THE INCREMENTAL INFORMATION PROVIDED BY DISCLOSING CASH FLOW AND ACCRUAL COMPONENTS OF EARNINGS

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CHAPTER I

THE RESEARCH PROBLEM

Introduction

The Financial Accounting Standards Board (FASB) and others argue that aggregated accrual-earnings data (earnings for short) are superior to aggregated cash flow data (cash flows for short) in predicting future cash flows. This aggregate superiority is presumably attributable to the incremental information content of the accrual components of earnings.[1] For example, in Statement of Financial Accounting Concepts (SFAC) No. 1: *Objectives of Financial Reporting by Business Enterprises*, the FASB states that

> Information about enterprise earnings provides a better indication of an enterprise's present and continuing ability to generate favorable cash flows than information limited to the financial aspects of cash receipts and payments (par. 9).

Furthermore, the extant requirements for disclosing operating cash flows in addition to earnings imply that cash flows are believed to provide incremental information over earnings. For example, in SFAC No. 5: *Recognition and Measurement in Financial Statements of Business Enterprises*, the FASB maintains that

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[1]The term "accruals" is used here and in prior studies to refer generally to all adjustments (e.g., accruals, deferrals, gains, losses, etc.) made via the accrual accounting process.

> It (the Statement of Cash Flows) provides useful information about an entity's activities in generating cash through operations to repay debt, distribute dividends, or reinvest to maintain or expand operating capacity (par. 52).
>
> 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. Users commonly consider that information in assessing the relationship between earnings or comprehensive income and associated cash flows (par. 53).

While the FASB maintains that disclosing both operating cash flows and accrual earnings is useful to investors, very little empirical evidence exists to support its claim.[2] In this context, the results of recent studies by Bernard and Stober (1989), Charitou and Ketz (1990), Livnat and Zarowin (1990), and Jennings (1990) imply that neither the cash flow nor the accrual components of earnings are likely to provide additional information beyond that provided by earnings alone. However, the designs of these studies may have lessened their efficacy in detecting incremental information content.

First, the cash flow/accrual decomposition used in prior studies fails to reflect the theoretical relations between current cash flow and accrual components of earnings and future cash flows. To overcome this defect, this study derives improved operating cash flows, current accruals, and noncurrent accruals variables that are intended to more accurately proxy for the information conveyed by the components.

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[2]A number of studies provide evidence that cash flows and accruals are informative components of earnings [see, for example, Raybum (1986) and Bowen et al. (1987)]. However, the fact that cash flows and accruals are value relevant does not necessarily imply that disclosing these components separately is useful to investors.

Second, extant studies used an association methodology to assess incremental information content. In an association study, disclosing disaggregated earnings data will be deemed useful if, and only if, the resulting components are both value relevant and differentially associated with security returns.[3] However, the pooled cross-sectional approach used in prior studies may not be sufficiently powerful to determine whether cash flows and accruals are differentially associated with security returns if the market reaction to these components varies across firms.[4] As an alternative to the pooled cross-sectional approach, this study uses a time-series approach to test for incremental information content.

Third, prior research has ignored another potentially important criterion for assessing the incremental information content of cash flows and accruals. Recall that the FASB emphasizes predictive ability as the criterion for assessing the usefulness of accounting disclosures. In this context, disaggregated earnings data will also have incremental information content if the data conveys additional information that is useful for predicting future cash flows. While the predictive ability criterion is similar to the association criterion, the latter is more sensitive to the existence of multicollinearity (a potentially significant problem given that prior studies document a strong correlation between cash flows and accruals) and to the effects of omitted variables that may also play a role in explaining abnormal stock returns. Accordingly, this study also examines the

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[3]Alternatively, if the cash flow and accrual components of earnings are associated equivalently with returns, disclosing their sum (net income) is sufficient. See Jennings (1990) for a discussion of this issue.

[4]The pooled cross-sectional approach assumes that the return response to cash flows and accruals is the same for all firms. In this context, the results of Lipe (1986), Kormendi and Lipe (1987), Easton and Zmijewski (1989), Collins and Kothari (1989), and Lipe (1990) indicate that the return response to aggregate earnings varies across firms as a function of the time-series properties of the earnings stream and the expected rate of return.

predictive ability of operating cash flows, current accruals, and noncurrent accruals.

Research Objective

The purpose of this study is to determine whether operating cash flows, current accruals, and noncurrent accruals have incremental information content over aggregate earnings. In this context, the study begins by deriving an earnings component valuation model (ECVM) that establishes an information link between earnings components and future cash flows and a valuation link between earnings components and stock prices. The ECVM shows that the theoretical return reaction to unexpected earnings components varies across components as a function of the time-series properties of the components and the firm's expected rate of return.

Based on the predictions of the model, three hypotheses are tested. Hypothesis 1 is designed to test whether the reformulated cash flow and accrual variables are differentially associated with security returns. Hypothesis 2 is intended to test whether the observed return reactions are related to the theoretical return reactions derived in the ECVM. Hypothesis 3 is pertinent in testing whether the reformulated cash flow and accrual variables convey incremental information that is useful for predicting future cash flows.

Importance of the Problem

The results of the study have several implications for accounting research and practice. First, the study derives the theoretical relations between current cash flow and accrual components of earnings and future operating cash flows. Prior studies have failed to derive the information link between accounting earnings and future cash flows accruing to stockholders - ignoring an important link in the relationship between accounting earnings and stock prices. Second, the study provides additional evidence on the incremental information content of cash flows and accruals over earnings. Accordingly, the study furthers existing knowledge on the usefulness of disclosing component data in addition to aggregated earnings data. Third, the results of the study provide additional evidence on the relationship between accounting earnings and stock prices. Hence, the study adds to the growing body of knowledge regarding the factors that govern the formation of security prices.

The study is organized as follows. Chapter II reviews prior research on the incremental information content of cash flows and accruals. Chapter III derives the ECVM and develops hypotheses that are designed to test the empirical issues suggested by the model. Chapter IV describes the basic econometric approach; discusses measurement issues that are pertinent to the design of the study; and identifies sample selection procedures and data requirements. Chapter V reports the empirical results of the study. Chapter VI summarizes the contributions made by the study and discusses possible extensions of this line of research.

CHAPTER II

LITERATURE REVIEW

Introduction

This chapter reviews two areas of the accounting literature that are pertinent to the dissertation: (1) research on the incremental information content of cash flows and accruals and (2) research on cross-sectional variation in the market reaction to accounting earnings. The chapter concludes with a discussion of the results and implications of prior research with respect to the dissertation.

Research on the Incremental Information Content of Cash Flows and Accruals

Wilson (1987) was the first to investigate the incremental information content of cash flows and (total) accruals over aggregate earnings. Wilson (1987) uses a pooled cross-sectional, time-series approach to examine the market reaction to the disclosure of operating cash flows at the annual report release date. He finds that the response coefficient associated with the unexpected operating cash flows variable is significant implying that either (1) cash flows are informative while total accruals are not or (2) both cash flows and total accruals are informative but they are differentially associated with security returns.

In an extension of Wilson (1987), Wilson (1986) examines the incremental information content of operating cash flows, current accrual adjustments (i.e., the change in current accruals during the period), noncurrent accruals, and total accruals (current accrual adjustments plus noncurrent accruals) over aggregate earnings. Wilson again uses a pooled cross-sectional, time-series approach to analyze market reactions around the annual report release date relative to reactions at the *Wall Street Journal* earnings announcement date. His findings imply that the disclosure of operating cash flows, current accrual adjustments, and total accruals (but not noncurrent accruals) is useful to investors.

Taken together, the results of Wilson (1986) and (1987) indicate that the cash flow and accrual components of earnings provide incremental information beyond aggregate earnings. Moreover, Wilson's results imply that, for a given level of earnings, the market values a dollar in unexpected operating cash flows more than a dollar in unexpected current accrual adjustments. However, in an extension of Wilson (1987), Bernard and Stober (1989) demonstrate that Wilson's results do not generalize beyond his sample period (1981-1982). Bernard and Stober test three competing explanations for the market's apparent preference for operating cash flows over current accrual adjustments. (1) The market reacts more favorably to unexpected operating cash flows than to unexpected current accrual adjustments due to the poor "quality of earnings." To test the "quality of earnings" explanation, Bernard and Stober apply Wilson's methodology to a larger sample (incorporating 29 additional firms and covering an extended period, 1977-1984).[5] (2) The market reacts favorably when management increases (decreases) noncash working capital during periods of economic expansion (contraction). The "macroeconomic conditions" explanation is tested by performing separate regressions for periods of economic expansion and contraction. (3) The market reacts differentially to both unexpected operating cash flows and to the components of unexpected current accrual adjustments. The "mix of components" explanation is tested by regressing abnormal returns on unexpected operating cash flows, unexpected inventories, unexpected receivables, and unexpected payables. In empirical tests of the three competing explanations Bernard and Stober find no evidence to indicate that cash flows and current accrual adjustments are differentially associated with returns.

Charitou and Ketz (1990) also use a pooled cross-sectional, time-series approach to examine the incremental information content of cash flow and accrual components of earnings. However, unlike prior studies they regress end-of-year market value on operating cash flows, current accrual adjustments, depreciation, and noncurrent accruals excluding depreciation. Consistent with Bernard and Stober (1989), their results imply that the cash flow and accrual components of earnings are valued equivalently by the market. That is, disclosing cash flow and accrual components of earnings fails to provide additional information beyond aggregate earnings.

[5] The additional firms included in Bernard and Stober's sample may in fact be driving some of the disparate results. Wilson includes only industrial firms (SIC codes 1000-4800) in his sample while Bernard and Stober also include nonindustrial firms. Since the pooled, cross-section approach used in these studies assumes that the return response to accruals and cash flows is the same for all firms, Bernard and Stober's results may be driven by a violation of the assumptions underlying their empirical tests.

Jennings (1990) analyzes the results of two earlier studies, Bowen et al. (1987) and Rayburn (1986), to test whether operating cash flows, current accrual adjustments, and noncurrent accruals provide incremental information over aggregate earnings. Bowen et al. (1987) and Rayburn (1986) both perform pooled cross-sectional regressions of abnormal returns on unexpected operating cash flows, unexpected current accrual adjustments, and unexpected noncurrent accruals.[6] Jennings' analysis of the results from Bowen et al. (1987) implies that cash flows and current accrual adjustments may provide incremental information in relation to aggregate earnings. However, the evidence is weak - the null hypothesis that cash flows and current accrual adjustments are valued equivalently is rejected at only the ten percent level of significance. Moreover, this result appears to be driven by data from two years and is not robust to the treatment of statistical outliers. Additionally, his analysis of the results from Rayburn (1986), indicates that disclosing cash flows and accruals fails to provide additional information beyond aggregate earnings.

Finally, Livnat and Zarowin (1990) investigate the information content of components of cash flows required by SFAS No. 95. In their analysis of cash provided by operations, Livnat and Zarowin also examine whether operating cash flows and total accruals (current accrual adjustments plus noncurrent accruals) are differentially associated with security returns. They estimate a series of annual, pooled cross-sectional regressions of abnormal returns on unexpected operating cash flows and unexpected total accruals. Like Bernard and Stober (1989), Charitou and Ketz (1990), and Jennings (1990), the results of

[6]Bowen et al. (1987) and Rayburn (1986) test whether cash flows and accruals are informative components of earnings (i.e., whether the related response coefficients are significantly different than zero). However, neither study attempts to determine whether cash flows and accruals have incremental information content over aggregate earnings (i.e., whether the response coefficients are also differentially associated with security returns).

Livnat and Zarowin indicate that the cash flow and accrual variables do not have incremental information content in relation to earnings.

Research on Cross-Sectional Variation in the Market Reaction to Accounting Earnings

A potential deficiency in all six of the studies reviewed above is the use of a pooled cross-sectional methodology. That is, the return response to cash flows and accruals is averaged across firms. As discussed in chapter I, a number of recent studies document significant cross-sectional variation in the return response to aggregate earnings numbers. In this context, if the market reaction to cash flows and accruals varies across firms, the pooled cross-sectional approach may not be sufficiently powerful to detect a differential return response to cash flow and accrual components of earnings.

Evidence of cross-sectional variation in earnings response coefficients (ERCs) was first documented in Kormendi and Lipe (1987). They use a univariate time-series model to examine whether the market reaction to unexpected earnings varies cross-sectionally as a function of two factors: the time-series properties of the firm's earnings stream and the expected rate of return (collectively referred to as the persistence of the earnings time series). They find that the magnitude of the return reaction to unexpected earnings is positively related to the persistence of the earnings stream. In an extension of Kormendi and Lipe (1987), Lipe (1990) finds that the market reaction to unexpected earnings also varies cross-sectionally as a function of the predictability of the earnings stream. That is, the more predictable the earnings stream, the greater the magnitude of the earnings response coefficient.

Lipe (1986) uses a multivariate time-series model to examine the market reaction to the unexpected portion of six components of accounting earnings (gross profit, general and administrative expense, depreciation expense, interest expense, income taxes, and other items). Consistent with Kormendi and Lipe (1987) and Lipe (1990), Lipe (1986) finds that the response coefficients for the six components are positively related to the persistence of the component time series'. Moreover, Lipe (1986) finds that the six components are differentially associated with security returns and value relevant - implying that the components have incremental information content over aggregate earnings.

Easton and Zmijewski (1989) propose that earnings response coefficients (ERCs) vary cross-sectionally as an increasing function of a "revision parameter" (similar to Kormendi and Lipe's persistence measure) and a decreasing function of the expected rate of return. Easton and Zmijewski estimate the empirical distribution of ERCs using the Swamy (1970) random coefficient model (a model which assumes that parameters are stationary over time but vary across firms). The results of the study indicate that ERCs are positively related to the revision parameter and negatively related to systematic risk.

Finally, Collins and Kothari (1989) investigate both temporal and cross-sectional variation in the market response to accounting earnings using a reverse regression procedure. To investigate cross-sectional variation in ERCs, Collins and Kothari perform time-series regressions of unexpected earnings on raw returns, market-to-book equity (a proxy for expected future growth opportunities), market model beta, firm size, and persistence. The results of the study imply that cross-sectional variation in ERCs is negatively related to systematic risk and firm size and positively related to market-to-book equity and persistence.

Summary

The results of extant studies on the incremental information content of cash flows and accruals [e.g., Bernard and Stober (1989), Charitou and Ketz (1990), Livnat and Zarowin (1990), and Jennings (1990)] imply that the disclosure of cash flows and accruals fails to provide incremental information in relation to aggregate earnings. However, the designs of these studies may have hindered attempts to detect incremental information content. First, as shown in chapter III, the operational definitions for the cash flow and accrual variables used in the earlier studies (operating cash flows and current accrual adjustments) fail to reflect the theoretical relations between current cash flow and accrual components of earnings and future cash flows. The presence of "garbling" in the operational definitions of the operating cash flows and current accruals variables is discussed at length in the next chapter. Second, prior studies used an association methodology to assess incremental information content. However, the pooled cross-sectional approach used in these studies may not be sufficiently powerful to detect incremental information content if the market reaction to cash flows and accruals varies across firms. The results of Lipe (1986), Kormendi and Lipe (1987), Easton and Zmijewski (1989), Collins and Kothari (1989), and Lipe (1990) support this prediction. Third, extant studies have ignored the predictive ability of cash flow and accrual components of earnings. As indicated, the components will also have incremental information content if they convey additional information useful for predicting future cash flows.

CHAPTER III

THEORETICAL FRAMEWORK

The Earnings Component Valuation Model

The ECVM is a theoretical model of the returns-earnings relationship that establishes an information link between earnings components and future cash flows and a valuation link between earnings components and stock prices. The model predicts that the magnitude of the association between abnormal stock returns and unexpected earnings components varies across components as a function of the time-series properties of the components and the firm's expected rate of return. Collectively, these two factors comprise the theoretical response coefficients that describe the stock return reaction to unexpected earnings components. For a complete derivation of the model, see Appendix A.

The ECVM is based on the classical valuation model [Miller and Modigliani (1961)] in which the value of the firm equals the present value of its expected future cash flows discounted at the expected rate of return. In this framework, the firm's stock price at time t (P_t) is

$$P_t = \sum_{s=1}^{S} R^s E_t(CFO_{t+s}), \tag{3.1}$$

where,

R = $1/(1 + r)$, r = the expected rate of return, and

$E_t(CFO_{t+s})$ = the expected operating cash flow per share in period t+s.

Let AR_t represent the *earnings induced* abnormal return realized in period t. Assuming that the cash flow in period t is paid out in dividends, we can derive AR_t as follows

$$AR_t = \frac{P_t + D_t - P_{t-1}}{P_{t-1}} - r, \tag{3.2}$$

To relate the abnormal return in period t to the firm's earnings components, AR_t must first be expressed as a function of the firm's current and expected future cash flows. As shown below, AR_t can also be expressed as the present value of revisions in current and expected future cash flows.

$$AR_t = \frac{P_t + CFO_t - (1 + r)P_{t-1}}{P_{t-1}} \tag{3.3}$$

$$= \frac{\sum_{s=1}^{S} R^s E_t(CFO_{t+s}) + CFO_t - (1 + r)\sum_{s=0}^{S} R^{s+1} E_{t-1}(CFO_{t+s})}{P_{t-1}} \tag{3.4}$$

$$= \frac{\sum_{s=0}^{S} R^s E_t(CFO_{t+s}) - \sum_{s=0}^{S} R^s E_{t-1}(CFO_{t+s})}{P_{t-1}} \tag{3.5}$$

$$= \sum_{s=0}^{S} R^s \frac{E_t(CFO_{t+s}) - E_{t-1}(CFO_{t+s})}{P_{t-1}} \tag{3.6}$$

Next, by specifying the relationship between the firm's earnings components and its operating cash flows, we can link AR_t directly to accounting earnings. For this purpose, the firm's earnings per share in period t+s (EPS_{t+s}) is defined as

$$EPS_{t+s} = CREBT_{t+s}(1-T) + CABT_{t+s}(1-T) - NABT_{t+s}(1-T), \qquad (3.7)$$

where,

$CREBT_{t+s}$ = operating cash flows per share before taxes *earned* in period t+s,

$CABT_{t+s}$ = current accruals per share before taxes *earned* in period t+s,

$NABT_{t+s}$ = noncurrent accruals per share before taxes recorded in period t+s, and

T = the firm's book income tax rate which is assumed to equal its marginal income tax rate.

To remain consistent with prior research, the term accrual is used here to refer to all adjustments made via the accrual accounting process. In this context, current accruals are defined as current assets (excluding cash and short-term investments) minus current liabilities (excluding income taxes payable). Noncurrent accruals are defined as depreciation, depletion, and amortization minus (plus) the amortization of bond premiums (discounts) plus the noncurrent portion of pension expense.[7] For simplicity, it is assumed that the income tax expense number reported on the income statement reflects the firm's actual income taxes paid during the period. Furthermore, in writing equation 3.7, the following conventions apply: (1) cash revenues earned in period t+s exceed

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[7]Ideally, the noncurrent portion of pension expense would be included as a separate variable in the analysis. However, it is aggregated due to data limitations (*SFAS* No. 87: Employer's Accounting for Pensions is effective for fiscal years beginning after December 15, 1986).

cash expenses implying $CREBT_{t+s}$ is positive, (2) debit balance current accruals earned in period t+s exceed credit balance current accruals implying $CABT_{t+s}$ is positive, and (3) credit balance noncurrent accruals in period t+s exceed debit balance noncurrent accruals implying $NABT_{t+s}$ is negative.

The cash flow/accrual decompostion defined by equation 3.7 differs from the decompostion used in prior research [e.g., Bernard and Stober (1989), Charitou and Ketz (1990), Jennings (1990), and Livnat and Zarowin (1990)]. Prior studies decomposed earnings into *realized* and *unrealized* components (i.e., operating cash flows and current accrual adjustments).[8] However, this decomposition fails to reflect the theoretical relations between current cash flow and accrual components of earnings and future cash flows. In contrast, equation 3.7 decomposes earnings into three types of *earned* components. To illustrate this difference, consider the composition of operating cash flows. Operating cash flows consist of the operating cash flows earned by the firm in period t plus current accruals from prior periods converted to cash in period t minus the tax effects of current and noncurrent accruals from period t. Similarly, the change in the firm's current accruals consists of current accruals that are recorded in period t minus any current accruals from period t-1 that are converted to cash in period t.

Assuming that the market is efficient (in the semi-strong form) with respect to earnings information, the information conveyed by cash flow and accrual components of earnings will be impounded in stock prices as soon as it becomes available. However, the decomposition used in prior studies "garbles" the information conveyed by the components by defining them as a function of

[8]The term realization is used in the accounting literature in several contexts. In the context of this study, realization refers to the conversion of noncash assets (liabilities) to cash.

both current and prior period values. Such a misspecification of the relationship between earnings and cash flows is likely to reduce the power of empirical tests and to hinder the interpretation of related results.

Assuming that current accruals from period t+s-1 are fully collected in period t+s, we can link the components of earnings defined in equation 3.7 to the cash flow in period t+s by modeling the accrual conversion process. Equation 3.8 demonstrates the information link between accrual earnings and operating cash flows.

$$CFO_{t+s} = CREBT_{t+s}(1\text{-}T) + CABT_{t+s\text{-}1}(1\text{-}T) + NABT_{t+s}(T) \qquad (3.8)$$

$$= CRE_{t+s} + CA_{t+s\text{-}1} + TNA_{t+s}, \qquad (3.9)$$

where,

CRE_{t+s} = operating cash flows per share (after taxes) earned in period t+s (referred to as cash revenues and expenses),

$CA_{t+s\text{-}1}$ = current accruals per share (after taxes) earned in period t+s-1 and collected in period t+s, and

TNA_{t+s} = tax-modified noncurrent accruals per share recorded in period t+s.

Given equation 3.9, we can link the components of earnings directly to P_t by substituting the (after tax) earnings components derived above for CFO_t in equation 3.6 (above).

$$AR_t = \sum_{s=0}^{S} R^s \frac{E_t(CRE_{t+s}) - E_{t-1}(CRE_{t+s})}{P_{t-1}}$$
$$+ \sum_{s=1}^{S} R^s \frac{E_t(CA_{t+s-1}) - E_{t-1}(CA_{t+s-1})}{P_{t-1}}$$
$$+ \sum_{s=0}^{S} R^s \frac{E_t(TNA_{t+s}) - E_{t-1}(TNA_{t+s})}{P_{t-1}} \qquad (3.10)$$

Finally, to express equation 3.10 as a function of current earnings components alone, recall that current accruals from period t+s-1 are (by assumption) completely collected in period t+s. This implies that $E_t(CA_{t-1}) = E_{t-1}(CA_{t-1})$. Hence, equation 3.10 can be rewritten as

$$AR_t = \sum_{s=0}^{S} R^s \frac{E_t(CRE_{t+s}) - E_{t-1}(CRE_{t+s})}{P_{t-1}}$$
$$+ \sum_{s=0}^{S} R^{s+1} \frac{E_t(CA_{t+s}) - E_{t-1}(CA_{t+s})}{P_{t-1}}$$
$$+ \sum_{s=0}^{S} R^s \frac{E_t(TNA_{t+s}) - E_{t-1}(TNA_{t+s})}{P_{t-1}} \qquad (3.11)$$

Equation 3.11 demonstrates the ECVM's valuation link between earnings components and stock prices. In words, the earnings induced abnormal return realized in period t equals the present value of revisions in current and expected future component values. In this context, note that the ECVM's valuation link was derived by modeling the relations between earnings components and future cash flows. Accordingly, the "weak earnings capitalization assumption" used in prior studies [e.g., Lipe (1986), Kormendi and Lipe (1987), and Lipe (1990)] is unnecessary here.[9] Eliminating this assumption should increase the power of empirical tests and improve the generality of research findings.

Given the valuation link between earnings components and stock prices derived above, we can derive the theoretical return response to cash revenues and expenses, current accruals, and noncurrent accruals. Assuming that the component values are generated by a vector autoregressive process of order 1 [VAR(1)], we can convert the analytical model above to a general time-series model. First, the expected period-t+s components are expressed in matrix form as a VAR(1) model.

$$E_t(\mathbf{C}_{t+s}) = \mathbf{Z}\mathbf{C}_{t+s-1}, \tag{3.12}$$

where,

$\mathbf{Z}$ = a 3 X 3 matrix of time series coefficients that capture the effect of current component shocks on future component values, and

$\mathbf{C}_{t+s}$ = a 3 X 1 vector containing the period t+s components.

The time-series coefficients contained in the matrix **Z** are a function of the autocorrelation structure (the diagonal elements) and cross-correlation structure (the off-diagonal elements) of the earnings components. In this context, positive autocorrelation (cross-correlation) implies that a component value in period t+s-1 will be followed by larger component values in future periods. For example, a firm that uses the half-year convention for depreciating long-term assets acquired during year t+s-1 will report larger depreciation values (and a larger depreciation tax shield) in year t+s. On the other hand, negative autocorrelation

[9] The "weak earnings capitalization assumption" maintains that the present value of revisions in expected future earnings equals the present value of revisions in expected future cash flows.

(cross-correlation) implies that a component value in period t+s will be followed by smaller component values in future periods. Analogously, a firm that uses an accelerated method of depreciation will report relatively smaller depreciation values (and a smaller depreciation tax shield) in year t+s than in year t+s-1 (assuming the firm does not use the half-year convention in year t+s-1).

The expected component values in period t+s can also be expressed as a function of all past component shocks, as shown below.

$$E_t(\mathbf{C}_{t+s}) = \sum_{k=1}^{K} \mathbf{Z}^k \mathbf{UC}_{t+s-k}, \tag{3.13}$$

where,

$\mathbf{UC}_{t+s-k}$ = a 3 X 1 vector containing the component shocks from period t+s-k.

Given equation 3.13, we can calculate the revisions in current and expected future earnings components resulting from the component shocks in period t as follows.

$$E_t(\mathbf{C}_{t+s}) - E_{t-1}(\mathbf{C}_{t+s}) = \sum_{s=1}^{S} \mathbf{Z}^s \mathbf{UC}_{t+s} + \mathbf{UC}_t \tag{3.14}$$

$$= \left[\mathbf{1}' + \sum_{s=1}^{S} \mathbf{Z}^s\right] \mathbf{UC}_{t+s}, \tag{3.15}$$

where,

$\mathbf{1}$ = a 3 X 1 vector of 1's.

Next, we can derive the present value of revisions in current and expected future cash flows by substituting equation 3.15 for the revisions in expected current and future earnings components in equation 3.10.

$$AR_t = \left[\mathbf{R}^{0'} + \sum_{s=1}^{S} \mathbf{R}^{s'}\mathbf{Z}^{s}\right]\mathbf{UC}_{t+s}/P_{t-1} \tag{3.16}$$

where,

$$\mathbf{R} = \text{a } 3 \text{ X } 1 \text{ vector of discount factors} = \begin{bmatrix} R^{s} \\ R^{s+1} \\ R^{s} \end{bmatrix}.$$

The last step is to derive the present value of revisions in current and future (aggregate) earnings induced by a shock in component j (PVR_j). The PVR_j are calculated by summing across components in equation 3.16 as follows.

$$\begin{bmatrix} PVR_1 \\ PVR_2 \\ PVR_3 \end{bmatrix} = \begin{bmatrix} 1 + \sum_{s=1}^{S} (R^{s}Z_{11} + R^{s+1}Z_{12} + R^{s}Z_{13}) \\ R + \sum_{s=1}^{S} (R^{s}Z_{21} + R^{s+1}Z_{22} + R^{s}Z_{23}) \\ 1 + \sum_{s=1}^{S} (R^{s}Z_{31} + R^{s+1}Z_{32} + R^{s}Z_{33}) \end{bmatrix} \tag{3.17}$$

To summarize, equation 3.17 demonstrates that the theoretical component response coefficients (the PVR_j) are a function of the time-series properties of the component shocks and the firm's expected rate of return. In the spirit of Lipe (1986), Kormendi and Lipe (1987), and Lipe (1990), these two factors are collectively referred to as the persistence of the earnings components. For a numerical example that demonstrates the dynamics of the model, see Appendix A.[10]

Hypotheses

The analytical development above suggests that cash revenues and expenses, current accruals, and tax-modified noncurrent accruals each may provide incremental information in relation to aggregate earnings empirically. If so, these components would explain more of the variation in abnormal returns than earnings alone. That is, all, or some, of these components would be valued differently by the market. To determine whether the reformulated variables are differentially associated with security returns the following null hypothesis is tested.

> H_{01}: There is no significant difference in the return response to cash revenues and expenses, current accruals, and tax-modified noncurrent accruals.

Rejection of H_{01} will be consistent with the reformulated variables providing incremental information over aggregate earnings alone.

While a differential return response is consistent with the components of earnings conveying different information regarding the value of the firm, H_{01} cannot test the descriptive validity of the ECVM. That is, the components may be valued differently, but in a manner that is not predicted by the ECVM. To test whether the sign and magnitude of the empirically observed response

[10] In the empirical section, these values are estimated as a perpetuity assuming a constant discount rate of 10% [consistent with Lipe (1986), Kormendi and Lipe (1987), and Lipe (1990)].

coefficients are related to the theoretical response coefficients derived in the ECVM, the following null hypothesis is tested.

> H_{02}: The empirically observed return reaction to cash revenues and expenses, current accruals, and tax-modified noncurrent accruals is unrelated to the theoretical component response coefficients derived in the ECVM.

Rejection of H_{02} will be consistent with a positive correlation between the empirically observed return reactions to cash flow and accrual components of earnings and the theoretical component response coefficients derived in the ECVM. It will also be consistent with the reformulated cash flow and accrual variables having incremental information content over aggregate earnings alone.

Finally, the ECVM also implies that the reformulated cash flow and accrual variables each may provide incremental information that is useful for predicting future cash flows. To assess whether the reformulated variables have incremental information content over earnings when the predictive-ability criterion is used, the following null hypothesis is tested.

> H_{03}: The reformulated cash flow and accrual variables do not have incremental information content when the predictive-ability criterion is used.

Rejection of H_{03} will be consistent with the reformulated variables having incremental information content over aggregate earnings.

The theoretical development underlying the study is now complete. As indicated by the three hypotheses developed above, disaggregating earnings into cash flow and accrual components is expected to provide additional information beyond earnings alone. The next chapter discusses the empirical procedures that are used to test for incremental information content.

CHAPTER IV

RESEARCH DESIGN

Introduction

This chapter discusses econometric models used to test for incremental information content, measurement and scaling of variables, and data selection procedures. Three econometric models are required to test the study's hypotheses. The first model (called the returns/components model) is a multivariate time-series model that relates annual abnormal returns and annual earnings component shocks. The second model (referred to as the cross-sectional model) is a multivariate cross-sectional model that also relates annual abnormal returns and annual earnings component shocks. The third model (referred to as the cash flow prediction model) is a multivariate forecasting model that uses annual earnings component data to predict future annual operating cash flows. All three models incorporate the same variables and sample firms to ensure comparability between association and predictive-ability tests for incremental information content.

The Returns/Components Model

The returns/components model is a multivariate time-series model that relates annual abnormal stock returns to annual earnings component shocks.

The first equation in the system (equation 4.1, below) describes the empirical return response to unexpected cash flow and accrual components of earnings. The remaining three equations (collectively represented by equation 4.2, below) are multivariate forecasting equations that are used to identify component shocks in each year. The model is estimated simultaneously to incorporate the estimation errors from the time-series coefficients in the test of hypothesis two.

$$AR_{it} = a_{0i}\frac{1}{\rho P_{t-1}} + \sum_{j=1}^{3} a_{ji}\frac{UEC_{jit}}{\rho P_{it-1}} + UAR_{it} \tag{4.1}$$

$$dEC_{jit} = \sum_{k=1}^{3} Z_{jki}EC_{jit-1} + UEC_{jit} \tag{4.2}$$

where,

AR_{it}	=	the estimated real abnormal return for firm i pertaining to the year-t return window (see discussion of the return window below),
a_{0i}	=	an intercept coefficient for firm i,
a_{ji}	=	the empirically observed response coefficient associated with component j for firm i,
ρP_{it-1}	=	the real stock price for firm i at the end of year t-1(ρ = 1 / the average consumer price index (CPI) for the last month of year-t),
dEC_{jit}	=	the per share/real/differenced/mean adjusted value related to component j for firm i in year t (j=1 is cash revenues and expenses, j=2 is current accruals, and j=3 is tax-modified noncurrent accruals),

UEC_{jit} = the unexpected portion of component j in year t,

Z_{jki} = a time-series coefficient that captures the effect of lagged values of component j on current values of component k, and

UAR_{it} = the unexplained portion of firm i's abnormal return in year t.

Equations 4.1-4.2 represent the unrestricted form of the time-series model. Implicit in equation 4.1 is the efficient markets assumption that only the new information conveyed by the components impacts on security returns. The three component forecasting equations form a first order vector autoregressive (VAR) process. The component equations express the expected component values in year t as a function of all available component data from year t-1 plus an unexpected current period shock. The VAR(1) model was selected because it adequately captures the cross-correlation inherent in the component data.[11]

Consistent with Jennings (1990), the components will have incremental information content in relation to aggregate earnings if they are both differentially associated with security returns and value relevant. Accordingly, two procedures are required to test hypothesis one. The first procedure uses an *F*-test to determine whether the three components, taken together, provide incremental information over earnings (i.e., whether they are differentially associated with security returns). This procedure involves comparing the sum of squared residuals from the unrestricted and restricted returns/components models. The required restrictions are

[11]The cross-correlation matrices for the three variables were examined in order to identify a general time-series model. As a supplementary procedure, the Final Prediction Error (FPE) [Akaike (1969)] was also used to specify the order of the system - yielding the same conclusion. See chapter V for a discussion of model selection procedures.

$$a_{1i} = a_{2i} = a_{3i}. \tag{4.3}$$

If the components possess additional explanatory power (i.e., they are differentially associated with security returns), the equality of the A-coefficients will be rejected. This procedure is emphasized because it yields a lower probability of type I error than the series of paired *t*-tests suggested by Jennings (1990). The second procedure is required to determine whether an individual component has incremental information content, given the information provided by the other two (i.e., whether the components are value relevant). This procedure uses the standard errors from the returns/components model to calculate asymptotic *t*-statistics. Given the two procedures outlined above, two results are possible. (1) The restrictions described by equation 4.3 are rejected implying that the components are differentially associated with security returns. Therefore, investors will prefer that all value-relevant components are disclosed separately. (2) The restrictions described in equation 4.3 are not rejected implying that the components are valued equivalently. Accordingly, investors will be indifferent with respect to the disclosure of disaggregated cash flow and accrual data.

Hypothesis two is tested by a second set of restrictions. Recall that, under the assumptions of the theoretical model, the A-coefficients from the returns/components model should equal the theoretical component response coefficients derived in the ECVM. However, restricting the A-coefficients to be equal to the theoretical response coefficients is likely to preclude rejection of H_{02} due to unrealistic simplifying assumptions made in the derivation of the ECVM. Therefore, the following (less stringent) set of restrictions is imposed.

$$a_{ji} = d_{0i} + d_{1i}PVR_{ji} \tag{4.4}$$

The restriction constrains the A-coefficients to be a linear function of the persistence measures (PVR_{ji}). The intercept coefficient, d_{0i}, is included to capture any mean difference between the A-coefficients and the persistence measures. If the A-coefficients equal the persistence measures, d_{0i} will be zero and d_{1i} will equal one.

Two methods are employed to aggregate the resulting *F*-statistics (*t*-statistics). The first method employs a binomial test to compare the observed distribution of *F*-statistics (*t*-statistics) to the hypothetical distribution under the null hypothesis. The second method, which is applied to *F*-statistics only, involves aggregating the restricted and unrestricted sums of squared weighted residuals across all observations producing an overall *F*-statistic that is also used to test the null hypothesis. The two methods of aggregating the *F*-statistics may produce different results. The binomial test is a nonparametric test and is therefore weaker than the overall *F*-test. However, the binomial test is more robust to outliers and requires a large number of significant *F*-statistics to reject the null. In contrast, the overall *F*-test could reject the null if only one firm has a relatively large *F*-value.

For comparison with extant studies, and to serve as a benchmark in evaluating methodological refinements, H_{01} and H_{02} will also be tested using the conventionally-defined cash flow and accrual variables (i.e., operating cash flows, current accrual adjustments, and noncurrent accruals) and the time-series regression approach discussed above. H_{01} alone will also be tested using a cross-sectional regression approach and both sets of variables (i.e., the reformulated variables and the conventionally-defined variables). The cross-sectional approach cannot be used to test H_{02} (i.e., the descriptive validity of the ECVM) because the ECVM predicts that the A-coefficients vary across firms as a function of the persistence measures (PVR_{ji}) while the cross-sectional approach assumes that the A-coefficients are constant across firms.

The Cross-Sectional Model

The cross-sectional model employed (shown below) is similar to that of Rayburn (1986), Bowen et al. (1987), and Livnat and Zarowin (1990).

$$AR_{it} = a_{0t} + \sum_{j=1}^{3} a_{jt} \frac{UEC_{jit}}{P_{it-1}} + UAR_{it} \qquad (4.5)$$

where,

AR_{it} = the estimated abnormal return for firm i pertaining to the year-t return window (see discussion of the return window below),

a_{0t} = an intercept coefficient for year t,

a_{jt} = the empirically observed response coefficient associated with component j for year t,

P_{it-1} = firm i's stock price (adjusted for stock splits and dividends) at the end of year t-1,

UEC_{jit} = the unexpected per share value related to component j for firm i in year t (j=1 is operating cash flows, j=2 is current accruals, and j=3 is noncurrent accruals), and

UAR_{it} = the unexplained portion of firm i's abnormal return in year t.

To ensure comparability with prior studies [e.g., Jennings (1990) and Livnat and Zarowin (1990)], a random walk model, $E_{t-1}(EC_{jit}) = EC_{jit-1}$, is used to forecast future component values.[12]

Like the returns/components model, two procedures are required to test for incremental information content in conjunction with the cross-sectional model. The first procedure involves estimating both the restricted and unrestricted versions of the cross-sectional model. The required restrictions are the same as those used in testing the returns/components model (i.e., $a_{1i} = a_{2i} = a_{3i}$). The second procedure uses the standard errors from the time-series model to calculate asymptotic *t*-statistics. Additionally, the same two methods are used to aggregate the resulting *F*-statistics (*t*-statistics).

The Cash Flow Prediction Model

The cash flow prediction model (shown below) is a multivariate forecasting model that uses current values of cash revenues and expenses, current accruals, and tax-modified noncurrent accruals to predict future cash flows.

$$CFO_{it} = c_0 + c_j \sum_{j=1}^{3} EC_{jit-1} + UCF_{it} \tag{4.6}$$

where,

CFO_{it} = operating cash flows *realized* by firm i in year t,

c_0 = an intercept coefficient,

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[12]Prior studies indicate that the time-series behavior of annual earnings is well approximated by a random walk model [e.g., Ball and Watts (1972), Albrecht, Lookabill, and McKeown (1977), and Watts and Leftwich (1977)].

c_j = the regression coefficient relating lagged values of component j to current values of operating cash flows,

EC_{jit-1} = the value of earnings component j for firm i in year t-1 (j=1 is cash revenues and expenses, j=2 is current accruals, and j=3 is tax-modified noncurrent accruals), and

UCF_{it} = the unexplained portion of firm i's operating cash flows *realized* in year t.

Equation 4.6 represents the unrestricted form of the cash flow prediction model. To test whether the components have incremental information content, the predictive ability of the reformulated variables is assessed in relation to aggregate earnings alone. Thus, the cash flow prediction model is also estimated with the following restrictions imposed.

$$c_{1i} = c_{2i} = c_{3i}. \tag{4.7}$$

The predictive ability of the components will be assessed by comparing the prediction errors from the unrestricted and restricted cash flow prediction models.

Two alternative test metrics will be used to compare the resulting prediction errors. The first test metric is the difference in mean absolute errors (MAEs). Differences in MAEs are calculated consistent with Balakrishnan, Harris, and Sen (1990). First, the relative absolute errors are computed for the unrestricted and restricted models (AE^m_{it}) as

$$AE^m_{it} = \frac{|UCF_{it}|}{CF_{it}}, \tag{4.8}$$

where m refers to either the unrestricted (denoted by a u superscript) or the restricted (denoted by an r superscript) model. Next, the MAE is calculated for each model as

$$MAE_i^m = \frac{1}{T}\sum_{t=1}^{T} AE_{it}^m. \tag{4.9}$$

Finally, the differences in MAEs (D_i) are calculated as

$$D_i = MAE_i^r - MAE_i^u. \tag{4.10}$$

Consistent with prior predictive-ability studies [e.g., Kinney (1971), Collins (1976), and Balakrishnan, Harris, and Sen (1990)] extreme values are truncated at + or -1 (i.e., 100%) to reduce the influence of outliers.

Because the MAE weights all forecast errors equally, it implicitly assumes that financial statement users have linear loss functions. As an alternative, the differences in mean square errors (MSEs) is used as a second test metric. In contrast to the MAE, the MSE is consistent with a quadratic loss function. Hence, greater weight is given to large forecast errors. The MSE is calculated similarly as

$$SE_{it}^m = \frac{UCF_{it}^2}{CF_{it}}, \tag{4.11}$$

$$MSE_i^m = \frac{1}{T}\sum_{t=1}^{T} SE_{it}^m, \text{ and} \tag{4.12}$$

$$D_i = MSE_i^r - MSE_i^u. \tag{4.13}$$

Having computed the MAEs (MSEs) for the unrestricted and restricted models, asymptotic *t*-tests and Wilcoxin Signed Rank tests are performed to determine whether there are significant differences in MAEs (MSEs). The Wilcoxin Signed Rank test is a nonparametric test. Accordingly, it is more robust to outliers and requires a large number of significant differences in MAEs (MSEs) to reject the null.

Finally, MAEs and MSEs are also calculated for the conventionally-defined variables. These values are estimated to assess the predictive ability of the conventionally-defined variables in relation to both the reformulated variables and aggregate earnings.

Measurement and Scaling of Component Shocks

The components were obtained from the *Compustat Annual Industrial File*. Each of the components is converted to a consistent per share basis by dividing by the number of shares used in calculating primary earnings per share [*Compustat* item (54)] -- which adjusts for common stock equivalents, stock splits, and stock dividends). Ignoring conversions to per share bases, differencing, and firm subscripts, etc., they are calculated as shown below in terms of *Compustat* items, item numbers, and supplementary procedures.

$CITE_{t+s}$	=	current income tax expense = income taxes--total (16) - deferred taxes (DT_{t+s}) (50);
T_{t+s}	=	the per-firm, per year effective income tax rate = $CITE_{t+s}$/pretax income (170);
$WCFO_{t+s}$	=	working capital from operations = income from operations before depreciation (13) - interest expense (15) - $CITE_{t+s}$;

$NABT_{t+s}$ = noncurrent accruals before income taxes = $WCFO_{t+s}$ - income before extraordinary items ($IBEI_{t+s}$) (18) - DT_{t+s};

TNA_{t+s} = tax-modified noncurrent accruals = $NABT_{t+s} * T_{t+s}$;

NA_{t+s} = noncurrent accruals = $WCFO_{t+s}$ - $IBEI_{t+s}$;

CA_{t+s} = current accruals = [current assets--total (4) - cash and short-term investments (1)] - [current liabilities--total (5) - current maturities of long-term debt (44)];

$CADJ_{t+s}$ = current accrual adjustments = CA_{t+s} - CA_{t+s-1};

CRE_{t+s} = cash revenues and expenses = income before extraordinary items available for common shareholders ($IBEIA_{t+s}$) (20) - CA_{t+s} - NA_{t+s} - TNA_{t+s}; and

CFO_{t+s} = operating cash flows = $IBEIA_{t+s}$ - CA_{t+s} + CA_{t+s-1} + NA_{t+s}.

The VAR(1) model assumes that all variables included in the model are stationary.[13] Accordingly the component shocks in equation 4.2 are differenced and mean adjusted (to remove any linear trend). Moreover, to remove the effects of inflation, the raw component shocks are deflated by the average CPI for year t. To obtain consistent measures of earnings components, stock prices, and abnormal returns each firm's stock price is also deflated by the average CPI for the last month of year t-1.

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[13] A vector stochastic process is stationary if and only if

(1) All random vectors have the same mean vector for all t,

(2) The variances of all variables in the model are finite for all t, and

(3) The covariance matrices for vectors y_t and y_{t+s} depend only on s.

Measurement of Abnormal Returns

To assess the sensitivity of the results to alternative specifications of the return metric two procedures are used to estimate annual abnormal returns for each firm.[14] First, the parameters of the market model are estimated using monthly market model prediction errors. Second, these values are estimated in size deciles. The estimated form of the market model utilized is

$$R_{ip} = a_i + b_i R_{mp} + e_{ip} \qquad (4.14)$$

where,

R_{ip} and R_{mp}	=	the monthly (period p) return from security i and the monthly return from the CRSP value-weighted market index (m), respectively,
a_i and b_i	=	regression coefficient estimators for alpha and beta, respectively, and
e_{ip}	=	a random disturbance term.

In estimating annual market model prediction errors, the parameters of the market model were estimated for each period using a 36 month out of sample procedure.[15]

The return window pertaining to a particular year includes the nine-months preceding and including the end of the year and the three-month period

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[14]Conditioning market model prediction errors on ex-post market returns (rather than the "true" expected return) biases parameter estimates if the proxy for expected earnings components is correlated with the unexpected market return. Accordingly, realized returns were also used as a supplementary procedure. The results were not substantially different.

[15]Monthly returns are used in estimating market model betas because the results of Scholes and Williams (1977) indicate that estimates based on daily returns are biased and inconsistent when trading in a security is thin - as would be expected for many of the smaller firms in the sample.

following this point. This window was chosen since, in principle, it encompasses the time period in which information about annual earnings and related components reaches market participants through news releases, conversations with analysts, quarterly reports to stockholders and the SEC, and so on.[16] The estimated abnormal return for firm i related to the year-t return window (AR_{it}) is calculated as $\{[(1 + AR_{i1})(1 + AR_{i2})...(1 + AR_{i12})] - 1\}$ (where AR_{ip} is the estimated abnormal return in month p and p = 1, 2, . . ., 12 pertain to the first, second, and twelfth months of the return window, respectively).

Data Requirements and Sample Selection Criteria

As implied above, each of the sample firms has complete returns data on the *CRSP Monthly Returns File* beginning with the last nine-months of its fiscal year 1956 and ending with the four months subsequent to its fiscal year 1990. Each of these firms also has complete earnings/components data on the *Compustat Annual Industrial File* for fiscal years 1958-90. The data requirements resulted in a sample of 58 firms. While the sample is not random, it includes both large and small firms which have survived approximately 35 years. Thus, the generality of research findings are not subject to any specific selection biases, except for survival as noted. For a list of sample firms and related descriptive statistics, see table 4.1 beginning on page 38.

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[16]While firms are required to file Form 10-K with the SEC within 90-days of their fiscal year-end, Alford, Jones, and Zmijewski (1992) find that 19.8% do not comply. To assess the sensitivity of the results to alternative specifications of the return window, a -8,+4 return window was also estimated - producing similar results.

TABLE 4.1

SAMPLE FIRMS AND DESCRIPTIVE STATISTICS

Firm Name	CUSIP	Fiscal Year-End	SIC Code	Market Value End of Fiscal Year 1990 (in millions)
Aluminum Co. of America	022249	Dec.	3334	$4,889
American Tel. & Telegraph	030177	Dec.	4813	32,901
Ametek Inc.	031105	Dec.	3823	415
Archer-Daniels-Midland Co.	039483	Jun.	2070	6,778
Ashland Oil Inc.	044540	Jul.	2911	1,575
Brunswick Corp.	117043	Dec.	3510	795
Campbell Soup Co.	134429	Jul.	2000	7,562
Carpenter Technology	144285	Jun.	3312	385
Caterpillar Inc.	149123	Dec.	3531	4,743
Chevron Corp.	166751	Dec.	2911	25,476
Cincinnati Milacron Inc.	172172	Dec.	3541	300
Crane Co.	224399	Dec.	3490	625
Crown Cork & Seal Co. Inc.	228255	Dec.	3411	1,637
Delta Air Lines Inc.	247361	Jun.	4512	2,569
Eagle-Picher Inds.	269803	Dec.	3714	30
Eaton Corp.	278058	Dec.	3714	1,691
Federal Paper Board Co.	313693	Dec.	2631	738
Ferro Corp.	315405	Dec.	2800	341
General Signal Corp.	370838	Dec.	3569	730
Georgia-Pacific Corp.	373298	Dec.	2600	3,230
Goodyear Tire & Rubber Co.	382550	Dec.	3011	1,104
Grace (W.R.) & Co.	383883	Dec.	2800	2,054
Harris Corp.	413875	Jun.	3663	797
Homestake Mining	437614	Dec.	1040	1,908
Honeywell Inc.	438506	Dec.	3822	3,149
Inland Steel Industries Inc.	457472	Dec.	3312	764
Interlake Corp.	458702	Dec.	3569	36
International Paper Co.	460146	Dec.	2621	5,869
Johnson & Johnson	478160	Dec.	2834	23,898
Kroger Co.	501044	Dec.	5411	1,219
Lone Star Industries	542290	Dec.	3241	50
McGraw-Hill Inc.	580645	Dec.	2731	2,575
Minnesota Mining & Mfg. Co.	604059	Dec.	2670	18,581
Monsanto Co.	611662	Dec.	2800	6,069
Motorola Inc.	620076	Dec.	3663	6,898
Olin Corp.	680665	Dec.	2800	717

TABLE 4.1 (CONTINUED)

Firm Name	CUSIP	Fiscal Year-End	SIC Code	Market Value End of Fiscal Year 1990 (in millions)
Owens-Corning Fiberglass	690734	Dec.	3290	649
PPG Industries	693506	Dec.	2851	4,984
Penney (J.C.) Co.	708160	Jan.	5311	5,158
Pfizer Inc.	717081	Dec.	2834	13,334
Phelps Dodge Corp.	717265	Dec.	3330	1,950
Phillips Petroleum Co.	718507	Dec.	2911	6,759
Pitney Bowes Inc.	724479	Dec.	3579	3,128
Pittston Co.	725701	Dec.	4731	713
Proctor & Gamble Co.	742718	Jun.	2840	29,998
Quaker Oats Co.	747402	Jun.	2000	3,997
Reynolds Metals Co.	761763	Dec.	3334	3,391
Rohr Industries	775422	Jul.	3728	289
Scott Paper Co.	809877	Dec.	2621	2,789
Starrett (L.S.) Co.	855668	Jun.	3420	144
TRW Inc.	872649	Dec.	3714	2,265
Texaco Inc.	881694	Dec.	2911	15,618
UAL Corp.	902549	Dec.	4512	2,410
Union Camp Corp.	905530	Dec.	2621	2,410
Warner-Lambert Co.	934488	Dec.	2834	9,068
Westvaco Corp.	961548	Oct.	2621	1,738
Whirlpool Corp.	963320	Dec.	3630	1,632
Wrigley (Wm.) Jr. Corp.	982526	Dec.	2060	2,007

CHAPTER V

EMPIRICAL RESULTS

Empirical Results -- Time-Series Approach

Estimation of the Returns/Components Model

The order of the component equations was estimated using the PROC ARIMA and PROC MODEL procedures in the SAS ETS statistical package. Initially, PROC ARIMA was used (1) to compute and plot the autocorrelation functions (ACF) and partial autocorrelation functions (PACF) for both the reformulated variables and the conventionally defined variables and (2) to compute and plot cross-correlations for each combination of the two sets of variables. Based on the ACF, the PACF, and the cross-correlation matrices for each set of variables the VAR(1) model was selected as the initial model. PROC MODEL was also used to compute the Final Prediction Error (FPE) for VAR models ranging from one to three lags - yielding the same conclusion. Only three lags were considered due to data limitations.

The ACF and PACF for each set of variables also indicated that the components were each generated by stationary time-series processes. This result was expected since per share component values were used in estimating the time-series properties of the components. Thus, the returns/components system was initially estimated by PROC MODEL using raw stock returns and raw (per share) component data (i.e., the most general model). The initial model produced insignificant results for both the reformulated variables and the conventionally-defined variables. Moreover, a substantial number of the A-coefficients had negative signs (contrary to the predictions of the ECVM).

Based upon the initial results from estimating the returns/components model with raw returns and raw component data, the collinearity diagnostics supported by PROC MODEL were run to determine whether the insignificant results were due (at least in part) to the existence of multicollinearity. The collinearity diagnostics supported by PROC MODEL are based on the approach of Belsley, Kuh, and Welsch (1980). This approach involves three steps: (1) a principal components analysis is performed, (2) the proportion of the variance of each estimated coefficient accounted for by each principal component is determined, and (3) a "condition index" is calculated for each principal component. The condition index is the ratio of the largest eigenvalue to the eigenvalue corresponding to a particular principal component. A collinearity problem exists when a component associated with a high condition index contributes strongly to the variance of two or more variables. The collinearity diagnostics revealed that, for all but a few firms, a substantial portion of the variation in cash revenues and expenses, current accruals, and tax-modified noncurrent accruals was accounted for by the same principal component. Moreover, this component had the second highest condition index (among 13 condition indices) indicating a substantial collinearity problem. Similarly, when the collinearity diagnostics were run on the conventionally-defined variables, operating cash flows, current accrual adjustments, and noncurrent accruals also appeared to be highly correlated.

Time-series models tend to attenuate a multicollinearity problem if there are linear trends in the data. Accordingly, initial attempts to overcome the effects of multicollinearity involved procedures designed to remove linear trends in the component data. First, the components were differenced and the model was re-estimated. However, the results were essentially unchanged. Next, the raw component data were converted to real component data by adjusting for inflation (i.e., dividing by the consumer price index) then differenced. Again the results were insignificant. Finally, the differenced, real value of each component was mean adjusted yielding only minimal improvements. Similar attempts to remove linear trends in the conventionally-defined variables also failed to yield any substantial improvements.

After attempts to remove linear trends in the component data failed to ameliorate the multicollinearity problem, several additional procedures were considered. First, the market model (estimated using individual firm parameters and in size deciles) was used to remove the expected return from raw returns - yielding only minimal improvements. Book to market equity was also considered as an additional explanatory variable. However, there were a substantial number of missing observations for this variable on the *Compustat* database (primarily during the early years of the sample period).

Next, two separate linear combinations of variables were formed and the model was re-estimated individually using each of the new aggregated variables. (1) Cash revenues and expenses and tax-modified noncurrent accruals were combined and market model residuals were regressed on the new aggregated variable and current accruals. However, the new variable was highly correlated with current accruals and the results were again insignificant. (2) Current accruals and noncurrent accruals were combined to form total accruals [similar to Wilson (1987) and Livnat and Zarowin (1990)] and market model residuals were regressed on unexpected cash revenues and expenses and unexpected total accruals. This time, cash revenues and expenses and total accruals were highly correlated and the results were also insignificant.

In summary, all attempts to overcome the multicollinearity problem failed and the results of the time-series portion of the study proved insignificant. The results reported below are based on the returns/components model shown in chapter IV.[17] The first equation in the system relates yearly market model residuals to annual earnings component shocks. The remaining three equations (i.e., the component forecasting equations) are estimated using differenced/mean-adjusted/real values for cash revenues and expenses, current accruals, and tax-modified noncurrent accruals. For comparison with extant studies, the returns/components model is also estimated for the conventionally-defined variables using similar empirical procedures (i.e., market model residuals and differenced/mean-adjusted/real component values).

Tables 5.1 and 5.2 summarize the results of estimating the component forecasting equations using the reformulated variables. Consistent with the results of prior studies on the time-series properties of earnings [e.g., Ball and Watts (1972), Albrecht, Lookabill, and McKeown (1977), and Watts and Leftwich (1977)], all of the means presented in table 5.1 (page 44) are within one-standard deviation of zero. Nevertheless, the time-series properties of the components display significant variation around a random walk.

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[17]For details on the estimation procedure, see Appendix B.

TABLE 5.1

CROSS-FIRMS MEAN (STANDARD DEVIATION) OF THE TIME-SERIES COEFFICIENTS FROM THE UNRESTRICTED RETURNS/COMPONENTS MODEL (REFORMULATED VARIABLES)

Current Period Component	Lagged Component $dCRE_{t-1}$	dCA_{t-1}	$dTNA_{t-1}$
$dCRE_t$	-0.19	0.12	-0.03
	(0.61)	(0.80)	(0.35)
dCA_t	-0.09	-0.14	0.05
	(0.65)	(0.71)	(0.30)
$dTNA_t$	-0.03	0.24	-0.18
	(1.98)	(2.14)	(0.58)

The time-series coefficients in table 5.1 were estimated across time (1959-90) for each of the 58 sample firms using equation 4.2 from the time-series model described in chapter IV.

$dCRE_t$ = the differenced/mean-adjusted/real value of cash revenues and expenses at time t.

dCA_t = the differenced/mean-adjusted/real value of current accruals at time t.

$dTNA_t$ = the differenced/mean-adjusted/real value of tax-modified noncurrent accruals at time t.

Table 5.2 (page 46) shows that there are significantly more nonzero time-series coefficients than expected by chance at the 10% level. The number of significant nonzero autocorrelation coefficients (the coefficients along the diagonal) are 19, 17, and 22 for $dCRE_{t-1}$, dCA_{t-1}, and $dTNA_{t-1}$, respectively. Using the binomial test, these values are significant at less than the .0001 level.[18] dCA_{t-1} has the greatest number of positive autocorrelation coefficients (7) while $dTNA_{t-1}$ has the greatest number of negative autocorrelation coefficients (18). Positive (negative) autocorrelation implies that a one-dollar change in a current period component will be followed by a greater (less) than one-dollar change in future values of the same component. Table 5.2 also indicates that the number of significant nonzero cross-correlations (the coefficients on the off-diagonals) is greater than expected by chance. These values range from 16 for the coefficient relating dCA_{t-1} to $dCRE_t$ to 9 for the coefficient relating dCA_{t-1} to $dTNA_t$. Using the binomial test, four of the six cross-correlations are significant at less than the .0001 level. The other two cross-correlations are significant at the .0242 and .0548 levels. The coefficient relating dCA_{t-1} to $dCRE_t$ has the greatest number of positive cross-correlations (13) while the coefficient relating $dCRE_{t-1}$ to dCA_t has the greatest number of negative cross-correlations (10). Positive (negative) cross-correlation implies that a one-dollar change in a current period component will be followed by a greater (less) than one-dollar change in future values of the cross-correlated component. Taken as a whole, the number of significant nonzero cross-correlations supports using the VAR(1) model over a random walk model or a system of univariate time-series forecasting equations.

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[18]The binomial test compares the observed proportion of significant t-statistics with the hypothetical distribution under the null hypothesis. The binomial test is distributed unit normal.

TABLE 5.2

NUMBER OF SIGNIFICANT TIME-SERIES COEFFICIENTS AT THE 10% LEVEL FROM THE UNRESTRICTED RETURNS/COMPONENTS MODEL (REFORMULATED VARIABLES)

Current Period Component	Sign	Lagged Component $dCRE_{t-1}$	dCA_{t-1}	$dTNA_{t-1}$
$dCRE_t$	pos.	4	13	11
	neg.	15	5	4
	Total	19	18	15
1- Pr(Bnml)		< .0001	< .0001	< .0001
dCA_t	pos.	6	7	12
	neg.	10	10	3
	Total	16	17	15
1- Pr(Bnml)		< .0001	< .0001	< .0001
$dTNA_t$	pos.	7	6	4
	neg.	3	3	18
	Total	10	9	22
1- Pr(Bnml)		.0242	< .0548	< .0001

The time-series coefficients in table 5.2 were estimated across time (1959-90) for each of the 58 sample firms using equation 4.2 from the time-series model described in chapter IV.

$dCRE_t$ = the differenced/mean-adjusted/real value of cash revenues and expenses at time t.

dCA_t = the differenced/mean-adjusted/real value of current accruals at time t.

$dTNA_t$ = the differenced/mean-adjusted/real value of tax-modified noncurrent accruals at time t.

1-Pr(Bnml) = 1 - the probability that an observation from a binomial distribution is less than or equal to 10%.

Tables 5.3 and 5.4 summarize the results of estimating the component forecasting equations using the conventionally-defined variables.[19] Consistent with the results pertaining to the reformulated variables, table 5.3 (page 48) shows that the cross-firms means of the time-series coefficients are all within one-standard deviation of zero. Nevertheless, the time-series properties of the components display significant variation around a random walk. Table 5.4 (page 49) shows that there are significantly more nonzero time-series coefficients than expected by chance at the 10% level. The number of significant nonzero autocorrelation coefficients are 16, 55, and 28 for $dCFO_{t-1}$, $dCADJ_{t-1}$, and dNA_{t-1} respectively. Using the binomial test, these values are significant at less than the .0001 level. $dCFO_{t-1}$ has the greatest number of significant positive autocorrelation coefficients (12) and $dCADJ_{t-1}$ has the greatest number of significant negative autocorrelation coefficients (51). The number of significant nonzero cross-correlations is also greater than expected by chance at the 10% level. These values range from 17 for the coefficients relating dNA_{t-1} to $dCFO_{t-1}$ and $dCFO_{t-1}$ to dNA_{t-1} to 8 for the coefficient relating $dCADJ_{t-1}$ to $dCFO_{t-1}$. Using the binomial test, four of the six cross-correlations are significant at less than the .0001 level while the other two cross-correlations are significant at the .0548 and .1112 levels. The coefficient relating dNA_{t-1} to $dCFO_{t-1}$ has the greatest number of significant positive cross-correlations (14) and the coefficient relating $dCFO_{t-1}$ to dNA_{t-1} has the greatest number of significant negative cross-correlations (6). Taken as a whole, the number of significant nonzero cross-correlations in table 5.4 also support using the VAR model for the conventionally-defined varaibles.

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[19]Calculating the current accrual adjustments variable uses one additional observation. Hence, only 31 annual observations are available for estimating the returns/components model with the conventionally-defined variables.

TABLE 5.3

CROSS-FIRMS MEAN (STANDARD DEVIATION) OF THE TIME-SERIES COEFFICIENTS FROM THE UNRESTRICTED RETURNS/COMPONENTS MODEL (CONVENTIONALLY-DEFINED VARIABLES)

Current Period Component	Lagged Component $dCFO_{t-1}$	$dCADJ_{t-1}$	dNA_{t-1}
$dCFO_t$	0.12	0.44	-0.21
	(0.40)	(1.06)	(0.67)
$dCADJ_t$	-0.02	-0.52	-0.03
	(0.13)	(0.19)	(0.15)
dNA_t	0.13	0.38	-0.36
	(0.47)	(1.23)	(0.44)

The time-series coefficients in table 5.3 were estimated across time (1960-90) for each of the 58 sample firms using equation 4.2 from the time-series model described in chapter IV.

$dCFO_t$ = the differenced/real/mean-adjusted value of operating cash flows at time t.

$dCADJ_t$ = the differenced/real/mean-adjusted value of current accrual adjustments at time t.

dNA_t = the differenced/real/mean-adjusted value of noncurrent accruals at time t.

TABLE 5.4

NUMBER OF SIGNIFICANT TIME-SERIES COEFFICIENTS AT THE 10% LEVEL FROM THE UNRESTRICTED RETURNS/COMPONENTS MODEL (CONVENTIONALLY-DEFINED VARIABLES)

Current Period Component	Sign	Lagged Component $dCFO_{t-1}$	$dCADJ_{t-1}$	dNA_{t-1}
$dCFO_t$	pos.	12	11	14
	neg.	4	4	3
	Total	16	15	17
1- Pr(Bnml)		< .0001	< .0001	< .0001
$dCADJ_t$	pos.	3	0	4
	neg.	5	51	5
	Total	8	55	9
1- Pr(Bnml)		< .1112	< .0001	< .0548
dNA_t	pos.	11	13	1
	neg.	6	2	27
	Total	17	15	28
1- Pr(Bnml)		< .0001	< .0001	< .0001

The time-series coefficients in table 5.4 were estimated across time (1960-90) for each of the 58 sample firms using equation 4.2 from the time-series model described in chapter IV.

$dCFO_t$ = the differenced/real/mean-adjusted value of operating cash flows at time t.

$dCADJ_t$ = the differenced/real/mean-adjusted value of current accrual adjustments at time t.

dNA_t = the differenced/real/mean-adjusted value of noncurrent accruals at time t.

1-Pr(Bnml) = 1 - the probability that an observation from a binomial distribution is less than or equal to 10%.

Results of Tests for Incremental Information Content

Under the null hypothesis that the cash flow and accrual components of earnings do not possess incremental information content, the A-coefficients will be equal across components for each of the sample firms. The first procedure for testing H_{01} yields an F-statistic with 2 and 111 degrees of freedom for each of the 57 sample firms for which the model converged. (The model failed to converge for one of the sample firms.) As shown in Table 5.5 (page 51), only 1 (0) of the individual firm F-statistics lie outside of the 80%(90%) confidence interval.[20] The overall F-statistic is .0061 with 114 and 6,327 degrees of freedom implying acceptance of H_{01}.[21] The observed proportion of significant F-statistics is 0% (1.8%) at the 10% (20%) level. Therefore, the binomial test also implies acceptance of H_{01}. Taken together, these results imply that the reformulated components are not differentially associated with security returns. Therefore, the components do not provide incremental information in relation to aggregate earnings when the time-series approach is used. Further discussion of the returns/components model is provided below.

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[20] For the reformulated variables, individual firm F-statistics are calculated as follows

$$F_{1i} = ((RSSR_{1i} - USSR_i)/2))/(USSR_i/(4 \times 32 - 13)),$$

where $RSSR_{1i}$ and $USSR_i$ are the restricted and unrestricted sum of squared residuals, respectively.

[21] For the reformulated variables, the overall F-statistic is calculated as

$$F = \frac{\sum_{i=1}^{57} (RSSR_{1i} - USSR_i)/(57 \times 2)}{\sum_{i=1}^{57} USSR_i/(57 \times 111)}.$$

TABLE 5.5

SUMMARY OF RESULTS OF ASSOCIATION TESTS FOR INCREMENTAL INFORMATION CONTENT (REFORMULATED AND CONVENTIONALLY-DEFINED VARIABLES)

Number of F-Statistics that are Significant at the 10% (20%) Level

	Reformulated Variables		Conventionally-Defined Variables	
	T-S Model	C-S Model	T-S Model	C-S Model
10% level	0	6	0	5
1- Pr(Bnml)	.9975	.0306	.9975	.0732
20% level	1	9	0	8
1- Pr(Bnml)	>.9999	.0746	>.9999	.1287
Grand-F	.0061	1.90	-.0011	1.30
1- Pr(F)	>.9999	.0001	>.9999	.0594

The A-coefficients ($a_{j,i}$) in table 5.5 were estimated across time (1959-90 for the reformulated variables and 1960-90 for the conventionally-defined variables) for each of the 58 sample firms using equation 4.1 from the time-series model described in chapter IV.

T-S Model = time-series model.

C-S Model = cross-sectional model.

1-Pr(Bnml) = 1 - the probability that an observation from a binomial distribution is less than or equal to 10% (20%).

1- Pr(F) = 1 - the probability that an observation from an *F*-distribution is less than or equal to zero.

Tables 5.6 and 5.7 summarize the results from estimating the unrestricted returns/components models using the reformulated variables. As indicated in chapter IV, the model was estimated using three alternative return metrics [(1) market model prediction errors calculated using individual firm parameters, (2) market model prediction errors calculated using size-based portfolio parameters, and (3) realized returns] and two return windows (-9,+3 and -8,+4). The six combinations of return metrics/windows produced similar results. For comparability with prior studies [e.g., Lipe (1986), Jennings (1990), and Livnat and Zarowin (1990)], the results presented in tables 5.6 and 5.7 are based on market model prediction errors using firm-specific parameters and a -9,+3 return window.

Table 5.6 (page 53) shows an across-firms, mean A-coefficient of -1.34, -0.86, and 0.69 for $UCRE_i$, UCA_i, and UNA_i, respectively, using the unrestricted procedure. The related median coefficients are -0.90, -0.58, and 0.24. Two additional procedures are performed to determine whether an individual component provides incremental information, given the information provided by the other two: (1) 57 firm-by-firm tests of whether each component's A-coefficient is significantly greater than zero and (2) a single binomial test of whether the number of significant A-coefficients is greater than expected by chance. Table 5.7 (page 54) identifies the numbers of significant A-coefficients and shows that $UCRE_i$, UCA_i, and $UTNA_i$ fail to provide incremental information, given the information provided by the other two components. Only 3 (3), 2(5), and 4(8) of the sample firms have significantly positive A-coefficients for $UCRE_i$, UCA_i, and $UTNA_i$, respectively, at the 10% (20%) level. The observed proportion of significant *t*-statistics is 5.2% (5.2%), 3.4% (8.6%), and 6.9% (13.8%) for $UCRE_i$, UCA_i, and $UTNA_i$, respectively. Thus, the binomial test also implies acceptance of H_{01} at conventional levels of significance.

TABLE 5.6

SUMMARY STATISTICS FOR THE COMPONENT RESPONSE COEFFICIENTS FROM THE UNRESTRICTED RETURNS/COMPONENTS MODEL (REFORMULATED VARIABLES)

Coef.	Mean	Std. Dev.	Min.	1st. Q'tile	Med.	3rd. Q'tile	Max.
$a_{cre,i}$	-1.34	2.91	-9.79	-2.20	-0.90	-0.07	5.45
$a_{ca,i}$	-0.86	3.37	-9.59	-1.59	-0.58	0.81	6.35
$a_{tna,i}$	0.69	8.66	-27.57	-3.63	0.24	2.75	30.00

The A-coefficients ($a_{j,i}$) in table 4.6 were estimated across time (1959-90) for each of the 58 sample firms using equation 4.1 from the time-series model described in chapter IV.

$a_{cre,i}$ = the empirically observed response coefficient associated with unexpected cash revenues and expenses for firm i.

$a_{ca,i}$ = the empirically observed response coefficient associated with unexpected current accruals for firm i.

$a_{tna,i}$ = the empirically observed response coefficient associated with unexpected noncurrent accruals for firm i.

Mean = the cross-firm mean of the A-coefficients.

Std. Dev. = the cross-firm standard deviation of the A-coefficients.

Min. = the minimum A-coefficient.

1st. Q'tile = the first quartile.

Med. = the median A-coefficient.

3rd. Q'tile = the third quartile.

Max. = the maximum A-coefficient.

TABLE 5.7

NUMBER OF SIGNIFICANT COMPONENT RESPONSE COEFFICIENTS FROM THE UNRESTRICTED RETURNS/COMPONENTS MODEL (REFORMULATED VARIABLES)

Number of A-Coefficients that are Significant at the 10% Level			
	$a_{cre,i}$	$a_{ca,i}$	$a_{tna,i}$
$t < -1.697$	9	8	3
$t > 1.697$	3	2	4
Total	12	10	7
1-Pr(Bnml)	.8344	.9344	.6860
Number of A-Coefficients that are Significant at the 20% Level			
	$a_{cre,i}$	$a_{ca,i}$	$a_{tna,i}$
$t < -1.310$	12	10	6
$t > 1.310$	3	5	8
Total	15	15	14
1-Pr(Bnml)	.9983	.9814	.8311

The A-coefficients ($a_{j,i}$) in table 5.7 were estimated across time (1959-90) for each of the 58 sample firms using equation 4.1 from the time-series model described in chapter IV.

$a_{cre,i}$ = the empirically observed response coefficient associated with unexpected cash revenues and expenses for firm i.

$a_{ca,i}$ = the empirically observed response coefficient associated with unexpected current accruals for firm i.

$a_{tna,i}$ = the empirically observed response coefficient associated with unexpected noncurrent accruals for firm i.

1-Pr(Bnml) = 1 - the probability that an observation from a binomial distribution is less than or equal to 10% (20%).

Similar results are produced when the returns/components model is estimated using the conventionally-defined variables (see table 5.5, page 51). The first procedure for testing H_{01} yields an *F*-statistic with 2 and 107 degrees of freedom for each of the 57 sample firms for which the returns/components model converged.[22] None of these statistics are significant at conventional levels. The overall *F*-statistic is -.0011 with 114 and 6,099 degrees of freedom implying acceptance of H_{01}.[23] The results of the binomial test also imply acceptance of H_{01} (the observed proportion of significant *F*-statistics is 0%). Accordingly, the conventionally-defined components also fail to provide incremental information in relation to aggregate earnings using a time-series approach.

Table 5.8 (page 56) summarizes the results from estimating the time-series model using the conventionally-defined variables. This table shows an across-firms, mean A-coefficient for the unrestricted procedure of -2.55, 0.05, and -2.96 for $UCFO_j$, $UCADJ_j$, and UNA_j, respectively. The related median coefficients are -1.73, -0.15, and -1.45. Table 5.9 (page 57) identifies the numbers of significantly positive A-coefficients and shows that none of the conventionally-defined components convey incremental information, given the

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[22]For the conventionally-defined variables, individual firm *F*-statistics are calculated as follows

$$F_{1i} = ((RSSR_{1i} - USSR_i)/2))/(USSR_i/(4 \text{ X } 30 - 13)),$$

where $RSSR_{1i}$ and $USSR_i$ are the restricted and unrestricted sum of squared residuals, respectively.

[23]For the conventionally-defined variables, the overall *F*-statistic is calculated as

$$F = \frac{\sum_{i=1}^{57} (RSSR_{1i} - USSR_i)/(57 \times 2)}{\sum_{i=1}^{57} USSR_i/(57 \text{ X } 107)}.$$

TABLE 5.8

SUMMARY STATISTICS FOR THE COMPONENT RESPONSE COEFFICIENTS FROM THE UNRESTRICTED RETURNS/COMPONENTS MODEL (CONVENTIONALLY-DEFINED VARIABLES)

Coef.	Mean	Std. Dev.	Min.	1st. Q'tile	Med.	3rd. Q'tile	Max.
$a_{cfo,i}$	-2.55	3.33	-12.92	-3.20	-1.73	-0.54	6.64
$a_{cadj,i}$	0.05	1.78	-3.51	-0.73	-0.15	0.69	7.71
$a_{na,i}$	-2.96	5.23	-21.70	-4.66	-1.45	0.50	7.28

The A-coefficients ($a_{j,i}$) in table 5.8 were estimated across time (1960-90) for each of the 58 sample firms using equation 4.1 from the time-series model described in chapter IV.

$a_{cfo,i}$ = the empirically observed response coefficient associated with unexpected operating cash flows for firm i.

$a_{cadj,i}$ = the empirically observed response coefficient associated with unexpected current accrual adjustments for firm i.

$a_{na,i}$ = the empirically observed response coefficient associated with unexpected noncurrent accruals for firm i.

Mean = the cross-firm mean of the A-coefficients.

Std. Dev. = the cross-firm standard deviation of the A-coefficients.

Min. = the minimum A-coefficient.

1st. Q'tile = the first quartile.

Med. = the median A-coefficient.

3rd. Q'tile = the third quartile.

Max. = the maximum A-coefficient.

TABLE 5.9

NUMBER OF SIGNIFICANT COMPONENT RESPONSE COEFFICIENTS FROM THE UNRESTRICTED RETURNS/COMPONENTS MODEL (CONVENTIONALLY-DEFINED VARIABLES)

Number of A-Coefficients that are Significant at the 10% Level			
	$a_{cfo,i}$	$a_{cadj,i}$	$a_{na,i}$
$t < -1.697$	17	4	15
$t > 1.697$	0	7	3
Total	17	11	18
1- Pr(Bnml)	.9975	.2066	.8344
Number of A-Coefficients that are Significant at the 20% Level			
	$a_{cfo,i}$	$a_{cadj,i}$	$a_{na,i}$
$t < -1.310$	18	7	22
$t > 1.310$	1	11	3
Total	19	18	25
1- Pr(Bnml)	.9999	.4375	.9983

The A-coefficients ($a_{j,i}$) in table 5.9 were estimated across time (1960-90) for each of the 58 sample firms using equation 4.1 from the time-series model described in chapter IV.

$a_{cfo,i}$ = the empirically observed response coefficient associated with unexpected operating cash flows for firm i.

$a_{cadj,i}$ = the empirically observed response coefficient associated with unexpected current accrual adjustments for firm i.

$a_{na,i}$ = the empirically observed response coefficient associated with unexpected noncurrent accruals for firm i.

1-Pr(Bnml) = 1 - the probability that an observation from a binomial distribution is less than or equal to 10% (20%).

information provided by the other two components. Only 0 (1), 7 (11), and 3 (3) of the sample firms have significantly positive A-coefficients for $UCADJ_i$, $UCADJ_i$, and UNA_i, respectively, at the 10% (20%) level. The observed proportion of significant *t*-statistics for $UCFO_i$, $UCADJ_i$, and UNA_i are 0% (1.8%), 12.3% (19.3%), and 5.3% (5.3%), respectively. Using the binomial test, these values also imply acceptance of H_{01} for all three variables.

Results of Tests for the Descriptive Validity of the ECVM

To determine whether the A-coefficients are related to the theoretical component response coefficients derived in the ECVM, the system model is estimated under the second set of restrictions described in chapter V. These restrictions express the theoretical response coefficients (the persistence measures) as a linear function of the A-coefficients. If the theoretical response coefficients equal the empirically observed response coefficients, then $d_{0,i}$ will be zero and $d_{1,i}$ will equal one (its theoretical value). Consistent with Lipe (1986), Kormendi and Lipe (1987), and Lipe (1990), the persistence measures are estimated as a perpetuity with a constant discount rate of 10%.

Summary statistics presented in table 5.10 (page 59) show that the cross-firms mean (median) persistence measures for the reformulated variables are 8.96 (8.74), 8.45 (8.48), and 9.97 (10.08) for $PVR_{cre,i}$, $PVR_{ca,i}$, and $PVR_{tna,i}$, respectively. In contrast, table 5.6 (page 53) shows that the mean (median) A-coefficients are -1.34 (-0.90), -0.86 (-0.58), and 0.69 (0.24), respectively, for CRE_i, CA_i, and TNA_i.

Table 5.11 (page 61) presents summary statistics for the D-coefficients that relate the persitence measures to the A-coefficients. This table shows that the mean (median) $d_{1,i}$ is -2.37 (.05). Moreover, table 5.12 (page 62) reveals

TABLE 5.10

SUMMARY STATISTICS FOR THE PERSISTENCE MEASURES FROM THE RETURNS/COMPONENTS MODEL (REFORMULATED VARIABLES)

Coef.	Mean	Std. Dev.	Min.	1st. Q'tile	Med.	3rd. Q'tile	Max.
$PVR_{cre,i}$	8.96	3.33	0.72	7.24	8.74	10.68	20.54
$PVR_{ca,i}$	8.45	3.48	-1.73	7.25	8.48	10.09	19.69
$PVR_{tna,i}$	9.97	7.09	-8.19	4.96	10.08	13.17	30.36

The persistence measures ($PVR_{j,i}$) in table 5.10 were estimated using the returns/components model under the second set of restrictions described in chapter IV. Consistent with Lipe (1986), Kormendi and Lipe (1987), and Lipe (1990), the discount rate is assumed to be 10%.

$PVR_{cre,i}$ = the estimated persistence measure associated with unexpected cash revenues and expenses for firm i.

$PVR_{ca,i}$ = the estimated persistence measure associated with unexpected current accruals for firm i.

$PVR_{tna,i}$ = the estimated persistence measure associated with unexpected tax-modified noncurrent accruals for firm i.

Mean = the cross-firm mean of the persistence measures.

Std. Dev. = the cross-firm standard deviation of the persistence measures.

Min. = the minimum persistence measure.

1st. Q'tile = the first quartile.

Med. = the median persistence measure.

3rd. Q'tile = the third quartile.

Max. = the maximum persistence measure.

that only 1 (6) of the $d_{1,i}$-coefficients are significantly positive at the 10% (20%) level. Given these values, the binomial test implies acceptance of the null hypothesis for the reformulated variables. Hence, the empirically observed component response coefficients are not related to the theoretical component response coefficients.

A similar procedure is used to test H_{02} using the conventionally-defined variables. That is, the persistence measures are estimated as a perpetuity using a constant discount rate of 10%. However, because these variables cannot be linked directly to operating cash flows in the same manner as the reformulated variables, the persistence measures for $UCFO_i$, $UCADJ_i$, and UNA_i were derived using the weak earnings capitalization model proposed by Lipe (1986), Kormendi and Lipe (1987), and Lipe (1990)].[24]

Table 5.13 (page 63) summarizes the results from estimating the persistence measures for the conventionally-defined variables. This table shows that the cross-firms mean (median) persistence measures for these variables are 13.84 (13.25), 4.25 (4.05), and 11.35 (8.16) for $PVR_{cfo,i}$, $PVR_{cadj,i}$, and $PVR_{na,i}$, respectively. In contrast, table 5.8 (page 56) shows that the mean (median) A-coefficients are -2.55 (-1.73), 0.05 (-0.15), and -2.96 (-1.45), respectively, for for CFO_i, $CADJ_i$, and NA_i.

Table 5.14 (page 65) presents summary statistics for the D-coefficients that result from estimating the returns/components model under the second set of restrictions using the conventionally-defined variables. This table shows that the mean (median) $d_{1,i}$ is -0.19 (-0.12) compared with the theoretical value of 1.00. Similarly, table 5.15 (page 66) reveals that only 2 (3) of the $d_{1,i}$-coefficients are significantly positive at the 10% (20%) level. Accordingly, the binomial test

[24]Appendix C derives the theoretical component response coefficients for the conventionally-defined variables using the weak earnings capitalization model.

TABLE 5.11

SUMMARY STATISTICS FOR THE REGRESSION COEFFICIENTS FROM THE SECOND SET OF RESTRICTIONS (REFORMULATED VARIABLES)

Coef. & t-statistic	Mean	Std. Dev.	Min.	1st. Q'tile	Med.	3rd. Q'tile	Max.
$d_{0,i}$	7.62	73.16	-85.57	-4.65	-0.57	2.11	449.44
$d_{1,i}$	-2.37	18.28	-129.75	-0.48	0.05	0.62	9.95

The D-coefficients ($d_{j,i}$) in table 5.11 were estimated across time (1959-90) for each of the 57 sample firms according to the second set of restrictions described by equation 4.4 in chapter IV.

$d_{0,i}$ = the intercept coefficient for firm i.
$d_{1,i}$ = the slope coefficient for firm i.
Mean = the cross-firm mean of the D-coefficients.
Std. Dev. = the cross-firm standard deviation of the D-coefficients.
Min. = the minimum D-coefficient.
1st. Q'tile = the first quartile.
Med. = the median D-coefficient.
3rd. Q'tile = the third quartile.
Max. = the maximum D-coefficient.

TABLE 5.12

NUMBER OF SIGNIFICANT RESPONSE COEFFICIENTS FROM THE SECOND SET OF RESTRICTIONS (REFORMULATED VARIABLES)

Number of D-Coefficients that are Significant at the 10% Level		
	d_0	d_1
t < -1.697	2	2
t > 1.697	1	1
Total	3	3
1-Pr(Bnml)	.9819	.9819

Number of D-Coefficients that are Significant at the 20% Level		
	d_0	d_1
t < -1.310	6	6
t > 1.310	2	6
Total	8	12
1-Pr(Bnml)	.9997	.9549

The D-coefficients ($d_{j,i}$) in table 5.12 were estimated across time (1959-90) for each of the 57 sample firms according to the second set of restrictions described by equation 4.4 in chapter IV.

$d_{0,i}$ = the intercept coefficient for firm i.
$d_{1,i}$ = the slope coefficient for firm i.
1-Pr(Bnml) = 1 - the probability that an observation from a binomial distribution is less than or equal to 10% (20%).

TABLE 5.13

SUMMARY STATISTICS FOR THE PERSISTENCE MEASURES
FROM THE RETURNS/COMPONENTS MODEL
(CONVENTIONALLY-DEFINED VARIABLES)

Coef.	Mean	Std. Dev.	Min.	1st. Q'tile	Med.	3rd. Q'tile	Max.
$PVR_{cfo,i}$	13.84	13.06	-40.70	6.95	13.25	18.71	59.18
$PVR_{cadj,i}$	4.25	2.47	-2.79	2.62	4.05	6.10	9.83
$PVR_{na,i}$	11.35	13.94	-28.62	4.85	8.16	17.82	61.07

The persistence measures ($PVR_{j,i}$) in table 5.13 were estimated using the returns/components model under the second set of restrictions described by equation 4.4 in chapter IV. Consistent with Lipe (1986), Kormendi and Lipe (1987), and Lipe (1990), the discount rate is assumed to be 10%.

$PVR_{cfo,i}$ = the estimated persistence measure associated with unexpected operating cash flows for firm i.

$PVR_{cadj,i}$ = the estimated persistence measure associated with unexpected current accrual adjustments for firm i.

$PVR_{na,i}$ = the estimated persistence measure associated with unexpected noncurrent accruals for firm i.

Mean = the cross-firm mean of the persistence measures.

Std. Dev. = the cross-firm standard deviation of the persistence measures.

Min. = the minimum persistence measure.

1st. Q'tile = the first quartile.

Med. = the median persistence measure.

3rd. Q'tile = the third quartile.

Max. = the maximum persistence measure.

also implies acceptance of the null hypothesis for the conventionally-defined variables.

Empirical Results -- Cross-Sectional Approach

Recall that the cross-sectional model described in chapter IV is estimated to assess the impact of methodological refinements (i.e., the reformulated earnings components and the time-series approach). However, because the cross-sectional approach assumes that the A-coefficients are constant across firms, only hypothesis one is tested. Moreover, for comparability with prior studies (and the time-series model discussed above), the results presented in this section are based on estimation of equation 4.5 using (1) market model residuals calculated on the basis of firm-specific parameters and (2) unexpected component values derived from random walk expectations models.

Using a cross-sectional approach, the null hypothesis that the earnings components do not possess incremental information content implies that the A-coefficients will be equal across components for each of the sample years. The first procedure for testing H_{01} with the reformulated variables yields an F-statistic with 2 and 54 degrees of freedom for each of the 32 sample years. Table 5.5 (page 51) shows that 9 (6) of these statistics lie outside the 80% (90%) confidence interval of the $F(2,54)$ distribution.[25] The overall F-statistic is 1.90 with 64 and 1,726 degrees of freedom implying rejection of H_{01} at less than the

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[25]For the reformulated variables, individual year F-statistics are calculated as follows

$$F_{1t} = ((RSSR_{1t} - USSR_t)/2)/(USSR_t/(54)),$$

where $RSSR_{1t}$ and $USSR_t$ are the restricted and unrestricted sum of squared residuals, respectively.

TABLE 5.14

SUMMARY STATISTICS FOR THE REGRESSION COEFFICIENTS FROM THE SECOND SET OF RESTRICTIONS (CONVENTIONALLY-DEFINED VARIABLES)

Coef. & t-statistic	Mean	Std. Dev.	Min.	1st. Q'tile	Med.	3rd. Q'tile	Max.
$d_{0,i}$	0.82	2.74	-3.29	-0.44	0.17	1.94	11.33
$d_{1,i}$	-0.19	0.42	-1.73	-0.26	-0.12	0.02	0.91

The D-coefficients ($d_{j,i}$) in table 5.14 were estimated across time (1960-90) for each of the 57 sample firms according to the second set of restrictions described by equation 4.4 in chapter IV.

$d_{0,i}$ = the intercept coefficient for firm i.
$d_{1,i}$ = the slope coefficient for firm i.
Mean = the cross-firm mean of the D-coefficients.
Std. Dev. = the cross-firm standard deviation of the D-coefficients.
Min. = the minimum D-coefficient.
1st. Q'tile = the first quartile.
Med. = the median D-coefficient.
3rd. Q'tile = the third quartile.
Max. = the maximum D-coefficient.

TABLE 5.15

NUMBER OF SIGNIFICANT RESPONSE COEFFICIENTS FROM THE SECOND SET OF RESTRICTIONS (CONVENTIONALLY-DEFINED VARIABLES)

Number of D-Coefficients that are Significant at the 10% Level		
	d_0	d_1
t < -1.697	3	5
t > 1.697	2	2
Total	5	7
1-Pr(Bnml)	.9334	.9334
Number of D-Coefficients that are Significant at the 20% Level		
	d_0	d_1
t < -1.310	1	7
t > 1.310	5	3
Total	6	10
1-Pr(Bnml)	.9814	.9983

The D-coefficients ($d_{j,i}$) in table 5.15 were estimated across time (1960-90) for each of the 58 sample firms according to the second set of restrictions described by equation 4.4 described in chapter IV.

$d_{0,i}$ = the intercept coefficient for firm i.
$d_{1,i}$ = the slope coefficient for firm i.
1-Pr(Bnml) = 1 - the probability that an observation from a binomial distribution is less than or equal to 10% (20%).

.0001 level.[26] The observed proportion of significant F-statistics is 18.8% (28.1%). Accordingly, the binomial test also implies rejection of H_{01} at less than the .0001 level. Together, these results imply that the reformulated earnings components explain more of the variation in abnormal returns than earnings alone. Thus, the components are differentially associated with security returns.[27] Further discussion of the A-coefficients is provided below.

Table 5.16 (page 69) summarizes the results from estimating the cross-sectional model with the reformulated variables. This table reveals an across-years, mean A-coefficient of 1.20, 0.99, and 2.71 for $UCRE_t$, UCA_t, and UNA_t, respectively. The corresponding median coefficients are 0.57, 0.59, and 0.96. Two additional procedures are performed to determine whether an individual component has incremental information content, given the information provided by the other two components: (1) 32 year-by-year tests of whether each component's A-coefficient is significantly greater than zero and (2) a single test of whether the number of significant A-coefficients is greater than expected by chance (using t-statistics and the binomial test). Table 5.17 (page 70) identifies the number of significant A-coefficients. This table shows that 10 (15), 7 (10), and 10 (14) of these values are significant at the 10% (20%) level for $UCRE_t$,

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[26]For the reformulated variables, the overall F-statistic is calculated as

$$F = \frac{\sum_{t=1}^{32} (RSSR_{1t} - USSR_t)/(32 \text{ X } 2)}{\sum_{i=1}^{32} USSR_t/(32 \text{ X } 54)}.$$

[27]One reason for the improved results is that, according to the results of the SAS collinearity diagnostics, the multicollinearity problem was lessened when the cross-sectional approach was used. Another reason for the improvement is the increase in sample size (58 firms-per-year vs. 32 years-per-firm) using the cross-sectional approach.

UCA_t, and $UTNA_t$, respectively. The observed proportion of significantly positive *t*-statistics for $UCRE_t$, UCA_t, and $UTNA_t$, respectively, are 31.3% (46.9%), 21.9% (31.3%), and 31.3% (43.8%). Using the binomial test, these values support rejection of H_{01} at less than the 5% level. Thus, each of the reformulated variables provide incremental information, given the information provided by the other two components.

Taken together, the two procedures for testing H_{01} imply that investors will prefer separate disclosure of the reformulated variables. That is, the results of the first procedure imply that the components are differentially associated with security returns. Furthermore, the results of the second procedure imply that all three components are value relevant. Therefore, disclosing CRE_t, CA_t, and TNA_t will convey additional information beyond aggregate earnings alone.

Similarly, the first procedure for testing H_{01} using the conventionally-defined variables shows that 8 (5) of these statistics lie outside the 80% (90%) confidence interval of the F(2,54) distribution (see table 5.5, page 51). The overall F-statistic is 1.30 with 62 and 1,620 degrees of freedom implying rejection of H_{01} at the .06 level. Moreover, the observed proportion of significant F-statistics is 16.1% (25.8%) at the 10% (20%) level implying rejection of H_{01} at the .07 level using the binomial test. Thus, the conventionally-defined variables are also differentially associated with security returns.

Table 5.18 (page 72) summarizes the results from estimating the cross-sectional model using the conventionally-defined variables. This table shows an across-years, mean (median) A-coefficient of 1.90 (1.52), -0.06 (-0.06), and -1.17 (-0.36) for $UCFO_t$, $UCADJ_t$, and UNA_t, respectively. Table 5.19 (page 73) identifies the numbers of significant A-coefficients for the conventionally-defined variables. These results show that 15 (20) of the A-coefficients relating to $UCFO_t$ lie outside of the 80% (90%) confidence interval. The observed

TABLE 5.16

SUMMARY STATISTICS FOR THE COMPONENT RESPONSE COEFFICIENTS FROM THE UNRESTRICTED CROSS-SECTIONAL MODEL (REFORMULATED VARIABLES)

Coef.	Mean	Std. Dev.	Min.	1st. Q'tile	Med.	3rd. Q'tile	Max.
$a_{cre,t}$	1.20	2.04	-3.45	-0.33	0.57	1.37	6.86
$a_{ca,t}$	0.99	2.14	-4.95	-0.01	0.59	1.61	6.82
$a_{tna,t}$	2.71	5.76	-11.31	-0.09	0.96	5.44	18.69

The A-coefficients ($a_{j,t}$) in table 5.16 were estimated across firms (58) for each of the sample years (1959-90) using the cross-sectional model (equation 4.5) described in chapter IV.

$a_{cre,t}$ = the empirically observed response coefficient associated with unexpected cash revenues and expenses for year t.

$a_{ca,t}$ = the empirically observed response coefficient associated with unexpected current accruals for year t.

$a_{tna,t}$ = the empirically observed response coefficient associated with unexpected noncurrent accruals for year t.

Mean = the cross-firm mean of the A-coefficients.

Std. Dev. = the cross-firm standard deviation of the A-coefficients.

Min. = the minimum A-coefficient.

1st. Q'tile = the first quartile.

Med. = the median A-coefficient.

3rd. Q'tile = the third quartile.

Max. = the maximum A-coefficient.

TABLE 5.17

NUMBER OF SIGNIFICANT COMPONENT RESPONSE COEFFICIENTS FROM THE UNRESTRICTED CROSS-SECTIONAL MODEL (REFORMULATED VARIABLES)

Number of A-Coefficients that are Significant at the 10% Level

	$a_{cre,t}$	$a_{ca,t}$	$a_{tna,t}$
t < -1.684	1	3	1
t > 1.684	10	7	10
Total	11	10	11
1-Pr(Bnml)	.0002	.0117	.0002

Number of A-Coefficients that are Significant at the 20% Level

	$a_{cre,t}$	$a_{ca,t}$	$a_{tna,t}$
t < -1.303	2	3	1
t > 1.303	15	10	14
Total	17	13	15
1-Pr(Bnml)	.0001	.0411	.0006

The A-coefficients ($a_{j,t}$) in table 5.17 were estimated across firms (58) for each of the sample years (1959-90) using the cross-sectional model (equation 4.5) described in chapter IV.

$a_{cre,t}$ = the empirically observed response coefficient associated with unexpected cash revenues and expenses for year t.

$a_{ca,t}$ = the empirically observed response coefficient associated with unexpected current accruals for year t.

$a_{tna,t}$ = the empirically observed response coefficient associated with unexpected noncurrent accruals for year t.

1-Pr(Bnml) = 1 - the probability that an observation from a binomial distribution is less than or equal to 10% (20%).

proportion of significant *t*-statistics for $UCFO_t$ is 50.0% (66.7%) at the 10% (20%) level. Using the binomial test, these values imply rejection of H_{01} at less than the .0001 level. Thus, $UCFO_t$ provides incremental information, given the information provided by UNA_t and $UCADJ_t$.

Table 5.19 also shows that only 2 (2) of the A-coefficients for UNA_t are significantly positive at the 10% (20%) level -- contrary to the predictions of the weak earnings capitalization model. In this context, recall that the weak earnings capitalization model predicts that unexpected increases (decreases) in NA_t will generate negative (positive) abnormal returns. For example, if depreciation expense is the only noncurrent accrual, the information conveyed by UNA_t about unexpected changes in the estimated life of the firm's plant assets is expected to overwhelm any related tax-savings information implying that a_{3t} will be positive (whether UNA_t is positive or negative). Therefore, if the incremental information content of UNA_t is judged in relation to the predictions of this model, then UNA_t fails to convey incremental information given the information provided by $UCFO_t$ and UCA_t. The observed proportion of significant *t*-statistics is only 6.7% (6.7%) at the 10% (20%) level implying acceptance of H_{01} using the binomial test.

On the other hand 8 (10) of the A-coefficients for UNA_t are significantly negative at the 10% (20%) level -- consistent with the predictions of the ECVM. In this regard, recall that the ECVM predicts that information conveyed by UNA_t about unexpected changes in current and future tax savings will overwhelm any other information conveyed by UNA_t and that a_{3t} will be negative (whether UNA_t is positive or negative). Therefore, if the incremental information content of UNA_t is judged in relation to the predictions of the ECVM, then UNA_t has incremental information content, given the information provided by $UCFO_t$ and UCA_t. The observed proportion of significant negative *t*-statistics is 26.7%

TABLE 5.18

SUMMARY STATISTICS FOR THE COMPONENT RESPONSE COEFFICIENTS FROM THE UNRESTRICTED CROSS-SECTIONAL MODEL (CONVENTIONALLY-DEFINED VARIABLES)

Coef.	Mean	Std. Dev.	Min.	1st. Q'tile	Med.	3rd. Q'tile	Max.
$a_{cfo,t}$	1.90	2.09	-0.92	0.43	1.52	3.09	7.69
$a_{cadj,t}$	-0.06	0.41	-0.80	-0.34	-0.06	0.26	0.94
$a_{na,t}$	-1.17	2.31	-5.35	-3.23	-0.36	0.03	5.12

The A-coefficients ($a_{j,t}$) in table 5.18 were estimated across firms (58) for each of the sample years (1960-90) using the cross-sectional model (equation 4.5) described in chapter IV.

$a_{cfo,t}$ = the empirically observed response coefficient associated with unexpected operating cash flows for year t.

$a_{cadj,t}$ = the empirically observed response coefficient associated with unexpected current accrual adjustments for year t.

$a_{na,t}$ = the empirically observed response coefficient associated with unexpected noncurrent accruals for year t.

Mean = the cross-firm mean of the A-coefficients.

Std. Dev. = the cross-firm standard deviation of the A-coefficients.

Min. = the minimum A-coefficient.

1st. Q'tile = the first quartile.

Med. = the median A-coefficient.

3rd. Q'tile = the third quartile.

Max. = the maximum A-coefficient.

TABLE 5.19

NUMBER OF SIGNIFICANT COMPONENT RESPONSE COEFFICIENTS FROM THE UNRESTRICTED CROSS-SECTIONAL MODEL (CONVENTIONALLY-DEFINED VARIABLES)

Number of A-Coefficients that are Significant at the 10% Level			
	$a_{cfo,t}$	$a_{cadj,t}$	$a_{na,t}$
t < -1.684	0	3	8
t > 1.684	15	3	2
Total	15	6	10
1-Pr(Bnml)	< .0001	.3762	.6114
Number of A-Coefficients that are Significant at the 20% Level			
	$a_{cfo,t}$	$a_{cadj,t}$	$a_{na,t}$
t < -1.303	1	5	10
t > 1.303	20	5	2
Total	21	10	12
1-Pr(Bnml)	< .0001	.6069	.9626

The A-coefficients ($a_{j,t}$) in table 5.19 were estimated across firms (58) for each of the sample years (1960-90) using the cross-sectional model (equation 4.5) described in chapter IV.

$a_{cfo,t}$ = the empirically observed response coefficient associated with unexpected operating cash flows for year t.

$a_{cadj,t}$ = the empirically observed response coefficient associated with unexpected current accrual adjustments for year t.

$a_{na,t}$ = the empirically observed response coefficient associated with unexpected noncurrent accruals for year t.

1-Pr(Bnml) = 1 - the probability that an observation from a binomial distribution is less than or equal to 10% (20%).

(33.3%) at the 10% (20%) level implying rejection of H_{01} at the 5% level using the binomial test.

Finally, table 5.19 also shows that $UCADJ_t$ fails to provide incremental information given the information provided by $UCFO_t$ and UCA_t. Only 3 (5) of the *t*-statistics are significantly positive at the 10% (20%) level. The observed proportion of significantly positive *t*-statistics is 9.7% (16.1%) implying acceptance of H_{01} using the binomial test. This result is also consistent with the predictions of the ECVM concerning the garbling of information conveyed by $UCADJ_t$. That is, the information conveyed by $UCADJ_t$ about revisions in current and future cash flows is unlikely to be useful to market participants.

Taken together, the two procedures for testing H_{01} also imply that market participants will prefer that CFO_t and NA_t are disclosed separately. That is, the results of the first procedure imply that the conventionally-defined components are differentially associated with security returns while the results of the second procedure imply that CFO_t and NA_t are value relevant. Therefore, disclosing CFO_t and NA_t conveys additional information beyond aggregate earnings alone.

Empirical Results - Predictive-Ability Approach

Using the predictive-ability approach, the component data will have incremental information content if the unrestricted cash flow prediction model generates smaller forecast errors than the restricted cash flow prediction model. The results of predictive-ability tests for both the reformulated variables and the conventionally-defined variables are reported in tables 5.20 and 5.21. These results show statistically significant increases in predictive accuracy from the use of the component data.

Table 5.20 (page 76) shows that the model based on the reformulated variables yields a mean (median) differences in MAEs of 29.4% (29.1%) when compared to the model based on aggregate earnings alone. Moreover, all test statistics are significant at the .01 level. The *t*-statistic is 4.92 and the Wilcoxen Signed Rank test statistic is 606.5.

Similarly, table 5.21 (page 77) shows that the model based on the reformulated variables yields a mean (median) differences in MSEs of 23.9% (22.1%) when compared to the model based on aggregate earnings alone. All test statistics pertaining to the differences in MSEs are significant at the .05 level. The *t*-statistic is 2.39 and the Wilcoxen Signed Rank test statistic is 333.5.

Together, the results presented in tables 5.20 and 5.21 support rejection of H_{03} for the reformulated variables. That is, these results imply that the reformulated earnings components convey incremental information that is useful for predicting future cash flows. Accordingly, the results also imply that the reformulated variables have incremental information content over aggregate earnings.

The model based on the conventionally-defined variables yields even greater improvements in predictive ability when compared to aggregate earnings alone. Table 5.20 (page 76) shows a mean (median) differences in MAEs of 36.4% (31.3%) for the conventionally-defined variables in relation to aggregate earnings. Furthermore, all test statistics are significant at the .01 level. The *t*-statistic is 7.14 while the Wilcoxen Signed Rank test statistic is 768.0. Similarly, table 5.21 (page 77) shows that the mean (median) differences in MSEs are 42.0% (50.6%) with all test statistics significant at the .05 level. The *t*-statistic is 4.96 and Wilcoxen Signed Rank test statistic is 561.0. The relatively larger mean (median) differences in MSEs, compared to the mean (median) differences in MAEs imply that there are some relatively large positive

TABLE 5.20

SUMMARY STATISTICS FROM TESTS OF DIFFERENCES IN MEAN ABSOLUTE ERRORS (MAEs)

Difference in MAE	Mean-Difference	Std. Dev.	*t*-Statistic	1st. Q'tile	Med.	3rd. Q'tile	Wilcoxen Signed Rank Test Statistic
$D_{a\text{-}rv,i}$	0.294	0.454	4.92	0.515	0.291	0.097	606.5
$D_{a\text{-}cdv,i}$	0.364	0.388	7.14	0.547	0.313	0.102	768.0
$D_{cdv\text{-}rv,i}$	0.043	0.321	1.01	-0.049	-0.008	0.107	101.5

The prediction models were estimated in pooled time-series, cross-section for the 15 years (X 58 firms) preceding the forecast period using equation 4.6 described in chapter IV.

$D_{a\text{-}rv,i}$ = the MAE for the cash flow prediction model estimated using aggregate earnings alone (a) minus the MAE for the cash flow prediction model estimated using the reformulated variables (rv) (i.e., MAE_a - MAE_{rv}).

$D_{a\text{-}cdv,i}$ = the MAE for the cash flow prediction model estimated using aggregate earnings alone (a) minus the MAE for the cash flow prediction model estimated using the conventionally-defined variables (cdv) (i.e., MAE_a - MAE_{cdv}).

$D_{rv\text{-}cdv,i}$ = the MAE for the cash flow prediction model estimated using the reformulated variables (rv) minus the MAE for the cash flow prediction model estimated using the conventionally defined variables (cdv) (i.e., MAE_{rv} - MAE_{cdv}).

Mean = the cross-firm mean of the $D_{j\text{-}k,i}$.

Std. Dev. = the cross-firm standard deviation of the $D_{j\text{-}k,i}$.

1st. Q'tile = the first quartile.

Med. = the median $D_{j\text{-}k,i}$.

3rd. Q'tile = the third quartile.

TABLE 5.21

SUMMARY STATISTICS FROM TESTS OF DIFFERENCES IN MEAN SQUARED ERRORS (MSEs)

Difference in MSE	Mean-Difference	Std. Dev.	*t*-Statistic	1st. Q'tile	Med.	3rd. Q'tile	Wilcoxen Signed Rank Test Statistic
$D_{a\text{-}rv,i}$	0.239	0.759	2.39	1.000	0.221	0.176	333.5
$D_{a\text{-}cdv,i}$	0.420	0.638	4.96	1.000	0.506	0.030	561.0
$D_{rv\text{-}cdv,i}$	0.135	0.594	1.73	0.158	0.025	0.762	171.5

The prediction models were estimated in pooled time-series, cross-section for the 15 years (X 58 firms) preceding the forecast period using equation 4.6 described in chapter IV.

$D_{a\text{-}rv,i}$ = the MSE for the cash flow prediction model estimated using aggregate earnings alone (a) minus the MSE for the cash flow prediction model estimated using the reformulated variables (rv) (i.e., MSE_a - MSE_{rv}).

$D_{a\text{-}cdv,i}$ = the MSE for the cash flow prediction model estimated using aggregate earnings alone (a) minus the MSE for the cash flow prediction model estimated using the conventionally-defined variables (cdv) (i.e., MSE_a - MSE_{cdv}).

$D_{rv\text{-}cdv,i}$ = the MSE for the cash flow prediction model estimated using the reformulated variables (rv) minus the MSE for the cash flow prediction model estimated using the conventionally defined variables (cdv) (i.e., MSE_{rv} - MSE_{cdv}).

Mean = the cross-firm mean of the $D_{j\text{-}k,i}$.

Std. Dev. = the cross-firm standard deviation of the $D_{j\text{-}k,i}$.

1st. Q'tile = the first quartile.

Med. = the median $D_{j\text{-}k,i}$.

3rd. Q'tile = the third quartile.

differences (i.e., component data superiority). This conclusion is also supported by the contrast between the mean and median differences, and the differences at the quartiles, for both the MAEs and MSEs. Accordingly, the results pertaining to the conventionally-defined variables also support rejection of H_{03}.

For comparison purposes, the differences in MAEs and MSEs are also calculated for the reformulated variables in relation to the conventionally-defined variables. Table 5.20 (page 76) shows that the conventionally-defined variables have slightly greater predictive ability than the reformulated variables when the MAEs are compared (i.e., a mean differences of 4.3%). However, the differences are not significant at conventional levels. The *t*-statistic is 1.01 and the Wilcoxen Signed Rank Test statistic is 101.5. While the differences in MAEs are not significant, the differences in MSEs indicate statistically significant incremental predictive ability for the conventionally-defined variables. Table 5.21 (page 77) shows a mean (median) differences in MSEs of 13.5% (2.5%) indicating some relatively large positive differences (i.e., conventionally-defined component superiority). This conclusion is also supported by the existence of large differences (76.2%) at the third quartile. Therefore, if financial statement users have quadratic loss functions, the differences in MSEs support the notion that the conventionally-defined variables have incremental predictive ability over the reformulated variables.

Finally, tables 5.22-5.25 summarize the results of estimating the pooled cross-section, time-series cash flow prediction model. Table 5.22 (page 80) reveals a mean C-coefficient of 0.97, 0.98, and 1.13 for c_{cre}, c_{ca}, c_{tna}, respectively. The related median coefficients are 0.96, 1.01, and 1.05. As shown in Table 5.23 (page 81), all C-coefficients are significantly positive at the .0001 level. Table 5.24 (page 82) indicates that the mean (median) C-coefficients for c_{cfo}, c_{cadj}, and c_{na}, respectively, are 1.00 (0.99), 1.05 (.95), and

-0.01 (0.10). Table 25 (page 83) shows that all of the C-coefficients for c_{cfo} and c_{cadj} are significantly positive at the .0001 level. Additionally, all of the C-coefficients relating to c_{na} are significant at the .0001 level. However, 8 (7) of these coefficients are positive (negative) indicating that NA may convey information about both changes in the life of plant assets and tax shielding effects. This result also suggests a plausible explanation for the incremental predictive ability of the conventionally-defined variables over the reformulated variables. That is, given that the value of TNA is imbedded in CFO, the conventionally-defined variables may generate smaller forecast errors during periods in which TNA and NA convey conflicting information. For example, assume that the only noncurrent accrual is depreciation expense. An increase in NA (and TNA) resulting from a change in the estimated life of a firm's plant assets may signal both reduced future operating cash flows (e.g., due to financial distress) and increased tax shielding effects. Therefore, the conventionally-defined variables may convey information pertinent to both reduced operating cash flows and increased tax shielding effects, while the reformulated variables may only convey information pertinent to the latter.

TABLE 5.22

SUMMARY STATISTICS FOR THE REGRESSION COEFFICIENTS FROM THE UNRESTRICTED CASH FLOW PREDICTION MODEL (REFORMULATED VARIABLES)

Coef.	Mean	Std. Dev.	Min.	1st. Q'tile	Med.	3rd. Q'tile	Max.
c_{cre}	0.97	0.11	0.81	0.86	0.96	1.10	1.12
c_{ca}	0.98	0.14	0.71	0.87	1.01	1.11	1.15
c_{tna}	1.13	0.17	0.90	1.00	1.05	1.32	1.42

The C-coefficients (c_j) in table 22 were estimated in pooled time-series, cross-section for the 15 years (X 58 firms) preceeding the forecast period using equation 4.6 described in chapter IV.

c_{cre} = the empirically observed regression coefficient associated with unexpected cash revenues and expenses.

c_{ca} = the empirically observed regression coefficient associated with unexpected current accruals.

c_{tna} = the empirically observed regression coefficient associated with unexpected noncurrent accruals.

Mean = the cross-firm mean of the C-coefficients.

Std. Dev. = the cross-firm standard deviation of the C-coefficients.

Min. = the minimum C-coefficient.

1st. Q'tile = the first quartile.

Med. = the median C-coefficient.

3rd. Q'tile = the third quartile.

Max. = the maximum C-coefficient.

TABLE 5.23

NUMBER OF SIGNIFICANT REGRESSION COEFFICIENTS FROM THE UNRESTRICTED CASH FLOW PREDICTION MODEL (REFORMULATED VARIABLES)

Number of C-Coefficients that are Significant at the .01% Level

	c_{cre}	c_{ca}	c_{tna}
$t < -3.090$	0	0	0
$t > 3.090$	15	15	15
Total	15	15	15
1-Pr(Bnml)	< .0001	< .0001	< .0001

The C-coefficients (c_j) in table 23 were estimated in pooled time-series, cross-section for the 15 years (X 58 firms) preceeding the forecast period using equation 4.6 described in chapter IV.

c_{cre} = the empirically observed regression coefficient associated with unexpected cash revenues and expenses.

c_{ca} = the empirically observed regression coefficient associated with unexpected current accruals.

c_{tna} = the empirically observed regression coefficient associated with unexpected noncurrent accruals.

1-Pr(Bnml) = 1 - the probability that an observation from a binomial distribution is less than or equal to .01%.

TABLE 5.24

SUMMARY STATISTICS FOR THE REGRESSION COEFFICIENTS FROM THE UNRESTRICTED CASH FLOW PREDICTION MODEL (CONVENTIONALLY-DEFINED VARIABLES)

Coef.	Mean	Std. Dev.	Min.	1st. Q'tile	Med.	3rd. Q'tile	Max.
c_{cfo}	1.00	0.34	0.58	0.63	0.99	1.39	1.50
c_{cadj}	1.05	0.31	0.69	0.72	0.95	1.43	1.52
c_{na}	-0.01	0.75	-1.06	-0.86	0.10	0.78	0.87

The C-coefficients (c_j) in table 24 were estimated in pooled time-series, cross-section for the 15 years (X 58 firms) preceeding the forecast period using equation 4.6 described in chapter IV.

c_{cfo} = the empirically observed regression coefficient associated with unexpected operating cash flows.

c_{cadj} = the empirically observed regression coefficient associated with unexpected current accrual adjustments.

c_{na} = the empirically observed response coefficient associated with unexpected noncurrent accruals.

Mean = the cross-firm mean of the C-coefficients.

Std. Dev. = the cross-firm standard deviation of the C-coefficients.

Min. = the minimum C-coefficient.

1st. Q'tile = the first quartile.

Med. = the median C-coefficient.

3rd. Q'tile = the third quartile.

Max. = the maximum C-coefficient.

TABLE 5.25

NUMBER OF SIGNIFICANT REGRESSION COEFFICIENTS FROM THE UNRESTRICTED CASH FLOW PREDICTION MODEL (CONVENTIONALLY-DEFINED VARIABLES)

Number of C-Coefficients that are Significant at the .01% Level

	$c_{cfo,i}$	$c_{cadj,i}$	$c_{na,i}$
t < -3.090	0	0	7
t > 3.090	15	15	8
Total	15	15	15
1-Pr(Bnml)	.0001	.0001	.0001

The C-coefficients (c_j) in table 25 were estimated in pooled time-series, cross-section for the 15 years (X 58 firms) preceeding the forecast period using equation 4.6 described in chapter IV.

c_{cfo} = the empirically observed regression coefficient associated with unexpected operating cash flows.

c_{cadj} = the empirically observed regression coefficient associated with unexpected current accrual adjustments.

c_{na} = the empirically observed regression coefficient associated with unexpected noncurrent accruals.

1-Pr(Bnml) = 1 - the probability that an observation from a binomial distribution is less than or equal to .1%.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The results of this study provide comprehensive evidence on the incremental information content of cash flows and accruals. Taken as a whole, these results indicate that both the reformulated and conventionally-defined cash flow and accrual variables provide incremental information in relation to aggregate earnings alone. Thus, the results of this study support the views of the FASB concerning the usefulness of reporting cash flow and accrual component data in addition to aggregate earnings data.

The study began by deriving a theoretical earnings component valuation model (ECVM) that establishes (1) an information link between ungarbled cash flow and accrual components of earnings and future cash flows and (2) a valuation link between the ungarbled components and stock prices. The model predicts that the theoretical return response to the ungarbled components is a function of the time-series properties of the components and the expected rate of return. The predictions of the model were tested using time-series, cross-sectional, and predictive-ability approaches.

The results of the time-series model proved insignificant. Using the returns/components model, both decompositions failed to provide additional information beyond earnings. This finding is consistent with the results of earlier studies [e.g., Bernard and Stober (1989), Jennings (1990), Charitou and Ketz

(1990), and Livnat and Zarowin (1990)] concerning the incremental information content of cash flows and accruals. Moreover, analysis of the time-series data indicated a high degree of correlation between cash flows and accruals for both decompositions implying that aggregating cash flow and accrual data is unlikely to result in a significant loss of information. The results of the time-series approach also show that empirical estimates of the return reactions to unexpected components derived from the returns/components model are unrelated to the theoretical component response coefficients derived in the ECVM. This result is not surprising given that only a few of the empirically observed response coefficients were significantly greater than zero.

The results of the cross-sectional approach imply that both the reformulated and the conventionally-defined variables explain more of the variation in abnormal returns than earnings alone. That is, both cash flow/accrual decompositions provide incremental information in relation to aggregate earnings. Moreover, all three of the reformulated variables and two of the conventionally-defined variables (operating cash flows and noncurrent accruals) have additional explanatory power, given the information provided by the other two components. Therefore, disclosing cash revenues and expenses, current accruals, and tax-modified noncurrent accruals (or, alternatively, operating cash flows and noncurrent accruals) provides additional information beyond aggregate earnings alone.

The results of the cross-sectional analysis also support the predictions of the ECVM. First, the ECVM predicts that the conventional decomposition garbles the information conveyed by operating cash flows and current accrual adjustments. Consistent with this prediction, the number of significant A-coefficients associated with the current accrual adjustments variable imply that it fails to convey additional information, given the information provided by operating cash flows and noncurrent accruals. Moreover, the number of significant A-coefficients associated with the (ungarbled) current accruals variable imply that it has incremental information content, given the information provided by cash revenues and expenses and tax-modified noncurrent accruals. Second, the ECVM predicts that the return response to noncurrent accruals is related to tax shielding effects. This prediction is supported by a greater number of significantly positive (negative) A-coefficients associated with tax-modified noncurrent accruals (conventionally-defined noncurrent accruals) than expected by chance.

The cross-sectional results reported in Chapter V appear to conflict with the findings of many of the earlier studies. However, they are potentially reconcilable when methodological differences are considered. First, Bernard and Stober (1989) find that operating cash flows fail to provide incremental information in relation to aggregate earnings. However, their analysis centers on the one-week period surrounding the release of the annual report. If market participants use alternative information (e.g., *The Value Line Investment Survey*, analysts' forecasts, etc.) to estimate operating cash flows, then the relatively narrow return window used by Bernard and Sober is unlikely to capture the return reaction to this component. Second, Jennings (1990) finds that operating cash flows, current accrual adjustments, and noncurrent accruals fail to provide additional information beyond earnings. Nevertheless, Jennings' analysis is confounded by two factors: (1) the operating cash flows variable used in Rayburn (1986) is less precise than the operating cash flows variable used in this and other studies [her proxy for operating cash flows may contain more noncurrent accruals - see Rayburn (1986), page 116] and (2) the components defined in Bowen et al. are redundant (i.e., unexpected earnings, unexpected working capital from operations, unexpected operating cash flows, and unexpected cash flow after investment are all included as independent variables in the same regression). Third, Livnat and Zarowin (1990) find that disaggregating earnings into operating cash flows and noncurrent accruals does not improve the association with security returns. However, their results are limited because they do not include current accrual adjustments and noncurrent accruals (or, for that matter, current accruals and tax-modified noncurrent accruals) as separate variables in their regressions. If current accrual adjustments are not informative, as implied by the results presented in chapter V, then aggregating current accrual adjustments and noncurrent accruals (to form the total accruals variable used in their study) is likely to have resulted in a significant loss of information. Fourth, Charitou and Ketz (1990) find that operating cash flows, current accrual adjustments, and noncurrent accruals are not differentially associated with security prices. However, their approach, which involves regressing end-of-year stock prices on realized component values, is likely to be less powerful than the approach used in this study if other variables that play a role in explaining stock prices are adequately controlled by the estimation of abnormal returns.

The results of the predictive-ability approach also support the notion that disaggregated cash flow and accrual data provides incremental information over aggregate earnings. Both the reformulated and conventionally-defined variables show significant gains in predictive-ability in relation to aggregate earnings. Therefore, disclosing cash revenues and expenses, current accruals, and tax-modified noncurrent accruals (or, alternatively, operating cash flows, current accrual adjustments, and noncurrent accruals) provides additional information beyond earnings alone.

Contrary to the predictions of the ECVM, the predictive-ability results also imply that the conventionally-defined variables yield more accurate forecasts of future cash flows than the reformulated variables. Analysis of the C-coefficients from the cash flow prediction model provides a plausible explanation for this result. That is, given that the value of TNA is imbedded in CFO, the conventionally-defined variables may generate smaller forecast errors during periods in which TNA and NA convey conflicting information. If so, the conventionally-defined variables may convey information pertinent to both reduced operating cash flows and increased tax shielding effects, while the reformulated variables may only convey information pertinent to the latter.

Given that the possibility of making meaningful interpersonal utility comparisons and related welfare judgements is eschewed, the new policy implications of this study depend on individual beliefs about the criteria to use in determining whether, and when, an earnings component should be disclosed. In considering policy implications, two alternative criterion are frequently advocated in the literature. Academics [e.g., Lev (1990) and Jennings (1990)] argue that the income disclosure procedure that best explains security returns is the one that ought to be disclosed periodically. Under this criteria, the results of this study imply that the reformulated cash flow and accrual components should also be disclosed when earnings numbers are reported. On the other hand, policy-making bodies (e.g., the FASB) support disclosing the components of earnings that best predict future cash flows. Using this alternative criteria, the above findings imply that the conventionally-defined cash flow and accrual variables should be disclosed when earnings are announced. In any case, neither set of components is currently disclosed directly in any context. Thus, pending the identification of a more substantive income decomposition, I recommend disclosing both the reformulated and the conventionally-defined components in addition to aggregate earnings. The results of the study also suggest that further research on income decompositions is likely to yield additional disclosure implications.

Finally, the results of the study imply that both sets of components are pertinent to, and are being used in (at least in some aggregate sense), security valuation and investment decisions. These implications are informative from the perspective of understanding the process that governs the formation of security prices. The results of the study also suggest that further research on the incremental information content of various earnings decompositions may be fruitful in understanding this process.

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APPENDIXES

APPENDIX A

A NUMERICAL EXAMPLE

To illustrate the dynamics of the ECVM, consider the following numerical example. Assume that the expected earnings components in periods t-1 and t are as follows:

	t-1	t
Cash Revenues and Expenses (CRE)	\$500	\$554
Current Accruals (CA)	\$100	\$106
Tax Modified Noncurrent Accruals (TNA)	\$300	\$330

Furthermore, assume that the firm's stock price at time t-1 (P_{t-1}) = \$1,000, the expected rate of return (r) = .10, the number of periods (s) = 0, 1, 2, and

the matrix of persistence measures ($\mathbf{Z}$) = $\begin{bmatrix} 0.75 & 0.25 & 0.90 \\ 0.50 & 0.50 & 0.10 \\ 0.15 & 0.50 & 1.00 \end{bmatrix}$.

Given these values, we can calculate the unexpected component values in period t as follows.

$$\mathbf{UC}_t = E_{t-1}(\mathbf{C}_t) - E_t(\mathbf{C}_t) = \begin{bmatrix} 554 \\ 106 \\ 330 \end{bmatrix} - \begin{bmatrix} 500 \\ 100 \\ 300 \end{bmatrix} = \begin{bmatrix} 54 \\ 6 \\ 30 \end{bmatrix}.$$

Then, we can calculate the abnormal return in period t using equation 3.15.

$$AR_t = \left[\mathbf{R}^{0\prime} + \sum_{s=0}^{S} \mathbf{R}^{s\prime}\mathbf{Z}^{s} \right] \mathbf{UC}_{t+s}/P_{t-1}$$

$$= \left\{ [\ 1 + 1/1.1 \quad 1\ ] + [\ 1/1.1 \quad 1/1.21 \quad 1/1.1\ ] \begin{bmatrix} 0.75 & 0.25 & 0.90 \\ 0.50 & 0.50 & 0.10 \\ 0.15 & 0.50 & 1.00 \end{bmatrix} \right.$$

$$\left. + [\ 1/1.21 \quad 1/1.331 \quad 1/1.21\ ] \begin{bmatrix} 0.75 & 0.25 & 0.90 \\ 0.50 & 0.50 & 0.10 \\ 0.15 & 0.50 & 1.00 \end{bmatrix} \right\} \begin{bmatrix} 54 \\ 6 \\ 30 \end{bmatrix} /1{,}000$$

$$= 336.55/1{,}000 = 33.655\%$$

APPENDIX B

ESTIMATION PROCEDURES FOR THE RETURNS/COMPONENTS MODEL

As discussed in chapter V, the returns/components model was estimated using the PROC MODEL procedure in the SAS ETS statistical package. The MODEL procedure works as follows. First, the minimization routine is supplied with initial parameter estimates. Consistent with Lipe (1986), the initial time-series coefficient estimates were set at zero - the values implied by a random walk model. The intercept coefficient in the returns equation was also set at zero. The A-coefficients were given starting values of 11 which is their theoretical value assuming a discount rate of 10%. Given these initial values, PROC MODEL uses the Gauss-Newton iterative minimization routine to minimize the sum of squared residuals (SSR) for the system. The Gauss-Newton minimization routine attempts to reduce the SSR by calculating a parameter-change vector at each iteration. The estimation is assumed to have converged when the attempted changes in all of the coefficients are less than 10^{-8}.

The estimation method assumes that the equation errors for each observation are identically and independently distributed with a zero mean vector and positive definite covariance matrix Σ estimated consistently by S. Tests and standard errors reported are based on the convergence of the distribution of the estimates to a normal distribution in large samples.

APPENDIX C

DERIVATION OF THE THEORETICAL RESPONSE COEFFICIENTS USING THE WEAK EARNINGS CAPITALIZATION MODEL

To derive the link between earnings components and abnormal stock returns using the weak earnings capitalization model (WECM), we begin with the classical valuation model [Miller and Modigliani (1961)] described in Chapter 3. Recall that, in this model, the firm's stock price at time t (P_t) is

$$P_t = \sum_{s=1}^{S} R^s E_t(CFO_{t+s}), \qquad (C.1)$$

where,

R = $1/(1 + r)$, r = the expected rate of return, and

$E_t(CFO_{t+s})$ = the expected operating cash flow per share in period t+s.

Let AR_t represent the *earnings induced* abnormal return realized in period t. Assuming that the cash flow in period t is paid out in dividends, AR_t is calculated as follows.

$$AR_t = \frac{P_t + D_t - P_{t-1}}{P_{t-1}} - r \qquad (C.2)$$

To relate AR_t to the firm's earnings components, it must first be expressed as a function of the firm's current and expected future cash flows This relationship is derived below.

$$AR_t = \frac{P_t + CFO_t - (1+r)P_{t-1}}{P_{t-1}} \tag{C.3}$$

$$= \frac{\sum_{s=1}^{S} R^s E_t(CFO_{t+s}) + CFO_t - (1+r)\sum_{s=0}^{S} R^{s+1} E_{t-1}(CFO_{t+s})}{P_{t-1}} \tag{C.4}$$

$$= \frac{\sum_{s=0}^{S} R^s E_t(CFO_{t+s}) - \sum_{s=0}^{S} R^s E_{t-1}(CFO_{t+s})}{P_{t-1}} \tag{C.5}$$

$$= \sum_{s=0}^{S} R^s \frac{E_t(CFO_{t+s}) - E_{t-1}(CFO_{t+s})}{P_{t-1}} \tag{C.6}$$

Next, assuming that the present value of revisions in current and expected future cash flows equals the present value of revisions in current and future (conventionally-defined) earnings components (i.e., the weak earnings capitalization assumption), we can substitute these components into equation C.6 as follows.

$$AR_t = \sum_{s=0}^{S} R^s \frac{E_t(CFO_{t+s}) - E_{t-1}(CFO_{t+s})}{P_{t-1}}$$
$$+ \sum_{s=1}^{S} R^s \frac{E_t(CADJ_{t+s}) - E_{t-1}(CADJ_{t+s})}{P_{t-1}}$$
$$- \sum_{s=0}^{S} R^s \frac{E_t(NA_{t+s}) - E_{t-1}(NA_{t+s})}{P_{t-1}} \qquad (C.7)$$

where,

CFO_{t+s} = operating cash flows realized in period t+s,

$CADJ_{t+s-1}$ = current accrual adjustments per share recorded in period t+s, and

NA_{t+s} = noncurrent accruals per share recorded in period t+s.

Given the link between earnings components and stock prices shown above, we can derive the theoretical return response to operating cash flows, current accrual adjustments, and noncurrent accruals. Assuming that the conventionally-defined component values are generated by a VAR(1) process, we can convert the analytical model above to a general time-series model as follows. First, the expected period-t+s components are expressed in matrix form as a VAR(1) model.

$$E_t(\mathbf{C}_{t+s}) = \mathbf{Z}\mathbf{C}_{t+s-1}, \qquad (C.8)$$

where,

Z = a 3 X 3 matrix of time series coefficients that capture the effect of current component shocks on future component values, and

$\mathbf{C}_{t+s}$ = a 3 X 1 vector containing the period t+s components (CFO_{t+s} and $CADJ_{t+s}$ are coded as positive values and NA_{t+s} is coded as a negative value.

The expected component values in period t+s can also be expressed as a function of all past component shocks as shown below.

$$E_t(\mathbf{C}_{t+s}) = \sum_{k=1}^{K} \mathbf{Z}^k \mathbf{UC}_{t+s-k}, \tag{C.9}$$

where,

$\mathbf{UC}_{t+s-k}$ = a 3 X 1 vector containing the component shocks from period t+s-k.

Next, the revisions in current and expected future cash flows resulting from the component shocks in period t are given by

$$E_t(\mathbf{C}_{t+s}) - E_{t-1}(\mathbf{C}_{t+s}) = \sum_{s=1}^{S} \mathbf{Z}^s \mathbf{UC}_{t+s} + \mathbf{UC}_t \tag{C.10}$$

$$= \left[\mathbf{1}' + \sum_{s=1}^{S} \mathbf{Z}^s \right] \mathbf{UC}_{t+s}, \tag{C.11}$$

where,

$\mathbf{1}$ = a 3 X 1 vector of 1's.

Substituting equation C.6 for the revisions in expected current and future earnings components in equation C.7 yields the present value of revisions in current and expected future cash flows.

$$AR_t = \left[\mathbf{R}^{0'} + \sum_{s=1}^{S} \mathbf{R}^{s'}\mathbf{Z}^{s} \right] \mathbf{UC}_{t+s}/P_{t-1} \tag{C.12}$$

where,

$$\mathbf{R} = \text{a 3 X 1 vector of discount factors} = \begin{bmatrix} R^s \\ R^s \\ R^s \end{bmatrix}.$$

Note that all three variables in the WECM are discounted by s-periods. In contrast, the current accruals variable in the ECVM is discounted by s+1-periods to model the accrual conversion process. Moreover, the WECM also assumes that unexpected increases (decreases) in noncurrent accruals decrease (increase) current and expected future cash flows. On the other hand, the ECVM predicts that unexpected increases (decreases) in *tax-modified* noncurrent accruals increase (decrease) current and expected future cash flows. These differences result because the WECM ignores the accrual conversion process by assuming that the present value of revisions in current and expected future cash flows equals the present value of revisions in current and expected future component values.

The last step is to derive the present value of revisions in current and expected future (aggregate) earnings induced by a shock in component j (PVR_j). These values are calculated by summing across components as follows.

$$\begin{bmatrix} PVR_1 \\ PVR_2 \\ PVR_3 \end{bmatrix} = \begin{bmatrix} 1 + \sum_{s=1}^{S} (R^s Z_{11} + R^{s+1} Z_{12} + R^s Z_{13}) \\ 1 + \sum_{s=1}^{S} (R^s Z_{21} + R^{s+1} Z_{22} + R^s Z_{23}) \\ 1 + \sum_{s=1}^{S} (R^s Z_{31} + R^{s+1} Z_{32} + R^s Z_{33}) \end{bmatrix}. \qquad \text{(C.13)}$$

The interpretation of the persistence measures from the weak earnings capitalization model derived above is similar to that of the persistence measures derived in the ECVM. That is, the theoretical return reaction to the unexpected conventionally-defined earnings components is a function of the time-series properties of the components and the expected rate of return.

VITA

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