadjusted data.

---

[2] The test for serial correlation should be carried out on the full model as developed in chapter 5. Because of the iterative nature of this type of research, the preliminary test was made on the reduced model and then checked with the full model. The conclusion of no serial correlation was maintained.

4.3 Structural Hypotheses

The primary reason to test for the proper model structure is to determine if observed dividend policies span the economy, industries, or are firm specific. In addition to this, if a model that is structurally incorrect is used to estimate the parameters, the parameter estimates will be biased estimates, possibly resulting in misleading results and conclusions.

The technique employed, is to gradually move from a restricted model to a more general, unrestricted model. The most restricted model forces the intercept and slope terms to be equal across all industries and firms included in the sample (equation 3.21). The most general model allows the slope and intercept terms to vary by firm (equation 3.25).

The remainder of this chapter will present the results of the structural hypotheses tests and conclude with a summary and implications for the asset flow measure hypotheses testing.

4.3.1 Structural Hypothesis Tests

By restricting the slope and intercept terms to be equal for all firms, dividend policy is effectively stated to be an economy wide phenomenon (equation 3.21). Equation 3.22 allows the slope and intercept terms to vary by one digit SIC code designations. This is the broadest definition of industry membership. By allowing the parameter estimates to change by this designation, effectively states dividend policy as a function of broad industry membership.

In parameter form, the first null hypothesis to be tested in this chapter is:

$$H_1: \; A_1 = A_2 \ldots = A_j \;\&\; B_{11} = B_{12} \ldots = B_{1j} \;\&\; B_{21} = B_{22} \ldots = B_{2j}$$

where A_1, B_1, and B_2 are regression estimates for equation 3.21. "j" is equal to one to J where J is equal to the total number of one digit SIC code classifications. There are nine different one digit classifications represented within the sample of 1,118 firms (J=9).

Table 4.2 details the number of companies classified into each group. For example, three companies had the necessary data and belonged to the zero first digit SIC code group.

If all the A_j's, B_{1j}'s, and B_{2j}'s are equal to one another, then one parameter is sufficient to supply all of the information contained in equation 3.22. If this the case, equation 3.22 reduces to equation 3.21. Therefore the null hypothesis is accepted.

If the null hypothesis is rejected the conclusion is that at least one parameter is not equal across one digit industry classifications and the system is not over parameterized by including a slope and intercept for each one digit industry specification.

This hypothesis and the four others to be detailed in this chapter were tested using the following procedure.

Both the restricted and unrestricted models are estimated using OLS. For this hypothesis, the restricted model is equation 3.21. The regression results for this model are detailed in Table 4.1. The parameter estimates are detailed adjacent to their labels with their individual significance levels listed within parentheses directly underneath the estimate. Each of the three parameters have the proper signs. The adjusted coefficient of determination is 26.4%.

Equation 3.22 is the unrestricted model. It is more general than equation 3.21 because it allows the intercept and slope parameters to change by a one digit industry classification. Table 4.2 details the regression results for the one digit system of equations. Equation 3.22 actually required nine separate regressions. Table 4.2 details the results for each one digit classification. The adjusted R^2 ranges from a high of 43.6% (class 0) to a low of 16.2% (class 4). The error sums of squares pooled across the nine regressions is 335.689.

The test statistic was developed and explained in Chapter 3, section 5.3. Specifically it is equation 3.27 and follows an F distribution. When moving from equations 3.22 to 3.21, (2J-2)+(J-1) parameters are being restricted to be equal to zero. In equation 3.22, the number of slope parameters is 2J and the number of intercept parameters is

J. J equals nine, the number of one digit industry specifications. Equation 3.21 has one intercept and two slope parameters. Thus the number of restricted parameters is equal to (3J-3), or 24. The test statistic determines if the reduction in error sums of squares is statistically significant given the number of added parameters. For H_1, the test statistic has 24 degrees of freedom in the numerator (the number of restricted parameters) and 14,507 degrees of freedom in the denominator. At the .01 level of significance the critical value is 1.79. The test statistic has a value of 9.2497. Therefore the null hypothesis is rejected and the conclusion that the intercept and slope parameters are equal across a one digit industry classification is rejected.

The next step is to use a finer definition of industry. Equation 3.23 allows the slope and intercept parameters to vary across a two digit industry classification. This is a more general model then that described by equation 3.22.

Null hypothesis two tests if dividend policy is a function of a finer measure of industry membership or if the broadest designation of industry membership explains the observed dividend policy of firms adequately. It is possible that some two digit specifications may not have any firms so classified. This indicates that the number of additional parameters to be estimated may be less than 270.

In parameter form the null hypothesis being tested is:

H_2: $A_{1j}=A_{1m}$ & $B_{1j}=B_{1m}$ & $B_{2j}=B_{2m}$.

Where the alphabetical subscripts represent the level of classification. "j" represents the one digit classification and "m" represents the two digit classification. There are nine A_1, B_1, and B_2 parameters estimated in the one digit specification. Within each of the nine estimates for each of the parameters there is a greater number of parameters estimated for the two digit specification. The null hypothesis tests if the numerous two digit parameter estimates are equal to the single one digit estimate.

For example, if the first industry digit is 1, all firms with four digit industry classification ranging from 1000 to 1999 will be included and represented within the model by one intercept and two slope parameters. From Table 4.2 there are 80 companies in this group. If the classification is broken down further to a two digit classification, the firms within the 1000 to 1999 range will now be potentially represented by ten intercepts and 20 slope parameters. This is an addition of 18 slope and 9 intercept parameters. As previously alluded to, it may not be necessary to estimate all 30 parameters if within the industry range there are two digit classification without data points.

The 80 companies within the 1000 to 1999 four digit range are further classified into seven two digit classifications. There are no companies within the 1100 to 1199, 1800 to 1899, and 1900 to 1999 ranges. Therefore six intercepts and twelve slope parameters are added. The null hypothesis tests if the seven intercepts are equal to the one intercept estimated for the one digit level and if the 14 slope parameters are equal to the two estimated for the one digit classification.

Within the nine one digit classifications, 60 two digit industry classification exist. Table 4.3 details the parameter estimates and adjusted R^2 for the 60 equations fitted by OLS. The first column designates the decile, the second column the calculated adjusted R^2, and columns three, four and five give the estimated values for the coefficients. The theoretical sign associated with the lagged dependent variable, LACDPS, is negative. From the table it is easy to see that at least 90% of the equations estimated yielded coefficients with the proper sign. The theoretical sign associated with OPNIPS is positive and from the table, 95% plus of the industries in the sample have the correct sign.

This test is simultaneously carried out for each of the nine one digit classification groups. The total number of parameters added by equation 3.23 to equation 3.22 in this sample is 153. This indicates that 60 of a possible 90 classifications are represented.

The test statistic's value for H_2 is 6.7856. The critical value is 1. Clearly, the null hypothesis is rejected and the conclusion is that moving from a one digit classification to a two digit classification adds significantly to the explanatory power of observed dividend policy.

Equation 3.24 is now estimated allowing the slope and intercept parameters to vary by a four digit industry classification. It is compared to equation 3.23 to determine if significant information is added when moving from a two digit to a four digit classification. In parameter form the null hypothesis is:

H_3: All $A_m=A_p$ & $B_{1m}=B_{1p}$ & $B_{2m}=B_{2p}$.

Where the alphabetical subscripts indicate the source of the parameters. For "m" the source is the two digit SIC code classification and for "p" the source is the four digit SIC code classification. There are 222 different four digit classifications represented within the sample.

Table 4.4 details the regression results for the four digit classification just as Table 4.3 does for the two digit classification. Notice that by using a four digit industry definition, the median value adjusted R^2 is 30%. This indicates that 111 four digit industries have adjusted R^2 greater than 30% and 111 four digit industries have adjusted R^2 less than 30%. This is an increase of 3% over the two digit specification. However the proper sign associated with LACDPS is correct only for at least 75% of the equations. This is an indication that equation 3.24 is not as well specified as equation 3.23.

When moving from a two digit classification to a four digit classification, 324 slope parameters and 162 intercept parameters are added to the system of equations. The test statistic value for H_3 is 3.8715, clearly greater than the critical value of one and again the null hypothesis is rejected at the .001 level of significance. This indicates that significant information is added to the system when moving from a two digit classification to a four digit classification.

The last equation to be estimated is 3.25. This equation allows the slope and intercept parameters to vary by firm. Therefore there will be 1,118 intercept and 2,236 slope parameters estimated. The information content of the firm specific system of equations will first be compared to equation 3.24, the four digit industry classification. In parameter form the following hypothesis is formulated.:

H_4: All $A_p=A_i$ & $B_{1p}=B_{1i}$ & $B_{2p}=B_{2i}$.

Again the alphabetical subscript represents the source of the parameters. For "p", the source is the four digit SIC code and for "i" the source is each firm in the sample. H_4 requires the addition of 896 intercepts and 1,792 slope parameters to the four digit model.

Table 4.5 details the regression results for the firm specific regressions. The median value for the adjusted R^2 is now at 40%. This is an increase of ten percentage points over the four digit specification, 13% over the two digit, and 14.3% over the one digit specification. In addition, the adjusted R^2 from the firm specific model lie above the adjusted R^2 from the four digit models at all deciles except at the beginning level of .99 where they are equal. Also the sign associated with the lagged dependent variable is negative, the theoretical direction, for 90 plus percent of the firms in the sample, an indication that the model agrees with the theory better than the four digit industry specification.

The critical value for the test statistic is again one at the .001 level of significance and the calculated value is 2.3917. In this case the null hypothesis is rejected. This indicates that significant information is gained by the system of equations by allowing the parameters to vary by firm when compared to allowing them to vary by a four digit industry specification.

The first four hypotheses have compared progressively more general models to its immediate predecessor. Table 4.6 details the calculated values of the test statistics associated with hypotheses one through four on the diagonal immediately above the main diagonal. Also displayed are values for all other possible nested model tests. It is possible to form five additional hypotheses, but only one is deemed essential to establish the proper structural form for the model. That hypothesis is:

H_5: All $A_i=A$ & $B_{1i}=B_1$ & $B_{2i}=B_2$.

Null hypothesis five compares the economy wide model to the firm specific model. It is possible to accept this hypothesis when rejecting all of the first four hypotheses because of the nonlinearity of the parameter additions and the corresponding effect of the number of additional parameters on the test statistic. This hypothesis compares equation 3.25 to equation 3.21. The number of restricted parameters is 3I-3, which is 3,351. From Table 4.6, the calculated test statistic is 3.1647. The critical value is again one at the .001 level of significance, indicating H_5 should be rejected. This indicates that a firm specific dividend model adds statistically significant information to the overall economy model.

4.4 Summary and Implications

The purpose of this chapter is twofold. First to determine the estimation technique appropriate for parameter estimation and second to test for the proper structure of the dividend policy model. It should be noted that the tests for the proper structure are limited by the fact they were made using a model that included only OPNIPS as an asset flow measure. It is possible that the results could change if a more complete model as that developed in chapter 5 were used.

The tests for serial correlation determined that it is not a problem at the overall economy level or at the firm level. This finding drove the choice of estimation method to be used for parameter estimation. From a review of the relevant econometrics literature in chapter three, it was determined if serial correlation is not present, it is appropriate to proceed using OLS in an autoregressive frame work. Therefore, the study should proceed using unadjusted data and applying OLS to estimate the models.

The structural hypotheses were then addressed. When moving from an economy wide specification for dividend policy to any of the three definitions of industry tested by this study, significant information is added. In addition, when moving within industry specifications, significant information is added by refining the definition of industry. One possible conclusion is that the finer definitions of industry supply additional information. Another possible explanation is that as you move from the most restricted model towards the firm specific model, the parameters are beginning to pick up firm specific information and not industry information. This conclusion can be defended on the grounds that the classification of a firm within an industry is tenuous at best because of the highly diversified nature of the modern enterprise.

The firm specific model structure always conveys statistically significant marginal information over the economy wide definition and any of the industry specifications. This indicates that dividend policy is best explained by firm specific attributes and not by industry or economy wide attributes. This is not to say that economy and industry attributes are not important, but only indicates that in addition to the firm specific information, the parameters also capture the industry and economy wide characteristics.

The above same conclusions are reinforced by examining the changes in R^2. R^2 ranges from .264 for the overall regression to a median and mean value of .40 and .50 respectively for the firm specific regression with the three levels of industry specifications falling uniformly in between. The range of change is virtually 14 points or explanatory power is increased by 52% when moving from the overall equations to the firm specific equations. For the specific values and distributions of the R^2 statistic, again see tables 4.1 through 4.5.

The implications of these results for the asset flow measure hypotheses is that firm specific regressions should be used when evaluating the information content of the alternative asset flow measures.

In closing, a brief discussion centering on the power of the tests is appropriate. The power of statistical tests is directly related to sample size. Recall that there are 1,118 firms with 14 years of data for each firm yielding a total of 15,652 observations. It is possible that almost any variable with some variation within it would be deemed to be statistically significant. Neter, Wasserman, and Kutner (NWK) [1985, p. 602] conclude that "sample sizes should be large enough to detect important differences with high probability". At the same time, NWK caution that "the sample sizes should not be so large that unimportant differences become statistically significant with high probability".(p. 602) The basic point is that some variables may be statistically significant, but not be economically significant. This difference is determined by examining the magnitude of the estimated coefficients. Therefore the interpretations of the findings within this chapter and the chapters to follow must be tempered with this in mind.

Table 4.1

Regression Results for Equation 3.21 Overall Estimation

Intercept	.003974 (.0194)
LACDPS	-.09123 (.0001)
OPNIPS	51.2678 (.0001)
SSE	341.04.
Adjusted R^2	.264

Significance level in parentheses.

LACDPS=Lagged adjusted cash dividends per share.

OPNIPS=Operating net income per share.

SSE=error sums of squares.

Table 4.2

Regression Results for Equation 3.22
One Digit SIC Estimation

One Digit Code	Number of Companies		Adjusted R^2
0 (Agriculture)	3		.436
1 (Mining and Construction)	80		.257
2 (Manufacturing)	295		.299
3 (Manufacturing)	448		.287
4 (Transportation and Communications)	72		.162
5 (Wholesale and Retail Trade)	144		.184
6 (Finance, Insurance, and Real Estate)	12		.226
7 (Services)	43		.176
8 (Services)	21		.259
	1,118	MEAN	.318
		MEDIAN	.257

One Digit Code	Intercept	LACDPS	OPNIPS
0	.047	.388	115.19
1	.013	-.149	52.77
2	-.002	-.065	51.01
3	.009	-.107	50.87
4	.009	-.093	55.61
5	.004	-.050	34.39
6	-.002	-.078	64.28
7	-.004	-.032	34.45
8	-.003	-.165	68.13
MEAN	.006	-.125	58.52
MEDIAN	.004	-.093	52.77

Error Sum of Squares for the System of Equations 335.689. Note in the first part of this table, the name of the industry is listed under the first digit code.

Table 4.3

Regression Results for Equation 3.23
Two Digit SIC Estimation

Decile	Adj. R^2	Intercept	LACDPS	OPNIPS
.99	.99	.300	.155	219.67
.95	.64	.095	.032	129.40
.90	.49	.046	-.006	108.82
.75	.37	.013	-.046	70.23
.50	.27	.003	-.101	46.98
.25	.17	-.009	-.176	33.22
.10	.12	-.019	-.220	20.48
.05	.10	-.027	-.385	11.18
.01	.07	-.053	-1.124	-.29
MEAN	.30	.012	-.140	55.87

Total Error Sums of Squares 313.047

Table 4.4

Regression Results for Equation 3.24
Four Digit SIC Estimation

Decile	Adj. R^2	Intercept	LACDPS	OPNIPS
.99	.96	.287	.150	209.48
.95	.75	.080	.069	132.17
.90	.65	.051	.017	101.99
.75	.47	.019	-.029	68.85
.50	.30	.002	-.093	43.34
.25	.19	-.010	-.177	27.72
.10	.11	-.029	-.327	13.32
.05	.06	-.038	-.420	-52.68
.01	-.07	-.079	-.998	-67.42
MEAN	.35	.011	-.130	53.36

Total Error Sums of Squares 275.623

Table 4.5

Regression Results for Equation 3.25
Firm Specific Estimation

Decile	Adj. R^2	Intercept	LACDPS	OPNIPS
.99	.96	.400	.308	339.10
.95	.89	.151	.081	201.17
.90	.81	.086	-.023	148.34
.75	.65	.032	-.062	93.69
.50	.40	.004	-.017	54.55
.25	.31	-.016	-.332	24.30
.10	.19	-.059	-.538	6.26
.05	.12	-.109	-.716	-2.12
.01	.01	-.255	-1.152	-39.74
MEAN	.50	10.74	-7.884	68.975

Total Error Sums of Squares 174.996

Table 4.6

Test Statistics Between Systems of Equations

	One Digit	Two Digit	Four Digit	Firm Spec
Overall	9.2497	7.2190	4.9570	3.1647
One Digit		6.7556	4.7296	3.0857
Two Digit			3.8745	2.7787
Four Digit				2.3917

Chapter 5

ASSET FLOW MEASURE HYPOTHESES--EMPIRICAL RESULTS

5.1 Introduction

The primary purpose of this chapter is to present the empirical results of the asset flow measure hypotheses developed in chapter 3, section 3.5.4. The hypotheses there were developed to investigate if a cash flow variable is a significant variable in the explanation of a firms dividend policy.

The structural form of the dividend policy model to be used in the empirical test of this chapter was determined by chapter four. The model will be a firm specific model, thereby requiring separate regressions for each of the 1,118 firms included in the sample.

The estimation technique will be OLS as validated by the results obtained in chapter four and the theoretical properties reviewed in chapter three.

The remainder of this chapter will be organized as follows. Section 5.2 will present results of the hypotheses designed to test each individual asset flow measure defined in chapter three. Section 5.3 will present the Spearman rank correlations between the asset flow measures and determine which pairs of asset flow measures are meaningful to continue with. The section will then test hypotheses concerned with the information content of pairs of asset flow measures. Of specific interest is the pairing of an income construct and a cash flow measure. Section 5.4 will test the unique information content of three different cash flow measures when included in a model with a lagged value of the dependent variable and operating net income. Section 5.5 will present the results of hypotheses designed to determine if four asset flow measures have enough information content to be statistically significant and section 5.7 will summarize the chapter.

5.2 Tests of Individual Asset Flow Measures

Hypotheses eight through fourteen take the first cut at the research question and determine which asset flow measures individually add significantly to the explanatory power of LACD (B_1 is the parameter associated with this variable). Specifically the hypotheses are:

H_8: $B_{21}=B_{22}=...=B_{2i}=0.$

H_9: $B_{31}=B_{32}=...=B_{3i}=0.$

H_{10}: $B_{41}=B_{42}=...=B_{4i}=0.$

H_{11}: $B_{51}=B_{52}=...=B_{5i}=0.$

H_{12}: $B_{61}=B_{62}=...=B_{6i}=0.$

H_{13}: $B_{71}=B_{72}=...=B_{7i}=0.$

H_{14}: $B_{81}=B_{82}=...=B_{8i}=0.$

In order to test the above seven null hypotheses, models one through nine are estimated[1]. The regression results from the nine equations are detailed in Table 5.2. The information in Table 5.2 will be explained as each hypothesis is analyzed.

Hypothesis eight asks whether OPNI adds significantly to the explanatory power of LACD. This is accomplished by comparing the results obtained from model one to the results from model four (the model used in chapter 4 to test for industry effects). Table 5.2 details the regression results in terms of deciles. This is necessary because for each model, *1,118 individual regressions are estimated. The* distributions of adjusted R^2 and the coefficients for models one through nine are detailed in Table 5.2.

Model four reduces to model one if all B_2's are equal to zero, i.e., if OPNI is not an important explanatory variable. The test statistic developed in chapter three is a joint test for all 1,118 B_2's estimated. Model one can be viewed as imposing 1,118 linear restrictions on model four. Therefore the test statistic has 1,118 degrees of freedom in the numerator and 11,180 degrees of freedom in the denominator yielding a critical value at the .001 level of significance for the test statistic equal to one. The calculated value of the test statistic is 10.68. Therefore the null hypothesis of all B_2's are equal to zero is

---

[1] For a complete list of all models and the variables included within each, see Table 5.1.

rejected and the conclusion is that OPNI adds significant explanatory power to LACD.

This conclusion is reinforced by examining the distribution of adjusted R^2's for model one and comparing them to the same distribution for model four. The estimated adjusted R^2's for model four lie above those for model one at all deciles. This indicates that after adjusting for the consumption of an additional degree of freedom by model four over model one, model four is superior in 100% of the cases over model one. In fact, at the median, model four adds 36 points to model one's median adjusted R^2.

Null hypothesis nine tests if NI adds significantly to the explanatory power of LACD. Models one and three are estimated and compared in order to test this hypothesis. The distribution of adjusted R^2 from model three again lies above the distribution of adjusted R^2 from model one, practically the same distance as model four using OPNI. The test statistic again has 1,118 degrees of freedom in the numerator and 11,180 degrees of freedom in the denominator yielding a critical value at the .001 level of significance equal to one. The calculated value is 9.19. Again the hypothesis is rejected and the conclusion is that NI adds significant explanatory power to LACD.

Null hypotheses ten through twelve test if often used simple cash flow measures add significant explanatory power to LACD. The first simple cash flow measure to be tested by H_{10} is NIPD. Model five is estimated and compared to model one. As in the first two hypotheses tests, the adjusted R^2 distribution resulting from model five lies above the distribution from model one at all deciles. The test statistics critical value is the same and the calculated value is 7.93, clearly rejecting the null hypothesis. The conclusion is that NIPD adds significant explanatory to LACD.

The second simple cash flow measure to be tested by H_{11} is OPNIPD. Model six is estimated and compared to model one. If OPNIPD adds no significant explanatory to model one, all the B_5's will be equal to zero and model six reduces to model one. The distribution of adjusted R^2 from model six again lies above the distribution from model one, indicating OPNIPD adds significant power to the model. Model six compared to model one has the same number of linear restrictions and parameters and therefore the test statistic has the same critical value as in the previous three cases. The calculated value is 8.73, clearly greater than the critical value, rejecting the null hypothesis. The conclusion is that OPNIPD adds significant explanatory power to LACD.

Null hypothesis 12 tests if WCFO adds significantly to the power of LACD. Model seven is estimated and compared to model one as models three through six were compared to model one. The distribution of adjusted R^2 from model seven lie above the distribution from model one. The joint test for all 1,118 B_6=0 is again rejected. The test statistics calculated value is 8.13. The conclusion is that WCFO adds significant explanatory to LACD.

Null hypotheses 13 and 14 test the significance of two more refined measures of cash flow, QFFO and CFFO respectively. The analysis proceeds as the analysis for the first five hypotheses.

For hypothesis 13, model eight is estimated and compared to model one and for hypothesis 14, model nine is estimated and compared to model one. The distribution of adjusted R^2 from model eight lies above the distribution from model one for all deciles except at the .10 decile. This indicates that model one with only LACD is superior to model eight with LACD and QFFO after adjusting for the added explanatory variable in some of the estimated equations. The calculated value of the test statistic to test jointly all B_7's are equal to zero is 3.97. Null hypothesis 13 is rejected and the conclusion is that QFFO adds significantly to the explanatory power of LACD.

The distribution of adjusted R^2 from model nine lies above the distribution from model one for 50 plus percent of the equations estimated. For 25 plus percent of the equations, model one with only LACD produces a greater adjusted R^2. The calculated value of the test statistic is 3.24. Therefore the joint hypothesis that all B_8's are equal to zero is rejected and the conclusion is that CFFO contributes significant explanatory to the system of equations with only LACD as an explanatory variable.

5.2.1 Summary of Section 5.3

The overall conclusion is that each of the asset flow measures individually contribute significant explanatory power to LACD. The asset flow measure that contributes the most is OPNI and the least is CFFO.

In the descriptions of the asset flow measures in chapter three, recall that the difference between each of the different asset flow measures is the number of accounting accruals used to determine the statistic. NI has the most accruals and CFFO has the least. Notice the steady decrease in both the distributions of adjusted R^2 and the value of the calculated test statistic as you move form OPNI to CFFO. The median value of adjusted R^2 range from a high of .40 for OPNI to a low of .13 for CFFO, with OPNIPD, NIPD, WCFO, and QFFO falling neatly in-between. This can be interpreted as a first indicator of the explanatory power that certain accounting accruals add to the model.

5.3 Tests of All Pairs Of Asset Flow Measures

Section 5.2 of this chapter concludes that each of the asset flow measures tested individually add significant explanatory power to the model. By examination of the distributions of adjusted R^2's, OPNI appears to add the most explanatory power to the model. This section tests the power of all combinations of asset flow measures to explain the observed dividend policy of the 1,118 firms included in the sample. The possible need for multiple asset flow measures is supported by prior studies indicating that liquidity, and specifically the need for cash to pay cash dividends, are, in addition to accounting income, important variables considered by management.

However, before pairs of asset flow measures are examined, it seems prudent to cut down on the number of different asset flow measures tested. From the results reported in section 5.3 of this chapter, several asset flow measures yield very similar results. NI and OPNI are both accounting income measures and both yield very similar results. From Table 5.2, the resulting distributions of adjusted R^2 are very similar. In addition, from Table 5.3, the Spearman rank correlation between NI and OPNI for the year 1980 is .972.[2] This very close correlation explains why the results are similar and also indicates that both probably measure similar dimensions of firm performance. Based on this analysis, NI will no longer be tested.

A very similar analysis can be made for OPNIPD/NIPD, and QFFO/CFFO. At this point NIPD and QFFO will no longer be used. OPNIPD is chosen over NIPD because it achieves a slightly higher distribution of adjusted R^2's. CFFO is retained over QFFO because it is the asset flow measure of greatest current concern and it is used more often in practice than QFFO. WCFO is retained because it is a

---

[2] The Spearman rank correlations for the years 1971 through 1984 are all very close to the numbers reported in Table 5.3.

statistic that is widely used in practical financial analysis.

5.3.1 Hypotheses Tests of Remaining AFM Pairs

In order to test the statistical significance of the second asset flow measure in the dividend policy model, models 10 through 15 are estimated (see Table 5.1). Each of the models 10 through 15 are more general models than models three through nine. Models three through nine can be viewed as nested in models ten through 15. For example, models four and six are nested in model ten. If all B_2's are equal to zero in model ten, model ten reduces to model six. If all B_5's in model ten are equal to zero, model ten reduces to model four. Therefore, when models four and six are compared to model ten, they have 1,118 linear restrictions.

Twelve null hypotheses result from the comparisons of models ten through 15 to models three through nine. The null hypotheses basically test the incremental information content of each asset flow measure to the three other asset flow measures. Therefore, four separate and distinct sets of three null hypotheses emerge. The first set test for incremental information of OPNI to OPNIPD, WCFO, and CFFO. The second set tests for incremental information content of OPNIPD to OPNI, WCFO, and CFFO. The third set will test for incremental information content of WCFO to OPNI, OPNIPD, and CFFO. Finally, the fourth set will test for incremental information content of CFFO to OPNI, OPNIPD, and WCFO.

In parameter form the null hypotheses are:

Set one:

H_{15}: $B_{21}=B_{22}=\ldots=B_{2i}=0$ in model 10 (M10 reduces to M6)

H_{16}: $B_{21}=B_{22}=\ldots=B_{2i}=0$ in model 11 (M11 reduces to M7)

H_{17}: $B_{21}=B_{22}=\ldots=B_{2i}=0$ in model 12 (M12 reduces to M9)

Set two:

H_{18}: $B_{51}=B_{52}=\ldots=B_{5i}=0$ in model 10 (M10 reduces to M4)

H_{19}: $B_{51}=B_{52}=\ldots=B_{5i}=0$ in model 13 (M13 reduces to M7)

H_{20}: $B_{51}=B_{52}=\ldots=B_{5i}=0$ in model 14 (M14 reduces to M9)

Set three:

H_{21}: $B_{61}=B_{62}=\ldots=B_{6i}=0$ in model 11 (M11 reduces to M4)

H_{22}: $B_{21}=B_{62}=\ldots=B_{6i}=0$ in model 13 (M13 reduces to M6)

H_{23}: $B_{61}=B_{62}=\ldots=B_{6i}=0$ in model 15 (M15 reduces to M9)

Set four:

H_{24}: $B_{81}=B_{82}=\ldots=B_{8i}=0$ in model 12 (M12 reduces to M4)

H_{25}: $B_{81}=B_{82}=\ldots=B_{8i}=0$ in model 14 (M14 reduces to M6)

H_{26}: $B_{81}=B_{82}=\ldots=B_{8i}=0$ in model 15 (M15 reduces to M7)

The analysis is now going to proceed much as it did in section 5.3 of this chapter. Each set will be examined in two ways. First the distributions of adjusted R^2's from the unrestricted will be compared to the restricted model. Then the test statistic described in chapter 3 will be calculated and compared to the critical value. In each of the above twelve null hypothesis, the test statistic will have 1,118 degrees of freedom in the numerator and 10,062 degrees of freedom in the denominator, yielding a critical value of one at the .001 level of significance.

5.3.1.1 Set One

The first set of null hypotheses test if OPNI has incremental information content when paired with one of OPNIPD, WCFO, or CFFO and LACD. The first hypothesis to be examined by this subsection will be H_{15}. By examining Table 5.1, it is easy to see that if all B_{2i}'s are equal to zero, model ten reduces to model six. If this the case, OPNI does not add significant explanatory power to OPNIPD and LACD. From an examination and comparison of the distributions of adjusted R^2 resulting from the estimation of model six (table 5.2) and model ten (Table 5.4), it appears that OPNI adds explanatory power to model six. The distribution of adjusted R^2 from model ten lies above the distribution from model six at all deciles. The calculated value of the test statistic is 2.69, clearly above the critical value of one. The conclusion is that OPNI adds significant information to model LACD and OPNIPD.

Null hypothesis 16 tests if OPNI adds significant information to LACD and WCFO. If all the B_{2i}'s in model 11 are equal to zero, from examination of Table 5.1, it is easy to see that model 11 reduces to model seven. By a comparison of the distribution of adjusted R^2's for model 11 (Table 5.4) to model seven (Table 5.2), it appears that OPNI does add significant power to LACD and WCFO. The model 11 distribution lies above model seven's distribution in all deciles. The calculated value of the test statistic is 3.30. Therefore the hypothesis is rejected and the conclusion is that OPNI adds significant information to LACD and WCFO.

Null hypothesis 17 tests if OPNI adds significant explanatory power to LACD and CFFO. Again, from a comparison of the distributions of adjusted R^2's, the model including OPNI lies above the restricted model in all deciles. The calculated value of the test statistic is 7.39, clearly rejecting the null hypothesis and concluding that OPNI adds significant information to the system of equations containing LACD and CFFO as explanatory variables.

5.3.1.2 <u>Set Two</u>

The second set of null hypotheses put forth in section 5.4 of this chapter test if OPNIPD adds significant information to the model already containing LACD and one of OPNI, WCFO, or CFFO.

By examining Table 5.1, it is easy to see how the models 10, 13, or 14 including OPNIPD reduces to a more restricted model. If all B_{5i}'s are equal to zero in model ten, the OPNIPD variable falls out leaving only OPNI which is model four. If all B_{5i}'s are equal to zero in model 13, the OPNIPD variable falls out leaving only WCFO which is model seven. A like scenario follows for model 14 which reduces to model nine.

From an examination and comparison of the distribution of adjusted R^2's resulting from the models 10, 13, and 14 (the unrestricted models) to the distribution from models 4, 7, and 9 (the restricted models), OPNIPD appears to add explanatory power to each of the other three asset flow measures (OPNI, WCFO, and CFFO). The calculated test statistic values are as follows:

H_{18}	1.59
H_{19}	2.08
H_{20}	5.90

With a critical value of one for the test statistic, it is evident that OPNIPD adds significant information to OPNI, WCFO, and CFFO. Therefore null hypotheses 18, 19, and 20 are rejected and the conclusion is OPNIPD is an important explanatory variable.

5.3.1.3 Set Three

The third set of null hypotheses (H_{21}, H_{22}, and H_{23}) tests if WCFO adds significant information to LACD and one of OPNI, OPNIPD, or CFFO.

The unrestricted models in this set are models 11, 13, and 15. Their nested counterparts are models 4, 6, and 9 respectively. If in each of the unrestricted models all B_{6i}'s are equal to zero, the unrestricted models reduce to their restricted counterparts. If this is the case, WCFO does not add significant information.

As in the first two sets of null hypotheses, WCFO does add significant explanatory power to each of OPNI, OPNIPD, and CFFO. This can be supported by an examination and comparison of the distribution of adjusted R^2's from the respective restricted and unrestricted models.

When WCFO is added to the model with LACD and one of OPNI or OPNIPD, the distribution of adjusted R^2's lies above the restricted model in all deciles, but the .10 decile. This indicates that the adjusted coefficient of determination for the models with LACD, OPNI or OPNIPD, and WCFO are greater than those for the models with only LACD and OPNI or OPNIPD in 75 plus percent of the firms. When WCFO is added to the model with LACD and CFFO already included as explanatory variables, the resulting distribution of adjusted R^2's lies above the distribution of adjusted R^2's in all deciles when compared to the model with only LACD and CFFO as explanatory variables.

The calculated values of the test statistic for hypotheses 21, 22, and 23 are:

H_{21} 1.79.
H_{22}...1.72.
H_{23} 5.21.

Each of the three test statistics are greater than the critical value of one. Therefore all three hypotheses are rejected and the conclusion is that WCFO adds significant explanatory power to each of OPNI, OPNIPD, and CFFO.

5.3.1.4 Set Four

The fourth set of null hypotheses tests if CFFO adds significant explanatory power to the models already including LACD and one of OPNI, OPNIPD, or WCFO as explanatory variables.

The necessary unrestricted models for this set of hypotheses are 12. 14, and 15. Their respective nested (restricted) counterparts are models 4, 6, and 7. If CFFO does not add significant information, than all B_{8i}'s will be equal to zero in models 12, 14, and 15, reducing them to 4, 6, and 7 respectively.

The distribution of adjusted R^2's resulting from the estimation of the unrestricted models lie above the distributions of adjusted R^2's for each of the restricted models in all deciles except the .10 decile for each of the three null hypotheses. This indicates that CFFO, after making an adjustment for the consumption of an additional degree of freedom, adds explanatory power in 75 plus percent of the equations estimated. The value of the calculated test statistic for each hypothesis is:

H_{24}	1.49
H_{25}	1.53
H_{26}	1.38

Each of the three values exceed the critical value of one. Therefore the conclusion is that CFFO adds significant explanatory power to each of OPNI, OPNIPD, and WCFO.

On a practical level, note the sign associated with the parameter for over one half of the estimated coefficients. It is negative which indicates that if CFFO is negative, i.e., if operations consume more cash than they generate, dividends will increase! This is a highly unlikely result and indicates that the power of the test due to sample size may be making a variable statistically significant, but in reality it is not practically significant.

5.3.2 Summary of Section 5.3

The results from the twelve null hypotheses tested in section 5.3 indicate that all asset flow measure pairs have incremental information content (but, not all permutations). In addition to this rather general conclusion, several other observations can now be made. OPNI appears to have the greatest amount of explanatory power and CFFO appears to have the least. This conclusion can be arrived at in several ways. One method is to look at the change in adjusted R^2 brought about by the addition of the respective variables. Another method is to look at the relative size of the calculated test statistics. From the formula for the test statistic presented in chapter three, it is evident that the numeric value is dependent on two parameters. One is the number of added parameters and the other is the reduction in the total error sums of squares brought about by the additional explanatory variable. Keeping the number of parameters constant, the only explanation for varying numeric values of the test statistic is due to the varying reduction in total error sums of squares (SSE) brought about by the added variable. The greater the numeric value, the greater the reduction in SSE. The greater the reduction in SSE, the more explanatory ability the added variable has. Whenever OPNI is already in the model as an explanatory variable, the test statistic value for the added variable is always less than two and whenever OPNI is the added variable, the test statistic's value is greater than two, indicating that OPNI has a bigger impact than does CFFO in all possible combinations. Whenever CFFO is the only asset flow measure in the model, the test statistic's calculated value is always greater than 5.5 for all additional asset flow measures added, and when CFFO is added to the model, the test statistic is always less than two, indicating that CFFO has the least to add and can use the most help from other asset flow measures. This indicates that OPNI, more than any other independent variable tested, reduces the SSE more and CFFO has the smallest impact on SSE.

If, for theoretical reasons, the dividend policy model should be restricted to include only two asset flow measures, the prior studies indicate that an income construct and cash flow construct should be the two asset flow variables. Income should be included from Litner's

[1956] original study, and a cash flow variable should be included because it represents dividend paying ability currently and serves as a liquidity constraint [Kolb, 1981]. Using the adjusted R^2 as the criterion to select the best model from a selection of models with the same number of independent variables, model 11 would be selected. This model includes LACD and OPNI as Litner suggested should be the case, but it also includes WCFO. When WCFO is added to a model including LACD and OPNI, the distribution of adjusted R^2's lies above the distribution of adjusted R^2's for its nearest competitor (OPNIPD) for 75 plus percent of the companies included in this study. This result has several appealing aspects. To begin, OPNI and OPNIPD are very closely correlated. The Spearman rank correlation is .889 (see Table 5.3) where as WCFO is lower at .860. The only difference between OPNI and OPNIPD is the addition of depreciation expense to OPNI. WCFO includes several other adjustments due to long term accruals that may or may not result in cash in the long term, _e.g._, long term deferred tax accrual increases the tax expense deducted from revenue in the current accounting period, but may likely never require the use of cash.

5.4 Hypotheses Tests of Three Asset Flow Measures

At this point it should be clear that LACD and OPNI are very important explanatory variables. LACD gets its support from the underlying theory and the distributed lag model and

OPNI receives its support from section 5.2 and 5.3 of this chapter. It is also apparent that a second asset flow measure is an important explanatory variable. WCFO receives both the best statistical results and is also the most theoretically sound additional variable to be paired with OPNI. The hypotheses examined in this section are going to determine if OPNIPD and/or CFFO have enough unique incremental information to lower the error sums of squares enough to achieve statistical significance. In other words, does either OPNIPD or CFFO measure enough of a different aspect of companies performance as it reflects dividend policy, to act as a significant information signal after income and a liquidity measure are already present in the model.

To examine this issue, models 16 through 18 are estimated and the following null hypotheses are formulated.

H_{27}: $B_{81}=B_{82}=\ldots=B_{8i}=0$ in model 18 (M18 reduces to M11)

H_{28}: $B_{51}=B_{52}=\ldots=B_{5i}=0$ in model 16 (M16 reduces to M11)

Model 11 can be viewed as nested in models 16 and 18. If CFFO does not add significant information to LACD, OPNI, and WCFO, then model 18 reduces to model 11. If OPNIPD does not add significant information to LACD, OPNI, and WCFO, then model 16 reduces to model 11.

The regression results from estimating models 16 through 18 are detailed in Table 5.5. The distribution of adjusted R^2's resulting from models 16 and 18 both lie above the adjusted R^2 distribution from model 11 (detailed in Table 5.3) in all deciles.

The test statistic for both null hypotheses tested in this section has 1,118 degrees of freedom in the numerator and 8,944 degrees of freedom in the denominator resulting once again in a critical value equal to one at the .001 level of significance. The calculated value for H_{27}, the hypotheses testing the incremental information of CFFO, is 1.25. The conclusion is that CFFO adds significantly to the explanatory power of LACD, OPNI, and WCFO. The calculated value for H_{28}, testing the incremental information of OPNIPD, is 1.71. The conclusion is that OPNIPD adds significantly to the explanatory of model 11.

Model 17 is estimated to serve as a check on the selection of WCFO as the second asset flow measure to be included in the dividend policy model. If WCFO is superior to OPNIPD, then the distributions of adjusted R^2's for the models including WCFO should lie above the model without it for the majority of the companies. Model 16's and 18's distribution of adjusted R^2's both lie above model 17's for 75 plus percent of the companies in the sample. Therefore the conclusion reached in section 5.3 of this chapter is reinforced by the results here.

Since both CFFO and OPNIPD are significant, a within model discussion is necessary. The discussion is going to center around which is better. Prior studies [Gombola and Ketz, 1983] would indicate that CFFO should be significant and OPNIPD should fall by the wayside because of its closeness to OPNI. This is not the observed result in this study. Both are still significant. In fact, from an examination of the distributions of adjusted R^2's and the numeric value of the tests statistics, OPNIPD appears to be superior to CFFO. This could occur for several reasons. OPNIPD differs from OPNI by depreciation expense. Depreciation expense could be serving as a surrogate for some aspect of firm performance that management determines to be important when setting a companies dividend policy. The logical conclusion is that depreciation expense is somehow measuring a possible relationship between a company's dividend policy and its capital equipment needs. This conclusion would make a company's dividend policy and its financing policies dependent on one another. However this conclusion is in contradiction with Miller and Modigliani [1961] dividend policy irrelevancy and Fama's [1974] conclusions that there is no empirical link between a firm's investment decisions and its dividend policy. An alternative explanation is that their is no real information in OPNIPD, it appears significant only because it is an endogenous variable within the system. This means that management understands the financial analysts use OPNIPD as a signal and therefore they pay attention to it also. The most likely explanation for the statistical significance of both OPNIPD and CFFO is the sheer size of the sample. As Judge _et al._ [1985, p. 870] state,

> As an aside, since it is known we generally work with false models and since the power of statistical tests increases with sample size, a statistical test can be relied on in virtually every application to reject the restricted model (hypothesis) for a large enough sample.

5.5 Hypotheses Tests of Four Asset Flow Measures

At this point, a dividend policy including LACD, OPNI, and WCFO has been reached. Section 5.4 of this chapter found OPNIPD and CFFO to add significantly to the explanatory of model 11. This section is going to examine two additional hypotheses. The first will determine if OPNIPD has significant information beyond LACD, OPNI, WCFO, and CFFO. The second will determine if CFFO has significant information beyond LACD, OPNI, WCFO, and OPNIPD. Both CFFO and OPNIPD are tested here because of the lack of a convincing argument for the superiority of one over the other to be included in the model. In parameter form the two null hypotheses are:

H_{29}: $B_{51}=B_{52}=...=B_{5i}=0$ in Model 19 (M19 reduces to M18)

H_{30}: $B_{81}=B_{82}=...=B_{8i}=0$ in model 19 (m19 reduces to M16)

Table 5.5 details the results for models 16, 17, and 18. Notice the distribution of adjusted R^2's for model 19 exceeds the distribution of adjusted R^2's in models 16 and 17 in all deciles except the .10 decile. This indicates that in 75 plus percent of the companies, the adjusted R^2 after the additional variable (either OPNIPD or CFFO) exceeds the adjusted R^2 resulting from the models excluding the variable.

The test statistic for both null hypotheses will have 1,118 degrees of freedom in the numerator and 7,826 degrees of freedom in the denominator. Again the critical value is one at the .001 level of significance.

The calculated value of the test statistic for H_{29} is 1.49. The statistical conclusion is that OPNIPD reduces the SSE to be considered a statistically significant variable.

The calculated value of the test statistic for H_{30} is 0.96. The conclusion is that CFFO does not convey statistically significant information and therefore null hypothesis 30 cannot be rejected.

The acceptance of H_{30} should be considered very significant given the size of the sample used to test for incremental information. As was noted earlier, Judge et al. [1985] believe it is almost impossible not to reject a null hypothesis given a large enough sample and Neter, Wasserman, and Kutner [1985] state that too large of a sample can make trivial variables statistically significant. Given this testimony to the power of the tests with a large sample, it is clear that CFFO is not a significant explanatory variable for the dividend policy of firms within this sample.

5.6 Summary of Chapter 5

The overall purpose of chapter 5 is determine which asset flow measures convey statistically significant information about a firm's dividend policy. The first set of null hypotheses tested determined which asset flow measures have significant information content on an individually basis. Hypotheses eight through 14 tested this proposition. It was determined that NI, OPNI, NIPD, OPNIPD, WCFO, QFFO, and CFFO all were individually significant variables.

Section 5.3 examined the Spearman rank correlations between the asset flow measures and it was determined that further tests were going to be made only on OPNI, OPNIPD, WCFO, and CFFO. Section 5.3 proceeded to test all possible pairs of these four asset flow measures. This resulted in twelve additional null hypotheses. All possible pairs were found to be significant (all twelve null hypotheses were rejected). However at this point several conclusions were reached. The first is that inclusion of OPNI always increases the adjusted R^2 more than any other variable. Therefore it was concluded that in all future test OPNI must be included in the model.

It was noted in the test of the asset flow measures on an individual basis, that as accounting accruals are taken out of the asset flow measures, without exception the adjusted R^2 fell. With model four serving as the base model, the adjusted R^2 fell systematically as the asset flow measure teamed with LACD contained fewer and fewer accounting accruals. As the asset flow measure went from OPNI to OPNIPD, the median value of the adjusted R^2 fell from .40 to .37. When the asset flow measure is WCFO, the median value for the adjusted R^2 is .34. When the asset flow measure is CFFO, the median value for adjusted R^2 is .13. The difference between OPNI and OPNIPD is the depreciation accrual. Taking the depreciation accrual out of the asset flow measure reduced the adjusted R^2 three points. The difference between OPNIPD and WCFO is other long term accruals that either increased or decreased income from operations, but did not affect working capital. Examples of these long term accruals are increases in long term portion of deferred taxes or a parent company's share of a subsidiary's earnings. The median adjusted R^2 fell six points from OPNI and three points from OPNIPD. The reduction in the adjusted R^2 indicates that the accounting accruals deleted from the asset flow measures add an important variability to the stream of asset flow measures. The biggest reduction in the calculated adjusted R^2 comes when the asset flow measure CFFO is substituted for OPNI, OPNIPD, or WCFO. The median value of the adjusted R^2 falls 17 points when compared to OPNI, 14 points when compared to OPNIPD, and 11 points when compared to WCFO. The difference between WCFO and CFFO is short term accounting accruals such as revenue earned, but not received in cash, and expenses incurred, but not paid in cash. The 11 point reduction in the median adjusted R^2 indicates that the short-term accounting accruals are very important modifications to the asset flow measure. This result makes good conceptual sense because short term accruals are measures of the company's most immediate cash needs and sources in the next accounting period.

Section 5.3 concluded with a dividend policy model that included LACD, OPNI, and WCFO. WCFO was included as the second asset flow measure based upon its superior distribution of adjusted R^2's and its lower Spearman rank correlation coefficient.

Section 5.4 tested OPNIPD and CFFO as possible third asset flow measures, Both were found to add statistically significant information to the model. OPNIPD was determined to add more to the model than CFFO. Several possible explanations for this were put forward with the most plausible being the effect of the sample size on statistical tests.

Finally, section 5.5 determined that OPNIPD added significant information to the dividend policy model and CFFO fell out, the null hypothesis was rejected. The final model, based on the statistical evidence is :

$$DACD=A + B_1LACD+B_2OPNI + B_6WCFO + B_5\ OPNIPD + error.$$

It should be noted and kept in mind when interpreting the results of this chapter the very large sample size used. Although they have been mentioned several times before, the effect of the sample size on the power of the tests is so critical, it is deemed appropriate to mention them again here. Judge et al. [1985] state that almost any variable can be statistically significant given a large enough sample size. It a common cliche' on Wall Street that as hem lines go so does the stock market. It does not take much intellect to determine that the height of women's hem lines has nothing to do with price movements on Wall Street. The same analogy holds for sample size. There are so many observations in this study, it is easy to understand why the majority of the variables stay in the analysis until the end. It is very surprising that CFFO drops out of the analysis at all. This should serve as a powerful testimony to the insignificance of an otherwise intuitively appealing variable in the explanation of a firm's dividend policy.

Table 5.1

Models Estimated Using Unadjusted Data

Model #	Model
1	$DACD = A + B_1LACD$
2	$DACD = A + B_2OPNI$
3	$DACD = A + B_1LACD + B_3NI$
4	$DACD = A + B_1LACD + B_2OPNI$
5	$DACD = A + B_1LACD + B_4NIPD$
6	$DACD = A + B_1LACD + B_5OPNIPD$
7	$DACD = A + B_1LACD + B_6WCFO$
8	$DACD = A + B_1LACD + B_7QFFO$
9	$DACD = A + B_1LACD + B_8CFFO$
10	$DACD = A + B_1LACD + B_2OPNI + B_5OPNIPD$
11	$DACD = A + B_1LACD + B_2OPNI + B_6WCFO$
12	$DACD = A + B_1LACD + B_2OPNI + B_8CFFO$
13	$DACD = A + B_1LACD + B_5OPNIPD + B_6WCFO$
14	$DACD = A + B_1LACD + B_5OPNIPD + B_8CFFO$
15	$DACD = A + B_1LACD + B_6WCFO + B_8CFFO$
16	$DACD = A + B_1LACD + B_2OPNI + B_5OPNIPD + B_6WCFO$
17	$DACD = A + B_1LACD + B_2OPNI + B_5OPNIPD + B_8CFFO$
18	$DACD = A + B_1LACD + B_2OPNI + B_6WCFO + B_8CFFO$
19	$DACD = A+B_1LACD +B_2OPNI + B_5OPNIPD + B_6WCFO + B_8CFFO$

See Table 5.1 (continued) for variable definitions.

Table 5.1 (continued)

Variable Definitions

DACD=Differenced Adjusted Cash Dividends=$D_{it}-D_{i,t-1}$.

A=OLS intercept.

LACD=Lagged Adjusted Cash Dividends=$D_{i,t-1}$.

OPNI=Operating net income.

NI=Net income.

NIPD=Net income plus depreciation.

OPNIPD=Opearting net income plus depreciation.

WCFO=Working capital from operations.

QFFO=Quick flow from operations.

CFFO=Cash flow from operations.

Table 5.2

Regression Results--Models One Through Nine

Mod	Dec	Adj R^2	A	LACD	NI	OPNI	NIPD	OPIPD
1	.90	.50	.184	.164				
	.75	.20	.091	.066				
	.50	.04	.035	-.033				
	.25	-.05	.010	-.232				
	.10	-.08	-.007	-.444				
2	.90	.72	.022			94.49		
	.75	.50	.005			60.19		
	.50	.23	-.009			36.42		
	.25	.04	-.051			19.02		
	.10	-.06	-.131			6.62		
3	.90	.81	.096	.042	135.44			
	.75	.63	.37	-.046	82.97			
	.50	.37	.007	-.154	46.87			
	.25	.14	-.013	-.313	18.59			
	.10	-.01	-.053	-.521	4.05			
4	.90	.81	.089	.024		148.34		
	.75	.66	.032	-.062		93.68		
	.50	.40	.004	-.171		54.55		
	.25	.17	-.016	-.332		24.30		
	.10	.03	-.059	-.538		6.26		
5	.90	.46	.095	.002			119.73	
	.75	.62	.031	-.10			74.41	
	.50	.36	.002	-.215			41.25	
	.25	.13	-.025	-.380			16.06	
	.10	-.01	-.088	-.583			2.97	
6	.90	.80	.091	-.004				128.50
	.75	.63	.028	-.113				80.62
	.50	.37	.001	-.231				45.62
	.25	.15	-.031	-.400				19.00
	.10	-.002	-.101	-.583				2.97

Mod	Dec	Adj R^2	A	LACD	WCFO	QFFO	CFFO
7	.90	.76	.099	.011	114.21		
	.75	.61	.033	-.085	67.90		
	.50	.34	.003	-.211	37.12		
	.25	.10	-.024	-.380	14.10		
	.10	-.05	-.094	-.605	3.89		
8	.90	.65	.128	.122		52.92	
	.75	.41	.065	.022		27.21	
	.50	.15	.018	-.094		9.17	
	.25	-.03	-.002	-.274		.413	
	.10	-.13	-.039	-.484		-6.141	
9	.90	.64	.157	.154			53.74
	.75	.37	.071	.042			25.56
	.50	.13	.023	-.085			6.59
	.25	-.05	.0008	-.284			-1.72
	.10	-.14	-.028	-.491			-12.26

Table 5.3

Spearman Rank Correlations
Year=1980

	OPNI	NIPD	OPNIPD	WCFO	QFFO	CFFO
NI	.972	.888	.856	.846	.697	.626
OPNI		.883	.889	.860	.710	.644
NIPD			.979	.960	.813	.760
OPNIPD				.964	.817	.766
WCFO					.840	.780
QFFO						.892
CFFO						

Table 5.4

Regression Results--Models Ten Through Fifteen

Mod	Dec	Adj R^2	A	LACD	OPNI	OPNIPD	WCFO	CFFO
10	.90	.83	.142	.067	300.83	260.49		
	.75	.69	.041	-.062	137.65	113.84		
	.50	.46	.000	-.238	29.08	13.77		
	.25	.21	-.035	-.472	-65.91	-9.86		
	.10	.02	-.113	-.765	-207.93	-182.55		
11	.90	.84	.100	.065	208.51		134.22	
	.75	.71	.029	-.053	102.16		43.36	
	.50	.46	.001	-.201	39.84		5.46	
	.25	.21	-.030	-.390	-3.73		-24.90	
	.10	-.003	-.106	-.652	-74.25		-85.78	
12	.90	.82	.086	.045	152.14			29.74
	.75	.68	.026	-.047	94.98			9.49
	.50	.44	.001	-.169	54.29			-.03
	.25	.19	-.021	-.338	22.01			-8.24
	.10	-.01	-.065	-.542	1.49			-23.95
13	.90	.83	.080	.015		237.98	167.99	
	.75	.69	.024	-.099		103.88	54.55	
	.50	.44	-.003	-.232		33.98	4.22	
	.25	.19	.043	-.413		-11.96	-38.47	
	.10	-.01	-.229	-.623		-103.84	-149.75	
14	.90	.82	.078	.009		134.07		29.74
	.75	.65	.024	-.101		83.63		9.71
	.50	.42	-.003	-.224		47.76		-.57
	.25	.15	-.037	-.398		17.38		-9.70
	.10	-.03	-.106	-.616		.86		-26.94
15	.90	.80	.097	.031			124.08	29.50
	.75	.65	.031	-.070			73.34	10.01
	.50	.40	.000	-.207			39.47	-.48
	.25	.12	-.030	-.397			13.33	-12.26

Table 5.5

Regression Results Models Sixteen Through Nineteen

Mod	Dec	Adj R^2	A	LACD	OPNI	OPNIPD	WCFO	CFFO
16	.90	.87	.155	.108	299.95	363.86	181.85	
	.75	.74	.040	-.046	153.13	125.06	56.92	
	.50	.51	.000	-.247	30.79	2.05	5.16	
	.25	.25	-.043	-.485	-73.08	-108.12	-42.24	
	.10	.02	-.136	-.789	-267.90	-298.76	-148.27	
17	.90	.86	.143	.082	317.15	286.89		32.42
	.75	.73	.038	-.051	137.33	118.01		9.85
	.50	.49	-.001	-.235	24.72	20.36		-1.02
	.25	.22	-.039	-.481	-72.60	-67.03		-10.42
	.10	.01	-.121	-.758	-235.74	-201.39		-27.30
18	.90	.87	.101	.086	217.35		145.63	29.82
	.75	.74	.027	-.046	105.73		52.58	10.45
	.50	.49	-.001	-.207	37.32		8.82	-.72
	.25	.23	-.036	-.40	-5.44		-31.58	-11.44
	.10	.00	-.112	-.656	-81.98		-97.71	-29.10
19	.90	.88	.141	.122	337.03	379.25	188.97	29.49
	.75	.77	.034	-.040	148.32	133.79	62.43	10.96
	.50	.56	-.006	-.246	29.83	6.25	5.95	-1.11
	.25	.27	-.045	-.493	-78.30	-106.51	43.97	-11.88
	.10	-.01	-.141	-.808	-285.86	-306.95	-157.00	-31.13

Chapter 6

DISCRIMINANT ANALYSIS

6.1 Introduction

To this point in this study, all of the analysis has been performed by pooling a 14 year time series of data on 1,118 firms. This chapter is going to analyze the data cross sectionally. The statistical technique that will be used is multiple discriminant analysis.

The primary conclusion to this point is that OPNI appears to hold the most explanatory power in regard to a firm's change in cash dividends from year to year. In addition, WCFO has been determined to be statistically significant and defensible on theoretical grounds. OPNIPD has been determined to be statistically significant, but not too appealing on theoretical grounds. CFFO drops out of the analysis because it is statistically insignificant.

This does not necessarily mean that CFFO is not an important financial statistic. It simply means that this study indicates it is not an important explanatory variable for the dividend policy of the firms included in this sample. It is also possible that certain financial statistics become important only in fringe areas [Largay and Stickney, 1980] and these areas are not captured adequately within the sample to show up statistically significant.

In the spirit of this study, a potential "fringe area" is when firms decrease their dividends. It makes conceptual sense that CFFO may become important only when a firm must decrease its dividends. Or in other words, when there is not enough cash available to pay the same dividend as last year, CFFO may be an indicator of this phenomenon. This may not become evident from the analysis in chapter five due to a minority of the data points corresponding to decreasing dividends. From examination of Table 6.2, it is apparent that firms decreasing their dividends are in the minority. During 1984, out of 1,125 companies 98 or 8.7% decreased their cash dividends from 1983 to 1984 while 52.8% increased their dividends and 38.5% left them the same. Discriminant analysis will address this possible shortcoming.

The remainder of this chapter will be organized as follows. Section 6.2 will present the sample selection criteria (slightly different from chapter three), describe the methodology and develop the test statistics to be used when evaluating the discriminant functions. Section 6.3 will present the analysis and it will be followed by a summary of the chapter.

6.2 Sample Selection and Methodology

Discriminant analysis is the proper technique when the dependent variable is categorical and the independent variables are quantitative. The dependent variable in this study is the change in cash dividends from year t-1 to year t. This quantitative variable can be expressed categorically as being either positive (dividend increasing firms), equal to zero (no change firms), or negative (dividend decreasing firms).

The independent variables to be used are OPNI, OPNIPD, WCFO, CFFO, and LACD.[1] The discriminant models to be estimated are described in Table 6.1. They parallel the models estimated using OLS in chapter 5. The models will be estimated for the years 1984, 1983, 1982, and 1981.

The firms to be included in this sample must have all the attributes described in chapter three, but must have the data available only for the years 1981 through 1984. There are 1,125 companies that meet these criteria.

The sample will be divided into two groups. Six hundred companies will be used to estimate the discriminant function and 525 companies will be used to validate the estimated function. This procedure guards against an upward bias in the predictive accuracy used for significance testing if one evaluated the model with the same data used in building the model[Frank, Massey and Morrison, 1965]

The validity of the discriminant function will be tested through the use of "confusion" matrices. The confusion matrices will be developed by applying the function estimated using the analysis sample to the data in the validation sample to classify the firms in the validation sample into the three possible groups.

---

1 See Table 5.1(continued) for variable definitions or Chapter 3, section 2 defining the variables.

The rows of the confusion matrix represent actual group membership and the columns represent the "as classified" by the discriminant function.

The hit ratio, or the percentage classified correctly can be calculated by adding the number of correctly classified companies and dividing this total by the sample size. The correctly classified companies show up on the main diagonal of the matrix. Table 6.4 presents the confusion matrices for the validation sample for all four years and Table 6.5 presents the overall hit ratio.

The information in the confusion matrices will be used to determine the validity of the function in two ways. First, the hit ratio will be compared to a chance ratio to determine if it classifies the firms better than can be expected by a chance criterion.

Two chance criteria will be used to evaluate the usefulness of the function. They are the maximum chance criterion, and the proportional chance criterion [Hair, Anderson, and Tatham, 1987, p.89]. The maximum chance is determined by taking the largest group within the sample and dividing it by the total sample. For example, from Table 6.2, the largest group during 1984 is the dividend increasing group. In the validation sample, 297 out of 525 firms increased their dividend or 56.6%. If the discriminant function does not out perform this ratio, then it does not perform any better than chance. The maximum chance criteria is useful when the sole objective is to maximize the percentage correctly classified. However, because it is desirable to correctly classify members of all three groups, the proportional chance criterion may be a more valid bench mark to compare the accuracy of the discriminant functions. The proportional chance bench mark with three groups and unequal sample sizes within each group is [Hair, Anderson, and Tatham, 1987, p. 99]:

$$C_{pro}=(P_-)^2+(P_0)^2+(P+)^2$$

C_{pro}=proportional chance bench mark.

P_-=Proportion of sample that decrease dividends.

P_0=Proportion of the sample that do not change their dividends.

$P+$=Proportion of the sample that increase their dividends.

The second way the data in the confusion matrices will be used is to perform a test between models. Tests between models will use a comparison of proportions statistic[2]. The statistic is distributed as a standard normal deviate. The formula to calculate Z is:

$$Z=(p_i-p_j)/SQRT(p_o q(1/n_i + 1/n_j))$$

where,

p_i=overall hit ratio using model i.

p_j=overall hit ratio using model j.

SQRT=the square root of the quantity in the parentheses.

p_o=the combined hit ratio.

---

[2] See Snedecor and Cochran [1980, pp. 107-134] for the theoretical development of this statistic.

$q=1-p_o$.

n_i=sample size for model one.

n_j=sample size for model two.

i=model 1 to 10.

j=model 1 to 10.

i cannot equal j.

One model will be determined to be statistically superior to the other at the .05 level of significance when the calculated Z is greater than 1.96.

6.3 Analysis

Table 6.2 details how the three groups are represented within each sample. Without exception, the majority of firms in each of the four years detailed increased their dividends. The minority of firms in all four years decreased their dividends.

Table 6.3 displays the mean values of the variables incorporated in the discriminant analysis by year. Mean OPNI is negative in three of the four years for the firms that decreased their dividends and in all four years increases as you move from decreasing to no change to increasing groups. The difference between the means of the decreasing and increasing firms is greatest for OPNI in all years. This indicates that it may possibly be a good variable to discriminate between increasing and decreasing firms. The mean value of LACD for the decreasing firms is never the lowest value. In 1983 and 1982 decreasing firms had a higher mean value for the prior years dividends than did increasing or no change firms. In 1984 and 1981, mean LACD for decreasing firms falls in between the mean values for increasing and no change firms. The mean value for no change firms is always the lowest. This indicates that LACD may be able to discriminate between no change and increasing/decreasing firms, but may not perform as well discriminating between increasing and decreasing firms. All of the other asset flow measures mean values are as expected. The lowest mean values are recorded for the decreasing firms and the highest mean values are recorded for the increasing firms. However, the differences between mean values is not nearly as great as it is for the mean values of OPNI.

Models one through ten (Table 6.1) were estimated. The discriminant function was used to classify the 525 firms in the validation sample. The discriminant results for each model and year are detailed in Table 6.4. As mentioned before, the actual group membership is represented by rows and the way the function classified firms within each group is represented by the columns. For example, from Table 6.2 35 firms in the validation sample decreased their dividends in 1984. The sum of all the rows for year 1984 designated as "-" equal 35. Model one classified eight firms who actually decreased their dividends as no change firms and 27 as increasing firms. Therefore the model incorporating LACD as the discriminatory variable classifies 0% of the decreasing firms correctly. Model one in 1984 classifies 89+241 firms correctly, the sum of the main diagonal for a overall hit ratio equal to (193/525) 63%.

Table 6.5 details the overall hit ratios for each of the ten models for each of the four years estimated. It reports the hit ratio for both the analysis sample and the validation sample. Model two, which includes only OPNI as an independent variable, achieves the best overall hit ratio is 1984 and 1983. It is surpassed in 1982 and 1981 by models that include OPNIPD as an additional explanatory variable.

To evaluate the discriminant models using the chance criterion, the chance values must be determined. Under the maximum chance criterion the values are:

1984	56.6%
1983	50.9%
1982	55.0%
1981	61.5%

The above values were taken from table 6.2 under the validation sample. Models three and four, both incorporating CFFO as an independent variable, do not discriminate better than the maximum chance criteria in 1984, 1982, and 1981. Model one, using LACD as the sole independent variable, does not discriminate better than the maximum chance criteria in years 1983, 1982, and 1981. During 1981, models five and six also do not discriminate as well as the maximum chance criteria. They add LACD and

LACD/CFFO to OPNI. It should be noted that model two, which has only OPNI as an independent variable discriminates better than the maximum chance criteria in all four years (It should be noted that the maximum chance criterion does not set an alpha level of significance. It simply determines a cutoff value to determine if the discriminant function helps the user discriminate between groups).

As noted in the methodology section of this chapter, the maximum chance criteria is a good validation criterion when the researcher is only interested in maximum discrimination power. If a researcher is interested in not only maximum discrimination, but also in the models ability to discriminate between the various groups, the proportional chance criteria is a better bench mark. Using the formula to calculate C_{pro} described in section 6.2, the proportional chance criteria values are:

1984	46.0%
1983	41.1%
1982	42.5%
1981	46.8%.

Using the proportional chance criteria, all the models in all years perform better than the chance criteria.

The Z statistic to test for significant discriminatory power between models is calculated for the model pairs (1,2), (2,4), (2,5), and (2,7) for the year 1984. For the year 1983, the statistic is calculated for the pairs (1,2) and (2,3). For the year 1982, the statistic is calculated for the pairs (1,2) and (2,7) and for 1981 it is calculated for (1,2), (2,3) and (3,7). The statistic is not calculated for all pairs because by examining the pairs that are significantly different and the pairs tested that are not, it is clear that the untested pairs would not be significant.

The actual calculated values are reported in Table 6.6. Notice, in only two cases are the differences in discriminatory capability measured by the overall hit ratio statistically significant between models. The first time is between models two and three in 1984. This result indicates that the difference in results obtained by the model incorporating OPNI and the model using CFFO does not occur by chance. The only other time a statistical difference occurs is in 1983 between models one and two. This result indicates that the difference between OPNI and LACD discriminatory power is statistically significant and is not a chance occurrence.

6.4 Concluding Remarks

The results from this chapter are very similar to those of chapter five. OPNI still emerges as the most powerful explanatory variable in dividend policy. In all cases it performs better than both the maximum chance criterion and the proportional chance criterion. Using a binomial test (the Z statistic), no model out performs OPNI. OPNI statistically significantly out performs LACD by itself in 1983 and CFFO by itself in 1984.

Table 6.1

Discriminant Models Used

Model #	Variables Included
1	LACD
2	OPNI
3	CFFO
4	LACD CFFO
5	LACD OPNI
6	LACD OPNI CFFO
7	LACD OPNI OPNIPD
8	LACD OPNI WCFO
9	LACD OPNI CFFO WCFO
10	LACD OPNI CFFO ONIDPS WCFO

Table 6.2

Break Down of Firms by Group Membership

SAMPLE

		ANALYSIS			VALIDATION		
Group		-	0	+	-	0	+
year							
84	#	63	297	240	35	297	193
	%	10.5	49.5	40.0	6.7	56.6	36.7
83	#	117	263	220	63	267	195
	%	19.5	43.8	36.7	12.0	50.9	37.1
82	#	116	316	168	64	289	172
	%	19.3	52.7	28.0	12.2	55.0	32.8
81	#	71	395	134	54	323	148
	%	11.8	65.8	22.4	10.3	61.5	28.2
80	#	67	427	106	48	364	113
	%	11.2	71.2	17.6	9.1	69.3	21.6

Table 6.3

Mean Values of AFM
by
Group

YEAR		1984			1983			1982	
GROUP	-	+	0	-	+	0	-	+	0
LACD	.7020	.8700	.6380	.8740	.7977	.7426	.9533	.8324	.6354
OPNI	-.0005	.0030	.0008	-.0009	.0024	.0012	-.0016	.0022	.0004
CFFO	.0020	.0050	.0040	.0030	.0420	.0036	.0028	.0048	.0035
ONID	.0013	.0047	.0031	.0013	.0039	.0034	.0006	.0039	.0023
WCFO	.0024	.0053	.0037	.0022	.0043	.0380	.0014	.0045	.0029

YEAR		1981	
GROUP	-	+	0
LACD	.7035	.8167	.6076
OPNI	.0005	.0028	.0014
CFFO	.0038	.0046	.0031
ONID	.0022	.0045	.0030
WCFO	.0027	.0050	.0034

Table 6.4

Confusion Matrices

Model/		1984			1983			1982			1981		
		-	0	+	-	0	+	-	0	+	-	0	+
1	-	0	8	27	0	4	59	0	0	64	0	0	54
	0	0	89	104	0	8	187	1	0	171	0	0	148
	+	0	56	241	0	17	250	0	0	289	0	0	323
2	-	0	15	20	3	27	33	5	17	42	10	2	42
	0	0	64	129	14	54	127	3	17	152	6	2	140
	+	0	23	274	4	29	234	0	5	284	1	0	322
3	-	0	3	32	0	4	59	2	0	62	0	0	54
	0	0	18	175	0	29	166	0	1	171	5	0	143
	+	0	21	276	0	26	241	1	0	288	9	0	314
4	-	0	8	27	2	5	56	5	0	59	1	2	51
	0	0	40	153	2	28	165	3	0	169	6	3	139
	+	0	45	252	2	27	238	3	0	286	9	2	312
5	-	2	11	22	4	23	36	7	18	39	13	5	36
	0	0	36	157	12	48	135	4	12	156	7	4	137
	+	1	14	282	3	27	237	0	6	283	4	2	317
6	-	3	11	21	4	22	37	7	16	41	14	5	35
	0	0	42	151	11	43	141	3	18	151	15	4	129
	+	0	32	265	2	30	235	2	5	282	9	5	309
7	-	2	10	23	5	19	39	9	16	39	15	9	30
	0	0	39	154	13	40	142	3	15	154	10	13	125
	+	0	25	272	1	40	226	1	4	284	7	5	311
8	-	2	9	24	6	21	36	11	14	39	12	8	34
	0	2	38	153	14	40	141	3	13	156	16	7	125
	+	0	20	277	3	32	232	1	2	286	9	4	310
9	-	4	10	21	6	18	39	8	14	42	13	8	33
	0	0	47	146	16	34	145	1	18	153	19	13	116
	+	0	35	262	3	34	230	1	10	278	10	9	304
10	-	2	10	23	8	18	37	7	11	46	13	13	28
	0	2	52	139	14	45	136	4	22	146	16	19	113
	+	0	50	247	3	35	229	2	12	275	13	9	301

Table 6.5

Percent Classified Correct

Year	1984		1983		1982		1981	
	Anal	Val	Anal	Val	Anal	Val	Anal	Val
Mod								
1	.63	.64	.44	.49	.53	.55	.66	.62
2	.63	.64*	.56	.55**	.55	.58	.67	.64
3	.51	.56	.46	.51	.53	.55	.65	.60
4	.52	.56	.45	.51	.55	.55	.65	.60
5	.60	.61	.56	.55	.58	.58	.67	.64
6	.58	.59	.56	.54	.57	.58	.66	.62
7	.59	.60	.59	.52	.58	.59	.68	.65
8	.58	.60	.57	.53	.58	.59	.65	.63
9	.57	.60	.57	.51	.59	.58	.66	.63
10	.60	.57	.56	.54	.58	.58	.67	.63

Anal=Sample used to build/estimate the discriminant function.

Val=Sample used to test the discriminant function.

*=statistically different from models 3 and 4 at the .05 level of significance.

**=statistically different from model 1 at the .05 level of significance.

Table 6.6

Between Model Comparisons

Year	Pair	Statistic
1984	(1,2)	0.3365
	(2,3)	2.6457
	(2,5)	1.0039
	(2,7)	1.3350
1983	(1,2)	2.0258
	(2,3)	1.4280
1982	(1,2)	0.9800
	(2,7)	0.3288
1981	(1,2)	0.6690
	(2,3)	0.6670
	(3,7)	1.6700

Chapter 7

SUMMARY, CONCLUSIONS, LIMITATIONS, AND EXTENSIONS

7.1 Summary and Conclusions

As introduced in chapter 1, the issue of cash flow reporting is at the forefront of the accounting profession. During 1985, the FASB issued an exposure draft and without some unforeseen major opposition, beginning in 1987, companies will be required to present the statement of changes in financial position on a cash basis.

The FASB bases this requirement on two assertions. One, the cash flow statistic is different from the income statistic and two, it provides additional information. As discussed in chapter 1, empirical research has confirmed the FASB's first assertion, but yields inconclusive results in regard to the second assertion. The primary research objective of this study is to provide evidence to either confirm or disconfirm the FASB's information content hypothesis.

The empirical realm within which this research is carried out in is the area of dividend policy. Litner's [1956] dividend policy model is used to test the information content of several asset flow measures. In the end, one income construct and three cash flow constructs were tested for incremental information content. However before the asset flow measure hypotheses could be addressed, several statistical assumptions had to be addressed as well as the structural form of the model.

Chapter 3 set forth the statistical considerations. It was determined that neither the partial adjustment or the rational expectations theories underlying the autoregressive model first introduced by John Litner [1956] would be accepted. This conclusion was reached after reviewing the relevant literature pertaining to which rationalization is correct. This review revealed evidence to support both rationalizations with the scale tilting in favor of the partial adjustment model. However, because it is desired to have the most general results possible, a more general model proposed by Johnston [1972] was used.

In order to use it, the question of serial correlation had to be addressed. In an autoregressive environment, Durbin's H or M tests are appropriate. For computational reasons, the M test was used. It was determined that autocorrelation was not present in the sample companies. Therefore estimation and hypothesis could proceed using OLS.

The study then turned to testing the structure of the model. Structure in this study refers to the proper parameterization of the model. Is it necessary to allow the slope and intercept parameters to be different for each firm or is a simpler model adequate? Simpler models include only an economy wide model or add some level of industry model. It was determined that a firm specific model is necessary to describe the observed dividend policies of the firms included in the sample adequately. This implies that observed dividend policies are firm specific, that even the finest definition of industry (four digit SIC designations) was not detailed enough to capture all the information conveyed by the data.

With the proper estimation method, test statistics, and structural form of the model determined, the study proceeded with the asset flow measure hypotheses. Remember the primary objective is to determine if a cash flow variable has information content beyond accounting earnings.

The first hypotheses examined were necessarily of a preliminary nature. They tested if the basic three variable dividend policy model was sensitive to the asset flow measure used. At this point seven different asset flow measures were included in the analysis. All seven provided statistically significant information to the model on an individual basis. However, from an examination of the distribution of adjusted R^2's OPNI was determined to have the most explanatory power. This is consistent with Litner's [1956], Fama and Babiak's [1968] and Kolb's [1981] results.

Because each model tested is computationally burdensome (1,118 regressions are required for each model tested), the Spearman rank correlation coefficients were examined before proceeding with the examination of asset flow measure pairs. It was determined that NI, NIPD, and QFFO were so closely correlated with OPNI, OPNIPD, and CFFO that they should be dropped from the analysis with little loss.

In the examination of all asset flow measure pairs, four separate and distinct sets of three hypotheses emerged that are necessary to test the incremental information content of each asset flow measure to the others. The results from this series of hypotheses is that OPNI, OPNIPD, WCFO, and CFFO are different enough from one another that each supplies statistically significant incremental information. From an examination of the adjusted R^2's it was concluded that once again OPNI adds the most explanatory power to the model over the three remaining asset flow measures. This conclusion was reinforced by an examination of the numeric values of the calculated test statistics. It was concluded that the most theoretically sound model would include LACD, OPNI, and WCFO as independent variables.

The study proceeded to examine incremental information content in a three asset flow measure model. Specifically addressed were the hypotheses, does OPNIPD have information content beyond OPNI and WCFO and does CFFO have information content beyond OPNI and WCFO. Both asset flow measures were found to have statistically significant information beyond LACD, OPNI, and WCFO. Because the value of the test statistics was rather low (1.71 for OPNIPD and 1.25 for CFFO with a critical value equal to one), a discussion of the plausible reasons for the significance was presented.

The discussion centered on the statistical significance of OPNIPD after OPNI and WCFO were in the model. Three possible reasons were forwarded. First, it is possible that OPNIPD has real significance. Because the only difference between OPNI and OPNIPD is depreciation, it is reasonable that the regression procedure is picking up the information contained by the depreciation number. If this is the case, then the conclusion could be dividend policy and investment policies are not independent. However because this is in contradiction to several important studies, it is dismissed. It could be that the observed statistically significant dependency is a result of managements's perception of OPNIPD's ability to, in addition to OPNI and WCFO, reflect dividend paying ability of the firm. However as noted by Beaver [1981], this begs the deeper question of what drives management's choices. In other words, is OPNIPD used as a measure of a firm's dividend paying ability or does management use it on the margin because management is aware that external analysts are using it as a cash flow surrogate and hence a measure of the company's ability to pay dividends. The most plausible reason is supplied by Judge et al. [1985]. That is because of the large sample size, it is almost impossible to accept a null hypothesis. Recall the sample size in this study has 1,118 firms and 14 observations per firm. The power of the tests is so great that trivial variables may become significant. Neter, Wasserman, and Kutner [1985] warn against too large of a sample for this very reason.

Notwithstanding the results of the three asset flow measure hypotheses, two additional hypotheses were examined in chapter 5. They determined if OPNIPD had information content beyond LACD, OPNI, WCFO, and CFFO and if CFFO had information content beyond LACD, OPNI, WCFO, and OPNIPD. It was determined that OPNIPD had incremental information but CFFO does not.

The acceptance of the null hypothesis that CFFO does not add incremental information content beyond LACD, OPNI, OPNIPD, and WCFO with the large sample does indicate that all the information contained by the cash flow measure is available in simpler cash flow surrogates.[1] The fact that CFFO is determined not to add information (null hypothesis is accepted) when the tests are very powerful because of the large sample, indicates very strongly the inability of this measure to add explanatory power to the dividend policy of firms. It is possible it tested significant in earlier hypotheses because of the large sample. At all times, the test statistic was the lowest when testing for the

---

1. Simpler here because of the starting point. Remember we are already at net income and have been working backwards to arrive at the cash flow measures. In chapter 2 a cash based system was presented as simpler and it is if this is the starting point. Ijiri [1978] believes the hypothesis testing is in the wrong direction. By the principle of Occam's razor, the simplest system should prevail until the more complex system is proven worth the complexity. Notice here we start with the more complex system, accrual accounting, and determine if the simpler measures have additional information.

incremental information content of CFFO. This indicates that CFFO reduced the error sums of squares the least and therefore explains less of the variation in observed dividend changes than any other asset flow measure tested.

Therefore the final model on pure statistical grounds includes LACD, OPNI, WCFO, and OPNIPD. On a more practical level, in light of what Judge et al. [1985] state, the final model should include LACD, OPNI, and WCFO. This model is consistent with Litner [1956] and Fama and Babiak [1968] because it contains an income measure. It is also consistent with Kolb [1981], and Baker, Farrelly, and Edelman [1985] because it adds a measure of liquidity (WCFO) to the model.

Chapter 6 addresses a possible weakness in the design used to derive the model in chapter 5. The weakness surrounds the paucity of dividend reducing firms. It is possible that CFFO fell out of the analysis because it is useful only in fringe cases. Discriminant analysis was used to estimate a multiple discriminant function for 1984, 1983, 1982, and 1981. Without exception, OPNI supplied the most discriminating power out of all the asset flow measures. Adding additional variables to the function did not, in most cases, increase the function's power to classify firms correctly as either increasing, decreasing, or not changing their dividends per share. In fact in most cases, the accuracy of the model decreased.

Based on the results from chapters 5 and 6, it is concluded that OPNI is the most important explanatory variable in regards to the dependent variable, the change in dividends from year t-1 to year t. This result is consistent with other studies and therefore does find support. Cash flow from operations is determined to be unimportant, and after OPNI, WCFO, and OPNIPD, it has nothing new to offer.

This result supports the FASB's belief that accrual-determined earnings are a better indicator of future dividend paying ability. The word future can be used here because of the demonstrated reluctance of management's to reduce dividends. If dividends are only increased when management feels they can be sustained, and you observe the significant statistical dependency between dividend changes and contemporaneous earnings, then contemporaneous earnings are related to future dividends. In SFAC #5, the FASB states that a statement of cash flows should supplement the income statement and balance sheet, not replace it. This same sentiment is echoed on Wall Street [The Wall Street Journal, Feb. 17, 1987, p.37].

> While none of "the sock analysts" advocates using cash flow analysis by itself, they say it can be an important tool in piercing the camouflage that sometimes makes reported earnings misleading.
>
> The main value of looking at cash flow, they add, may be that it can lead investors to consider stocks they might otherwise overlook.

7.2 Limitations and Possible Extensions

The primary limitation of this study is that it can not and does not prove causality. OPNI has been determined to be an important determinant of a firm's dividend policy by observing a covariation between dividend changes and reported OPNI. It is always possible the variable incorporated in the model is serving as a proxy for the true causal variable [Ball, 1978, p.111]. This is of course the "deeper question" Beaver [1981, pp.104-105] is referring to.

Another important limitation is that the dividend policy model developed here will be impacted in some unknown way by the advent of the new tax code. The previously different taxation of dividends and capital gains represented an important friction in the market and developed tradeoffs between the desire for liquidity without selling your investments and the desire to minimize the tax bite. Analysts on Wall Street feel dividends are now more important than before. A Wall Street Journal reporter's conversation with two companies that recently raised their dividends is led to believe they did so because of investors' new emphasis on dividends. One of the companies stock value rose 6.5% in the four days following a dividend increase when the Dow Jones Average rose only 2.3% [WSJ, Dec 9, 1986, p.37].

The results reported by this study cannot be used as the sole basis to reject the FASB position that cash flow are not only different from earnings, but also have additional information. This study examines only one small part of a very complex reality. It is possible, that on the margin (e.g., allows stock analysts to identify good opportunities they otherwise would have overlooked) cash flow supplies additional information.[2] The conclusion here is that it does not supply incremental information for dividend decision.

An area that deserves attention that is fleshed out by this study is dividend decreasing firms. They appear to be different from the dividend increasing and stable dividend firms. The discriminant analysis of chapter 6 and, for that matter, Kolb's [1981] discriminant functions, performed the poorest on the decreasing firms. In the context of this study, it would appear that something more substantial is occurring within those companies and a clear delineation of the "something more" is worthy of future study.

In addition to the concentration on decreasing firms, this study could be extended by incorporating a practical level of significance test. That is, measure the predictive accuracy of the models developed and determine if on this very practical level one is better than the other.

---

[2] Largay and Stickney [1980] supply another good example of when cash flow could have supplied incremental information.

REFERENCES

Abdel-khalik, A.R. and T. F. Keller, "Earnings or Cash Flows: An Experiment on Functional Fixation and the Valuation of the Firm," Studies in Accounting Research No. 16 (AAA 1979).

Baker, H. Kent, Gail E. Farrelly, and Richard B. Edelman, "A Survey of Management Views on Dividend Policy," Financial Management (Autumn 1985), pp. 78-84.

Ball, R., "Anomaliew in Relationships Between Securities yields and Yield Surrogates," Journal of Financial Economics (No. 2/3 1978), pp. 103-126.

________ and P. Brown, "An Empirical Evaluation of Accounting Income Numbers," Journal of Accounting Research (Autumn 1968), pp. 159-178.

Beaver, W., "Financial Rations as Predictors of Failure," Empirical Research in Accounting (AAA 1966).

Beaver, W., "Alternative Accounting Measures as Predictors of Failure," The Accounting Review (January 1968), pp.113-122.

________, Financial Reporting: An Accounting Revolution (Prentice-Hall, 1981).

_________, and R. E. Dukes, "Interperiod Tax Allocation, Earnings Expecations, and the Behavior of Security Prices," The Accounting Review (April 1972), pp.320-332.

_________, and P. Griffin and W. Landsman, "The Incremental Information content of Replacement Cost Earnings," Journal of Accounting and Economics (July 1982), pp. 15-40.

_________, J. W. Kennelly, and W. M. Voss, "Predictive Ability as a Criterion for the Evaluation of Accounting Data," The Accounting Review (October 1968), pp. 675-683.

Black, F. and M. Scholes, "The Effects of Dividend Yield and Dividend Policy on Common Stock Prices and Reture," Journal of Fianacial Economics (January 1974), pp. 1-22.

Bowen, R. M., D. Burgstahler, and L. A. Daley, "Empirical Evidence on the Relationshops Between Earnings, Cash Flow, and Cash Flow Surrogates," Working Paper: University of Washington (Seatttle, 1984).

Brigham, Eugene F., Financial Management, Theory and Practice (Dryden Press, 1982).

Brittain, J. A., Corporate Dividend Policy (The Brookings Institution, 1966).

Casey, C. J., and N. J. Bartczak, "Cash flow- it's not the bottom line," Harvard Business Review (July-August 1984), pp. 61- 66.

Charitou, A. G., "The Information Content of Accrual and Cash Flow Measures: A Cross-sectional Valuation Study," Dissertation: The Pennsylvania State University (University Park, 1986).

Chenery,k H. B., "Overcapacity and the Acceleration Principal," Econometrica (January 1952), pp. 1-28.

Copas, J.B., "Monte Carlo Results for Estimation in a Stable Markov Time Series," J. Roya Statistical Society (Series A, Vol 129, 1966), pp. 110-116.

Durbin, J., "Testing For Serial Correlation in Least-Squares Regreeeion When Some of The Regressors are Lagged Dependent Variables," Econometrica (May 1970), pp. 410-421.

__________, and G.S. Watson, "Testing for Serial Correlation in Least Squares Regression," Biometrika (Vol. 38), pp. 159-177.

Fama, E. F., "The Empirical Relationshops Between the Dividend and Investment Decisions of Firms," The American Economic Review (June 1974), pp. 304-318.

__________, and H. Babiak, "Dividend Policy: An Empirical Analysis," American Statistical Association Journal (December 1968), pp 1132-1161.

__________, and M. H. Miller, The Theory of Finance (McGraw-Hill 1971).

Financial Accounting Standards Board, Statement of Financial Accounting Concepts No. 1, "Objectives of Financial Reporting by Business Enterprises," (FASB 1978).

__________, Discussion Memorandum, "Reporting Funds Flows, Liquidity, and Financial Flexibility," (FASB 1980).

__________, Statement of Financial Accounting Concepts No. 2, "Qualitative Characteristics of Accounting Information," (FASB 1981a).

_________, "Reporting Income, Cash Flows, and Financial Position of Business Enterprises," (FASB 1981b).

_________, Statement of Financial Accounting Concepts No. 5, "Recognition and Measurement in Financial Statements of Business Enterprises," (FASB 1984).

_________, Exposure Draft, "Statement of Cash Flows," (FASB 1986).

Foster, G., Financial Statement Analysis, Second Edition (Prentice Hall, 1986).

Frank, R.E., W. F. Massey, and D. G. Morrison, "Bias in Multiple Discriminant Analysis," Journal of Marketing Research (August 1965), pp. 250-258.

Gombola, M. J., and J. E. Ketz, "A note on Cash Flow and Classification Patterns of Financial Ratios," The Accouting Review (January 1983), pp. 105-114.

_________________, "A Factor Analysis of Asset Flow Measures," Akron Business and Economic Review (Fall 1982), pp. 35-38.

Govindarajan, V., "The Objectives of Financial Statements: An Empirical Study of the Use of Cash Flow and Earnings by Security Analysts," Accounting, Organizations and Society (Vol. 5, No. 4 1980), pp. 383-392.

Griliches, Z., "Distributed Lags: A Survey," Econometrica (January 1967), pp. 16-49.

Gujaratia, D., Basic Econometrics (Mcgraw-hill 1978).

Gynther, M.M., "Future Growth Aspects of the Cash Flow Computation," The Accounting Review (October 1968), pp. 706-718.

Hagerman, R.L. and R. J. Huefner, "Earnings Numbers and Dividend Predication," Review of Business and Economic Research (Spring 1980), pp. 39-48.

Hair, J.F. Jr., R. E. Anderson, and R. L. Tatham, Multivariate Data Analysis, 2nd. ed. (Macmillan 1987).

Harmon, K . W., "Earnings vs. Cash Flows: An Empirical Investigation of Market Reaction," Journal of Accounting, Auditing, and Finance (Fall 1984), pp. 24-34.

Hawkins, D., "Toward an Old Theory of Equity Valuation," Financial Analysts Journal (November-December 1977), pp. 48-53.

_________, and W. Campbell, Equity Valuation: Models, Analysis and Implications (Financial Executives Institute, 1978).

Ijiri, Y., "Cash Flow Accounting and Its Structure," Journal of Accounting, Auditing, and Finance (Summer 1978), pp. 331-148.

_________, "A Simple System of Cash-Flow Accounting," In R. R. Sterling and A. L. Thomas, Ed., Accounting for a Simplified Firm Owning Depreciable Assets (Scholars Book Co., 1979), pp. 57-71.

_________, "Recovery Rate and Cash Flow Accounting," Financial Executive (March 1980), pp. 54-60.

Johnston, J., Econometric Methods 2nd ed (McGraw-Hill, 1972).

Johson, B., "The Cross Sectional Stability of Fianncial Ratio Patterns," Journal of Financial and Quantitative Analysis (December 1979), pp. 1035-1048.

Judge, G., R.C. Hill, W.E. Griffiths, H. Lutkepohy, and T-C Lee, Introduction To The Theory and Practice of Econometrics (John Wiley & Sons 1982).

_______________, The Theory and Practice of Econometrics (John Wiley 1985).

Kmenta, J., Elements of Econometrics 2ed (Macmillan, 1986).

Kolb, R. W., "Predicting Dividend Changes," Journal of Economics and Business (Spring 1981), pp. 218-230.

Koyck, L. M., Distributed Lag and Investment Analysis (North-Holland, 1954).

Largay, J. A. III and C. P. Stickney, "Cash Flows, Ratio Analysis and the W. T. Grant Company Bankruptcy," Financial Analysts Journal (July-August 1980), pp. 51-54.

Laub, M., "The Dividend-Earnings Relationshop: A Study of Corporate Panel Data," Ph. D. Diss. (University of Chicago, 1970).

Litner, J., "Distributions of Incomes of Corporations Amoung Dividends, Retained Earnings and Taxes," The American Economic Review (May, 1956), pp. 97-113.

Myers, S. C. and N. S. Majluf, "Corporate investment and Financing Decisions when Firms have Information that Investors do not have," Journal of Financial Economics (13, 1984), pp. 187-221.

Miller, M., and R. Modigliani, "Dividend Policy, Growth and the Valuation of Shares," Journal of Business (October 1961), pp. 411-433.

Neter, J., W. Wasserman, and M.H. Kutner, Applied Linear Statistical Models (Irwin, 1985).

Patell, J. and R. Kaplan, "The Information Content of Cash Flow Data Relative to Annual Earnings," Unpublished working paper, Stanford University (1977).

Pinches, G. E,, K. A. Mingo, and J. K. Caruthers, "The Stability of Financial Patterns in Industrial Organizations," Journal of Finance (May 1973), pp. 389-396.

Snedecor, G.W. and W.G. Cochran, Statistical Methods, 7th ed. (Iowa State University Press, 1980).

Staubus, G., "The Association Of Financial Accounting Variables with Common Stock Valuse," The Accounting Review (Jan. 1965), pp. 119-124.

Stern, J., "Earnings Per Share Doesn't Count," Financial Analysts Journal (July-August 1974), pp. 39-43.

Taylor, L.D., and T.A. Wilson, "Three-Pass Least Squares: A Method for Estimating Models with a Lagged Dependent Variable," Review of Economic Statistics (Vol. 46), pp. 329-348.

Thomas, A. L., The Allocation Problem in Financial Accounting Theory, Studies in Accounting Research No. 3 (American Accounting Association, 1969).

Wallis, K.E., "Lagged Dependent Variables and Serially Correlated Errors: A Reappraisal of Three-Pass Least-Squares," Review of Ecomomics and Statistics (Vol 49), pp. 555-567.

Watts, R., "The Information Content of Dividends," *The Journal of Business* (April 1973), pp. .191-211.

Weston J. F., E. F. Brigham, *Managerial Finance, Sixth Ed.* (Dryden Press 1978).

Wilson, P., "The Incremental Information Content of Accruals and Cash Flows After Controlling for Earnings," Dissertation: *Carnegie Mellon* (March 1985).

VITA

David E. Jensen

EDUCATION

The Pennsylvania State University 1983-present
Candidate the Ph.D. Degree in Accounting

The Pennsylvania State University 1982-1983
Master of Science Degree in Acccunting

Bloomsburg University 1978-1981
Bachelor of Science Degree in Accounting

EXPERIENCE

Assistant Professor, Bucknell University 1986-present

Associate Professor, Bloomsburg University 1985-1986

Instructor, The Pennsylvania State University 1982-1985

Peat, Marwick, Mithcell and Co. 1981-1982
Tax specialist

REFEREED JOURNAL ARTICLES

Asset Flow Measures and the Length of the Operating Cycle, forth coming in *Review of Business and Economic Research*, (Fall 1987), Co-authored with J. E. Ketz.

The Use of Professional Accounting Microcomputer Software in Introductory Fianacial and Intermediate Accounting at The Pennsylvania State University, *Kent/Bentley Review*, (Fall 1986), Co-Authored with Clinton E. White, Jr. and Joanne C. Duke.

REFEREED PROCEEDINGS

Asset Flow Measures and the Length of the Operating Cycle, Mid Atlantic Regional Meetings, March 1985. Co-authored with J. E. Ketz.

WORKING PAPERS

Using Professional Accounting Software in the Microcomputer Lab, Amis Working Paper No. 84-9, (December 1984), Co-authored with Joanne C. Duke and Clinton E. White, Jr.