EARNINGS MANAGEMENT AND ITS IMPACT ON THE INFORMATION CONTENT OF EARNINGS AND THE PROPERTIES OF ANALYSTS FORECASTS

by

Jinhan Pae

B.B.A., Seoul National University, 1986
M.B.A., Seoul National University, 1988
M.Acc., University of Wisconsin-Madison, 1993

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ABSTRACT

Accounting information is an integral part of the information set used by investors. However, accrual based accounting earnings are susceptible to earnings management. Investors are concerned about earnings management since earnings management can distort reported earnings and they may make decisions that they otherwise would not have made. The purpose of this thesis is to examine the impact of earnings management on the informativeness of reported earnings about firm value and analysts' forecasts.

Chapter 2 develops an earnings management model and examines the impact of earnings management on income smoothing and the earnings response coefficient. Chapter 3 critically reviews the existing discretionary accrual models and discusses the measurements of earnings management and income smoothing, which are used in the subsequent empirical chapters. Chapter 4 empirically examines the impact of earnings management on the earnings response coefficient after controlling either for the smoothness of pre-managed earnings or for the smoothness of reported earnings. Firms are further decomposed into income smoothing and variance-increasing earnings management firms and the same analyses are repeated. Chapter 5 examines the impact of smoothness of reported earnings and earnings management on the equilibrium demand for analysts' services and the properties of analysts' forecasts.

This thesis contributes to our understanding of the impact of earnings management on firm value and analysts' forecasts by providing empirical evidence consistent with the hypothesis that the financial market and analysts are aware of the nature of a firm's discretionary accrual policy, and use their beliefs about the firm's discretionary accrual policy in assessing firm value and deciding whether to follow the firm.

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Chapter 1

Introduction

Accrual based earnings are criticized because reported earnings are susceptible to earnings management. The flexibility of Generally Accepted Accounting Principles (GAAP) gives managers some discretion over accounting accruals. If this discretion is exercised to its extreme, then the resulting accrual based earnings can be uninformative about firm value (Schipper (1989)). It is an empirical question whether earnings management decreases the informativeness of reported earnings about firm value. However, the understanding of the nature of earnings management has an important policy implication with respect to 'uniformity versus flexibility' in accounting standard setting (Subramanyam (1996)). If the flexibility of GAAP is opportunistically used and consequently impairs the usefulness of reported earnings in assessing firm value, then accounting standard setters may want to choose uniformity over flexibility. Investors are also concerned about earnings management since earnings management can distort reported earnings and they may make decisions that they otherwise would not have made (Rosenzweig and Fischer (1994)).

Even if accrual based earnings are subject to manipulation, it is well documented that accrual based earnings have a higher association with stock returns than cash based earnings (e.g., Rayburn (1986) and Dechow (1994)). Recent earnings management studies further decompose accounting accruals into the non-discretionary (normal) and discretionary components. According to Healy (1985), "non-discretionary accruals are accounting adjustments to the firm's cash flows mandated by accounting standard-setting bodies" while "discretionary accruals are adjustments to cash flows selected by the manager."[1] The superiority of accrual based accounting earnings in assessing firm value to operating cash flows may imply that non-discretionary accruals are useful for valuation. However, it is not clear whether discretionary accruals are informative or not. By definition, discretionary accruals are arbitrarily determined by managers or the firm. The usefulness of discretionary accruals for valuation depends on the nature of discretionary accruals. If discretionary accruals are correlated with or influenced by value relevant information which is not known to investors, then discretionary accruals will be useful for valuation. Otherwise, discretionary accruals can be viewed as noise. The latter case raises a question about the flexibility of GAAP.

Most empirical earnings management studies take either an information or an opportunistic perspective about earnings management (Jiambalvo (1996)). The information perspective emphasizes that managers use the flexibility of accrual accounting to communicate their private value relevant information whereas the opportunistic perspective emphasizes that managers manage earnings to maximize their expected utility. Rather than taking one of these perspectives, this thesis takes the view that all earnings management is opportunistic.[2] However, depending on the incentives faced by managers, some earnings management can be more (or less) informative than others. Consistent with other earnings management studies (e.g., Healy (1985), Jones (1991), and DeFond and Park (1997)), this thesis assumes that earnings management is implemented through the selection of discretionary accruals, and examines the impact of earnings management on the informativeness of reported earnings about firm value

[1] See chapter 2 for a discussion about the conceptual framework of the non-discretionary and discretionary accruals.

[2] If we view managers as always acting in their own interests, then all earnings management is inherently opportunistic.

and analysts' forecasts.

The thesis is organized as follows. Chapter 2 develops an earnings management model based on Feltham and Ohlson (1996), and examines the impact of earnings management on income smoothing and the earnings response coefficient. Income smoothing is defined as a type of earnings management that induces a decrease in the ex-ante variance of unexpected earnings. It is shown that information enhancing earnings management leads to income smoothing only when income smoothing unravels the transient component of an earnings shock. It is also shown that the earnings response coefficient, which is defined as the coefficient on unexpected earnings regressed against share returns, is higher for more informative earnings management than that for less informative earnings management. The implications of income smoothing for earnings response coefficients are empirically examined in chapter 4.

Chapter 3 critically reviews the existing discretionary accrual models, focusing on the Jones (1991) model and its variants. The strengths and weakness of the Jones model and its variants are discussed and a possible improvement is suggested. This chapter discusses the measurements of earnings management and income smoothing, which are used in the subsequent empirical chapters.

Chapter 4 empirically examines the impact of earnings management on the earnings response coefficient (ERC) after controlling either for the smoothness of pre-managed earnings[3] or for the smoothness of reported earnings. It is found that the ERC is an increasing function of the degree of income smoothing. Firms are further decomposed into income smoothing and variance-increasing earnings management firms. For the income smoothing firms, it is found that income smoothing increases the stock price reaction to unexpected earnings. However, for the variance-increasing earnings management firms, the hypothesis that variance-increasing

[3] Pre-managed earnings are defined as reported earnings minus discretionary accruals (see chapter 2 for details).

earnings management decreases the stock price reaction to unexpected earnings is not supported by the data.

Chapter 5 examines the impact of earnings management on the equilibrium demand for analysts' services and the properties of analysts' forecasts. When the demand for analysts' services for a given firm is proxied for by the number of analysts following the firm, it is found that the number of analysts flowing is a decreasing function of the measure of smoothness of reported earnings. After controlling for the smoothness of reported earnings, it is found that the number of analysts following is a decreasing function of the degree of income smoothing. With respect to other properties of analysts' forecasts, it is found that smooth income decreases dispersion, forecast error, and revision volatility.

This thesis contributes to two strands of accounting research. First, this thesis contributes to the earnings response coefficient literature by showing that earnings management is an important factor determining the magnitude of the earnings response coefficient. Second, this thesis contributes to the analysts' forecasts literature by showing that the demand for analysts' services is negatively associated with the degree of smoothness of reported earnings and income smoothing. The empirical evidence of this thesis is consistent with the hypothesis that the financial market and analysts are aware of the nature of a firm's discretionary accrual policy, and use their beliefs about the firm's discretionary accrual policy in assessing firm value and deciding whether to follow the firm. This thesis will contribute to our understanding of the impact of earnings management on firm value and analysts' forecasts.

Chapter 2

An Earnings Management Model

2.1 Introduction

Since Ball and Brown (1968), many accounting studies have reported the positive relationship between accounting earnings and stock returns. The earnings response coefficient literature goes beyond the simple sign test, and examines the magnitude of the change in a stock's price in response to a release of accounting earnings. It is well documented that the earnings response coefficient, which is defined as the coefficient on unexpected earnings regressed against unexpected share returns, is affected by many factors including the cost of capital, firm size, earnings predictability, etc.[1] In particular, the more persistent the earnings shock, the higher the earnings response coefficient (e.g., Collins and Kothari (1989), Easton and Zmijewski (1989), and Kormendi and Lipe (1987)). If an earnings shock is temporary, then its impact on stock returns is weak since the shock does not repeat in the future. Furthermore, if an earnings shock is not relevant for valuation, i.e., is pure noise, then the earnings shock will have no influence on stock returns. In that sense, earnings with a low earnings response coefficient are defined to have low information content.

Under an accrual based accounting system, managers have some discretion in reporting

[1] See the chapter 4 of Brown (1994) for a good summary.

earnings through accounting accruals. In this thesis, accounting accruals are decomposed into non-discretionary (normal) and discretionary accruals. Discretionary accruals are chosen by management and can be viewed as total accruals minus non-discretionary accruals. Total accruals equal reported earnings minus cash flows. The problem is that the concept of non-discretionary accruals or normal accruals is not well defined theoretically, and is particularly problematic to measure empirically. For example, Healy (1985, p. 89) states that:

> "Non-discretionary accruals are accounting adjustments to the firm's cash flows mandated by accounting standard-setting bodies (e.g., the Securities Exchange Commission and the Financial Accounting Standards Board). ··· Discretionary accruals are adjustments to cash flows selected by the manager. The manager chooses discretionary accruals from an opportunity set of generally accepted procedures defined by accounting standard-setting bodies."

It is not clear what adjustments accounting standard-setting bodies mandate. Generally Accepted Accounting Principles allow a wide range of alternatives for a transaction or an economic event. In many cases, it is hard to determine which accounting method among alternatives is the most appropriate. Different people will often make different judgments about the proper accounting treatment depending on the information available to them. Since managers are usually better informed about the business than others, they can make a better judgment about the proper accounting method and accounting estimates. That is a reason why GAAP leaves the choice of accounting method to managers. A problem with leaving the selection of accruals to managers is that their judgment is influenced by incentives such as their bonus, thereby leading them to make inappropriate accounting choice. Conceptually, non-discretionary accruals may be defined as accruals a panel of impartial professional accountants might agree to implement if they have access to the same information available to managers. Since a third party does not have the same information as managers, it is very difficult (or impossible) to determine what is the most appropriate accounting treatment for a transaction or an economic event.

Under informational asymmetry, the determination of non-discretionary accruals is constrained by the availability of information and the adopted non-discretionary accrual model. For example, the Jones (1991) model, which is one of the most widely used non-discretionary accrual models in empirical earnings management studies, uses only the change in sales and gross property, plant, and equipment, and effectively ignore other information. Under the Jones model, discretionary accruals may contain some accruals which might be recognized as non-discretionary accruals if researchers had access to the same information available to managers. Similarly, non-discretionary accruals may contain some accruals which might be recognized as discretionary accruals if researchers had the same information as managers. For example, assume that a firm expects an abnormally high level of uncollectible accounts, and that managers set up the above normal allowance for doubtful accounts. Without the information about the collectibility of doubtful accounts, the Jones model will misclassify those accruals as discretionary. On the other hand, if the same firm does not consider the information in setting up the allowance for doubtful accounts, then the Jones model misclassifies discretionary accruals as non-discretionary accruals. In this thesis, non-discretionary accruals are defined as expected (or normal) earnings based on the information available to investors or researchers. Note that this definition does not assume that investors have access to the same information as managers. Therefore, some non-discretionary accruals are classified as discretionary since investors do not have access to the same information as managers.

Accounting accruals can be viewed as consisting of three components. The first component consists of adjustments based on publicly available information. The second component consists of adjustments based on management private information. The third component consists of adjustments made due to management's personal incentives. Most people will agree that the first component of accrual adjustments should be classified as non-discretionary and the last component should be classified as discretionary. However, it is not clear whether the second component should be classified as non-discretionary or discretionary accruals. If non-discretionary accruals are defined as in Healy (1985), then the second component will be classified as non-discretionary since a panel of impartial professional accountants will make such adjustments. But, under information asymmetry, the second component cannot be identified. Therefore, this thesis treats the second component as discretionary accruals. That is, non-discretionary accruals consist of accrual adjustments that might be made by a panel of impartial professional accountants based on publicly available information. Observe that discretionary accruals are composed of adjustments to accruals to reflect management private information (adjustments that would be made by a "panel") and manipulation due to management's personal incentives (would not be made by a "panel") which may be influenced by random events.

Pre-managed earnings are defined as operating cash flows plus non-discretionary accruals. Therefore, reported earnings can be viewed as the sum of pre-managed earnings and discretionary accruals. The information content of reported earnings depends on the nature of the discretionary accruals chosen by management as well as pre-managed earnings. Depending on the incentives faced by managers, discretionary accruals can be used to communicate managers' private value relevant information or can result in garbling of pre-managed earnings. For example, the explicit and implicit contracts with shareholders or managerial reputation in the labor market may induce managers to disclose value relevant information. On the other hand, if debt covenants use accounting numbers, then managers have incentives to circumvent covenant restrictions by managing reported earnings, which may result in garbling. Key (1997) reports that firms in the cable television industry managed earnings in order to mitigate Congressional scrutiny in late 1980s and early 1990s. The cable TV managers used discretionary accruals to relieve the political pressure of rate regulation, not to communicate managers' private information. Big baths by incoming CEOs or large income increasing discretionary accruals by IPO firms are other examples of the garbling of pre-managed earnings.

If discretionary accruals add noise which is not valuation relevant, then the informational value of reported earnings is much lower than that of pre-managed earnings. In that case, the response of share price to managed earnings will be weaker than pre-managed earnings. In that sense, noisy earnings management decreases the information content or quality of earnings announcement. On the other hand, if earnings management is intended to communicate managers' private value relevant information, then reported (managed) earnings will be more value relevant than pre-managed earnings.

Feltham and Ohlson (1996) and Ohlson and Zhang (1998) discuss an extreme income statement based approach called *permanent earnings* accounting.[2] In the permanent earnings accounting, current earnings are a sufficient statistic for the market value of the firm and the value of the firm is determined by a multiple of current earnings, i.e., capitalized earnings. A firm that implements the permanent earnings accounting will report a long-run earnings rather than transitory earnings or will convert transitory earnings into permanent earnings equivalent. In this thesis, persistent earnings are defined as a long run earnings that are expected to persist in the future. The persistent earnings are similar to permanent earnings, but they do not assume that the market value of the firm is represented by a multiple of earnings. The persistent earnings emphasize that the transitory component of earnings is eventually offset by other transitory earnings that have the opposite effect, hence, the transitory component of earnings is not reported. If a firm reports the persistent earnings by eliminating transitory earnings, then the response of share price to the reported earnings will be stronger than pre-managed earnings which contain both persistent and transitory components. That is, earnings management changes the characteristics of reported earnings. Depending on the nature of earnings

[2] The other extreme approach is called mark-to-market accounting, in which book value of the equity is a sufficient statistic for market value.

management, the price reaction to reported (managed) earnings can be stronger or weaker than pre-managed earnings. This chapter analytically examines the impact of earnings management on the market value of the firm.

Analytical earnings management research usually focuses on conditions where earnings management occurs as an equilibrium behavior. Demski et al. (1984) show that delegation to managers of accounting method choice leads to more efficient contracting in an one period principal agent setting where risk averse managers have superior private information. Dye (1988) shows that the breakdown of the Revelation Principle is important for earnings management to exist since otherwise the owner of the firm can implement an equivalent truth telling mechanism whenever there is an equilibrium.[3] Some studies focus on income smoothing, and examine under what conditions managers smooth earnings. Lambert (1984) shows that risk averse managers without access to the capital market have incentives to smooth earnings. Dye (1988), however, shows that even if managers have access to the capital market, managers smooth earnings since their borrowing and lending rates are different from what they can achieve by managing earnings. Fudenberg and Tirol (1995) show that a concern about tenure leads to income smoothing.

Unlike the above mentioned analytical earnings management studies, this chapter does not examine conditions which lead to earnings management. Rather it is assumed that managers are engaged in different types of earnings management. The nature of earnings management is determined by management incentives, political consideration, and institutional factors such as auditors and accounting rules. That is, adopted discretionary accrual policies are management's endogenous reaction to the above mentioned factors, which this chapter treats as exogenous. While it might be ideal to have a model in which the incentives and management's response

[3] Arya et al. (1998) also emphasize that the violation of assumptions of the Revelation Principle is crucial for earnings management to exist. For a good review of the breakdown of the Revelation Principle, see Table 1 of Arya et al. (1998).

to these incentives are endogenous, it is useful to understand the market's rational reaction to earnings management. Prior empirical earnings management studies focused on identifying whether income smoothing exists (e.g., Subramanyam (1996) and DeFond and Park (1997)) or on the relation between the characteristics of earnings and the earnings response coefficient (e.g., Collins and Kothari (1989)), but none of them examined the impact of earnings management on the smoothness of reported earnings or the earnings response coefficient. By analyzing how earnings management affects the variance of unexpected earnings and the association between the unexpected earnings and the unexpected returns, this chapter provides insights about the relation between earnings management and market prices.

The rest of the chapter is organized as follows. Section 2 introduces the basic information dynamics similar to that specified in Feltham and Ohlson (1996), and derives a linear valuation function. In section 3, the accounting system is described. In section 4, discretionary accruals are modeled as the sum of the informative and noisy components. The discretionary accruals are valuation relevant as long as they are correlated with managers' private value relevant information. However, the presence of noise makes the discretionary accruals less useful for valuation. The information content of reported earnings depends on the relative weights of the informative and noisy components. The impact of earnings management on the variance of unexpected earnings is examined in section 5. In section 6, the impact of earnings management on the earnings response coefficient under a typical short window event study framework is examined. Conclusions are reached in the final section.

2.2 Information Dynamics

As in Feltham and Ohlson (1996), the transactions and economic events for a firm are summarized by a Markovian information dynamics based on cash flows and other information. The firm sells its products or service on credit. Current period's sales (s_t) are influenced by prior period sales, cash investments, and other information about sales (υ_t). The collection of credit sales is made in the next period. It will be referred to as operating free cash flows (cr_t) since it results from operating activities, not from investing or financing activities.[4] Current period cash investment (ci_t) is influenced by investment opportunities which are known prior period. Current period investment opportunities (io_t) are influenced by prior period investment opportunities. In contrast to Feltham and Ohlson (1996), sales dynamics play a key role rather than the operating free cash flows. In fact, the market value of the firm at time t, which will be derived later, does not depend on the operating free cash flows at time t since next period expected operating free cash flows are determined by current period sales. The approach starting with sales forecasts is more descriptive of the process used by investors or analysts when they analyze a firm.[5] The information set available to managers at time t is represented by $I_t = [s_t, cr_t, ci_t, io_t, \upsilon_t]^T$. Note that the entire history of the information is available, but the current information is sufficient for valuation due to the Markovian nature of the assumed information dynamics. The information dynamics across periods are represented as follows:

$$\tilde{I}_{t+1} = \Omega I_t + \tilde{\varepsilon}_{t+1}, \quad \text{where} \quad \Omega = \begin{bmatrix} \gamma & 0 & \kappa & 0 & 1 \\ \rho & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & \omega & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}. \tag{IFD}$$

where $\tilde{\varepsilon}_{t+1} = [\tilde{\varepsilon}_{st+1}, \tilde{\varepsilon}_{rt+1}, \tilde{\varepsilon}_{it+1}, \tilde{\varepsilon}_{ot+1}, \tilde{\varepsilon}_{\upsilon t+1}]^T$ are unpredictable disturbance terms with zero mean. For example, $\tilde{\varepsilon}_{st+1}$ and $\tilde{\varepsilon}_{rt+1}$ are interpreted as unexpected sales and unexpected operating free cash flows, respectively. For simplicity, $\tilde{\varepsilon}_{\cdot t+1}$s are assumed to be independent of each other except that $\tilde{\varepsilon}_{st+1}$ and $\tilde{\varepsilon}_{\upsilon t+1}$ may be correlated. The parameters in the information

[4]The terminology is motivated by the cash flow statement, which classifies cash flows into operating, investing, and financing.

[5]In their study of the implication of non-discretionary accruals on market-based research, Dechow et al. (1998) take a similar approach by stating that "The fundamental transaction/event for the computation of accrual accounting income is the sale."

dynamics are restricted such that $\gamma \in (0,1)$, $\kappa > 0$, $\rho \in (0,1)$, and $\omega \in [0,R)$, where R represents one plus risk-free interest rate.[6] $\gamma \in (0,1)$ represents the persistence in sales, implying that next period's sales are expected to decay at a constant rate $1-\gamma$. $\kappa > 0$ represents the impact of current cash investment on next period's sales. $\rho \in (0,1)$ represents the impact of one dollar in sales on next period's operating cash flow. That is, ρ can be interpreted as expected contribution margin. ρ is assumed less than 1 since there are costs associated with sales such as production costs, collection costs, bad debts, and administrative costs. $\omega \in [0,R)$ represents one plus the expected growth in anticipated investment opportunities.[7]

The information dynamics assumed in this chapter extend Feltham and Ohlson (1996) by including non-cash information such as credit sales and investment opportunities while they are less general than Feltham and Ohlson (1996) because error terms are assumed to be independent of each other. On the other hand, Ohlson and Zhang (1998) take a more general approach by allowing an arbitrary number of cash and non-cash information. The information dynamics adopted in this chapter is not designed to be comprehensive, rather it is done in the simplest manner possible to accommodate two types of accruals associated with working capital and property, plant, and equipment (see Section 3).[8]

In order to focus on the accounting for operations, it is assumed that the firm is an all-equity firm, and that the net cash flow equals the net dividend. There is no borrowing and lending. If operating cash flows exceed cash investments, the excess cash is distributed as a dividend whereas if there are insufficient funds for cash investments, the equity holders contribute. It is

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[6] See Feltham and Ohlson (1996) for a discussion on the restrictions on parameters.

[7] To ensure a bounded market value, the maximum eigenvalue of Ω must be less than R (see Ohlson and Jhang (1998, page 8)). The eigenvalues of the transition matrix are $(0, \gamma, \omega)$. Hence, the upper bound for γ and ω should be less than R.

[8] A somewhat more general model would recognize that sales generate cash outflows in the current period and cash inflows in the next period. Furthermore, sales would be decomposed into cash sales and credit sales (as in Appendix B of Ohlson and Zhang (1998)).

assumed that the present value of future expected net cash flows determines the value of the firm (V_t).[9] The interest rate $(R-1)$ is assumed constant over time.

$$V_t = \sum_{\tau=1}^{\infty} R^{-\tau} E_t[\tilde{cr}_{t+\tau} - \tilde{ci}_{t+\tau}]. \tag{PVCF}$$

Under the assumption of a linear valuation function, the value of the firm is expressed as follows:[10]

$$V_t(I_t) = \pi I_t, \tag{2.1}$$

$$\text{where} \quad \pi = \begin{bmatrix} \frac{\rho}{R-\gamma} & 0 & \frac{\rho\kappa}{(R-\gamma)R} & \frac{\kappa\rho - R^2 + R\gamma}{R(R-\gamma)(R-\omega)} & \frac{\rho}{(R-\gamma)R} \end{bmatrix}.$$

The valuation function does not depend on operating free cash flows at time t since the expected future operating free cash flows are determined by sales and other information about sales at time t. That is, current sales, cash investments, available investment opportunity, and other information about sales are sufficient for valuation.

Feltham and Ohlson (1996) assume that managers and investors have the same information, and that part of the information may be represented by accounting numbers. The accounting system influences the part represented by accounting numbers, but does not influence the investors' *total* information. Hence, in their case, accounting does not affect the market price of the firm. In contrast, this chapter assumes that managers may know more than investors,

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[9] Alternatively, the no-arbitrage condition can be imposed. Ohlson (1991)'s proposition 1 shows that the no-arbitrage condition is equivalent to the present value of expected future dividends.

[10] PVCF implies

$$\begin{aligned} V_t(I_t) &= R^{-1}E_t[\tilde{cr}_{t+1} - \tilde{ci}_{t+1} + \pi I_{t+1}] \\ &= R^{-1}(\begin{bmatrix}0 & 1 & -1 & 0 & 0\end{bmatrix}\Omega I_t + \pi\Omega I_t). \end{aligned}$$

Hence, the coefficients of the valuation function are computed by

$$\pi = \begin{bmatrix}0 & 1 & -1 & 0 & 0\end{bmatrix}\Omega(RI-\Omega)^{-1}, \quad \text{where } I \text{ is an identity matrix of order 5.}$$

and that the accounting system can influence what investors know. It will be useful to distinguish the *intrinsic* value of the firm from the *market* value of the firm. The intrinsic value of the firm is based on all information available to the managers while the market value of the firm is based on information known to investors. Since the accounting system can be used to communicate the managers' private value relevant information, it can affect what is known to investors. Hence, the accounting system can affect the market value of the firm. However, the accounting system does not affect the intrinsic value of the firm since it is assumed that the accounting system does not affect the accounting for taxes and contractual obligations.

I_t and I_t^i will be used to represent the managers' information set and investors' information set at time t, respectively. Managers are assumed to have superior information, $I_t \supset I_t^i$. In particular, it is assumed that υ_t is known to the managers at time t, but is not directly known to investors until time $t+1$. That is, $I_t = [s_t, cr_t, ci_t, io_t, \upsilon_t]^T$ and $I_t^i = [s_t, cr_t, ci_t, io_t, \upsilon_{t-1}]^T$.[11] This assumption reflects that managers have some information in advance, but their information is eventually known to investors with delay. If υ_t is not correlated with information available to investors at time t and the accounting system is not used to communicate managers' private value relevant information, then the information dynamics for investors are represented as follows:

$$\tilde{I}_{t+1}^i = \hat{\Omega} I_t^i + \hat{\varepsilon}_{t+1}, \quad \text{where} \quad \hat{\Omega} = \begin{bmatrix} \gamma & 0 & \kappa & 0 & 0 \\ \rho & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & \omega & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}.$$

$\hat{\varepsilon}_{t+1}$ is the same as $\tilde{\varepsilon}_{t+1}$ except that $\upsilon_t + \tilde{\varepsilon}_{st+1}$ is redefined as $\hat{\varepsilon}_{st+1}$, and $\tilde{\varepsilon}_{\upsilon t+1}$ is replaced with

[11] ε_t is known to investors as well as managers. It is not explicitly included in the information set since it can be inferred from other variables.

$\tilde{\varepsilon}_{\upsilon t}$. The corresponding valuation function consistent with the above information dynamics is:

$$V_t(I_t^i) = \pi I_t^i,$$

$$\text{where} \quad \pi = \begin{bmatrix} \frac{\rho}{R-\gamma} & 0 & \frac{\rho\kappa}{(R-\gamma)R} & \frac{\kappa\rho - R^2 + R\gamma}{R(R-\gamma)(R-\omega)} & 0 \end{bmatrix}.$$

Note that the coefficient on υ_{t-1} is zero since it is not valuation relevant information (its information content is reflected in s_t). If the accounting system can be used to communicate the managers' private value relevant information (υ_t), investors form a conditional expectation about υ_t. In that case, the valuation function (2.1) is used with $I_t^i = [s_t, cr_t, ci_t, io_t, \bar{\upsilon}_t]^T$, where $\bar{\upsilon}_t$ is a conditional expectation about υ_t given information available to investors including accounting numbers. The following two sections describe the accounting system and examines how the accounting system is used to communicate managers' private information.

2.3 Accounting

This section discusses accounting procedures a firm might take if the firm does not manage earnings. The pre-managed (or unmanaged) earnings derived in this section will be used as a benchmark when managed earnings are introduced in the next section.

Accounting earnings are different from operating free cash flows due to accounting accruals. In this model, it is assumed that accounting accruals consist of depreciation and the change in working capital. For depreciation, a simple declining balance policy is assumed. That is, depreciation is a fixed percentage of the beginning property, plant, and equipment (ppe_{t-1}):

$$dep_t = (1 - \delta_t) ppe_{t-1}, \tag{2.2}$$

where δ_t denotes the depreciation policy on property, plant, and equipment. The above model allows managers' discretion over depreciation rate $(1 - \delta_t)$. However, the appropriate depreciation expense may be determined by applying the matching principle, i.e., by equating the depreciation expense of an asset with future benefits it produces. It is assumed that the appropriate depreciation rate is equal to the decay rate of sales, $1-\gamma$. $\delta_t < \gamma$ represents an over-depreciation while $\delta_t > \gamma$ represents an under-depreciation. Under non earnings management, depreciation expense is as follows:

$$dep_t = (1-\gamma)ppe_{t-1}. \tag{2.3}$$

The property, plant, and equipment at time t equals the remaining balance of the property, plant, and equipment at time $t-1$ plus cash investments. Cash investments are fully capitalized and added to the property, plant, and equipment, which is subject to depreciation:

$$ppe_t = \gamma ppe_{t-1} + ci_t.$$

Operating assets at time t (oa_t) consist of property, plant, and equipment and working capital at time t (wc_t):

$$oa_t = ppe_t + wc_t.$$

Working capital, defined as the excess of current assets over current liabilities, includes accounts receivable and accounts payable. There are, however, no financial assets or debt since the firm is assumed to be an all-equity firm and to immediately distribute all cash flows to equity-holders.

The clean surplus relationship is assumed to hold:

$$oa_t = oa_{t-1} + ox_t - (cr_t - ci_t), \tag{CSR}$$

where ox_t denotes operating earnings for period t. By definition, operating earnings for period t are the sum of operating free cash flows and total accruals for period t, where total accruals (ta_t) equal the change in working capital minus depreciation:

$$\begin{aligned} ox_t &\equiv cr_t + ta_t \\ &= cr_t + \Delta wc_t - (1-\gamma)ppe_{t-1}, \end{aligned}$$

where $\Delta wc_t \equiv wc_t - wc_{t-1}$ is the change in working capital. Consistent with most empirical earnings management studies (e.g., Jones (1991), Dechow et al. (1995), and Subramanyam (1996)), it is assumed that the change in unmanaged working capital is influenced by the change in the firm's activity level, which is measured by the change in sales, $\Delta s_t \equiv s_t - s_{t-1}$. More specifically, unmanaged working capital is determined by $\Delta wc_t = \rho \Delta s_t$, implying that working capital is determined by the expected cash receipts from sales.[12] Pre-managed operating earnings are determined by a proportion of sales, depreciation, and unexpected operating free cash flows.

$$ox_t = \rho s_t - (1-\gamma)ppe_{t-1} + \tilde{\varepsilon}_{rt}. \tag{2.4}$$

Observe that if there is an unexpected increase in uncollectible accounts receivable, i.e., $cr_t < \rho s_{t-1}$, then bad debt expense for period t will increase. In that case, the accrual based reported earnings decrease since $\tilde{\varepsilon}_{rt}$ is negative. Similarly, if the collection of accounts receivable is above expectation, i.e., $cr_t > \rho s_{t-1}$, then bad debt expense for period t will decrease and the reported earnings increase since $\tilde{\varepsilon}_{rt}$ is positive.

2.4 Earnings Management

The flexibility of generally accepted accounting principles gives managers some discretion in choosing accounting policy and determining accounting estimates. Under the assumption that managers can manage earnings through accounting accruals, this section formally introduces earnings management based on the information asymmetry between managers and investors.

Jones (1991) proposes an empirical discretionary accrual model. The Jones model assumes that the change in working capital is explained by the change in sales and depreciation is

[12]For simplicity, it is assumed that the change in working capital is fully determined by a multiple of the change in sales. In empirical earnings management literature, the measurement error is a big concern (Bernard and Skinner (1996)). Even if it is stochastic, the basic results do not change.

explained by gross property, plant, and equipment.

$$ta_t = \beta_0 + \beta_1 \Delta Rev_t + \beta_2 PPE_t + \varepsilon_t,$$

where $\Delta Rev_t =$ change in revenues from the prior period,

$PPE_t =$ gross property, plant, and equipment.

In the Jones model, $\beta_0 + \beta_1 \Delta Rev_t + \beta_2 PPE_t$ are interpreted as non-discretionary accruals whereas the prediction error, ε_t is interpreted as discretionary accruals.

Before introducing the total accrual model adopted in this chapter, the empirical implications of the Jones model will be briefly discussed. In the previous section, non-discretionary accruals are assumed to be determined by $\rho\Delta s_t - (1-\gamma)ppe_{t-1}$. If the empirical Jones model correctly measures non-discretionary accruals, then β_0 will be zero, and β_1 and β_2 will be ρ and $\gamma - 1$, respectively. Even though the model in this chapter aassumes that those parameters are known to investors or researchers, empirical earnings management research estimates those parameters using the past data. Therefore, the parameters estimated by the Jones model can be different from the theoretical counterparts suggested in this chapter. The failure of obtaining the correct parameters leads to measurement error in non-discretionary and discretionary accruals. For example, the deprecation rate parameter estimated from the Jones model (β_2) will be the average of $1-\delta_t$ which were chosen by a firm over the estimation period. If the firm had applied a conservative depreciation rate, then the estimated β_2 will be greater than the theoretically correct $\gamma - 1$. In that case, the Jones model cannot properly measure non-discretionary depreciation. Similarly, the parameter for the change in sales estimated from the Jones model (β_1) may not be equal to ρ. β_1 will be the average rate of changes in working capital.

The model in this chapter assumes that total accruals are determined by the change in sales, beginning capital assets, and the prior and current period discretionary accruals. In contrast to the Jones model, this chapter considers additional non-discretionary accruals, the fraction of prior period discretionary accruals that are reversed in the current period. That is, ε_t is further decomposed into current period discretionary accruals and the reversion of prior period discretionary accruals. The reversion of prior period discretionary accruals is anticipated by investors, hence it is a part of non-discretionary accruals. Total accruals are modeled as follows:

$$ta_t = \rho\Delta s_t - (1-\gamma)ppe_{t-1} - \eta_t da_{t-1} + da_t, \tag{2.5}$$

where da_t denotes discretionary accruals for period t, and $\eta_t \in [0,1]$ represents the fraction of prior period discretionary accruals that are reversed in the current period.[13]

Compared to the Jones model, the total accrual model does not have an intercept term, and ε_t equals $da_t - \eta_t da_{t-1}$. Note that only da_t (out of $\varepsilon_t = da_t - \eta_t da_{t-1}$) constitutes discretionary accrual. As noted by Bernard and Skinner (1996), the misclassification of discretionary accruals as non-discretionary accruals has great impact on the interpretation of market-based earnings management research. The above specification suggests a possible improvement in non-discretionary accrual models by considering an ARMA type error term rather than a standard independent error term.[14]

The reversion parameter (η_t) is determined by earnings management instruments used by the firm. For example, if the firm reports credit sales early or underestimates allowance for bad debts, then full reversion will occur in the next period. In that case, da_t equals extra accounts receivable times contribution margin (ρ) and $\eta_{t+1} = 1$. On the other hand, in valuing marketable securities, if the decline in the market price below acquisition costs is treated as permanent rather than temporary, then reversion does not occur in the next period. In that case,

[13]For simplicity of the model, it is assumed that sales are not subject to earnings management or that unmanaged sales are known. However, Dechow et al. (1995) do assume that sales are subject to earnings management. They use the change in sales less the change in accounts receivable as a proxy for unmanaged sales amount. Similarly for depreciation, most empirical earnings management studies (e.g., Jones (1991), Dechow et al. (1995), and Subramanyam (1996)) use gross property, plant, and equipment rather than net property, plant, and equipment.

[14]Healy (1996, p.113) suggests this line of improvement by stating: "Accounting rules also constrain accruals to reverse over time. $\cdots$ Most accrual models do not reflect this relationship, which presumably increases the noise in estimates of discretionary accruals."

da_t equals the decrease in the market price and $\eta_{t+1} = 0$. If depreciation is used to manage earnings, then reversion will occur in the remaining life of the asset. For example, assume that a firm takes income increasing discretionary accruals by taking $\delta_t > \gamma$. In that case, da_t equals $(\delta_t - \gamma)ppe_{t-1}$. The discretionary accruals will affect the next period's depreciation expense. If the firm did not manage depreciation, then the next period non-discretionary depreciation will be $(1-\gamma)(\gamma ppe_{t-1} + ci_t)$. But, under earnings management, it will be $(1-\gamma)ppe_t$, where $ppe_t = \delta_t ppe_{t-1} + ci_t$. Due to the earnings management, the next period depreciation will increase by $(1-\gamma)da_t$. Therefore, $\eta_{t+1} = (1-\gamma)$.

Accruals are a flow concept and they are accumulated in related assets accounts such as working capital and property, plant, and equipment. If earnings are managed through accruals other than depreciation, then discretionary accruals do not affect property, plant, and equipment, but do affect working capital. Working capital consists of accumulated non-discretionary accruals associated with sales, accumulated past unreversed discretionary accruals, and current discretionary accruals. Unreversed discretionary accruals, $(1-\eta_t)da_{t-1}$, remain as working capital. However, past unreversed discretionary accruals cancel each other over time since da_ts are assumed independent of each other. Therefore, working capital on average equals accumulated non-discretionary accruals associated with sales and current discretionary accruals. On the other hand, if earnings are managed through depreciation, then discretionary accruals do not affect working capital. Therefore, discretionary accruals are accumulated in property, plant, and equipment. Working capital consists of accumulated non-discretionary accruals associated with sales. In general, both working capital and property, plant, and equipment will be affected by discretionary accruals. Discretionary accruals related with depreciation will be accumulated in property, plant, and equipment and other discretionary accruals will be accumulated in working capital accounts.

Under earnings management, operating earnings are represented as follows:

$$ox_t = \rho s_t - (1-\gamma)ppe_{t-1} - \eta_t da_{t-1} + da_t + \tilde{\varepsilon}_{rt}. \tag{2.6}$$

da_t and $\tilde{\varepsilon}_{rt}$ are unanticipated components of operating earnings while $(1-\gamma)ppe_{t-1}$ and $\eta_t da_{t-1}$ are anticipated components. ρs_t consists of both the anticipated and unanticipated components.

This chapter does not explicitly incorporate what determines the characteristics of discretionary accruals. Rather it is assumed that the nature of discretionary accruals is exogenously determined. Of course, the nature of discretionary accruals are endogenously determined by the incentives faced by managers. Prior research has identified a variety of reasons for earnings management, including maximizing bonus, proxy contests, meeting debt covenants, top executive change, etc. The nature of discretionary accruals depends on circumstances faced by managers. Therefore, even if investors hold some beliefs about the on average nature of discretionary accruals, they do not know about the exact nature of reported earnings. It is assumed that investors' assessment of the nature of earnings management *on average* coincides with the real nature of earnings management, but there is some randomness.

Discretionary accruals are modeled as the sum of the informative and noisy components:

$$da_t = \xi \upsilon_t + \varepsilon_t^n, \tag{2.7}$$

where ε_t^n is a disturbance term with mean zero and variance σ_n^2, and ξ is the weight on the other information (υ_t). This model does not assume that every firm has the same incentives to manage earnings. The discretionary accrual model encompasses the following four types.

Type a (Non Earnings Management): If the accounting system is totally inflexible and does not allow any discretion over discretionary accruals, then both ξ and σ_n^2 are set to zero ($da_t = 0$). In that case, there is no room for the discretionary accruals to signal other value relevant information. This setting also includes the case in which managers have no incentives to manage earnings.

Type b (Uninformative Earnings Management): If ξ is zero and σ_n^2 is not zero, it is the case of uninformative earnings management. In that case, discretionary accruals are not informative about υ_t and they are not used for valuation.

Type c (Perfectly Informative Earnings Management): If discretionary accruals are perfectly informative about υ_t, then σ_n^2 is equal to zero and ξ takes on a non-zero value. In communicating managers' private information, managers can choose any non-zero ξ. It is, however, reasonable to assume that managers choose ξ such that it reflects the persistent change in earnings.

Type d (Informative Earnings Management): The previous two settings are extreme cases. In general, ξ and σ_n^2 will be non-zero. Note that as long as ξ is non-zero, the discretionary accruals are informative about υ_t. Due to the noise, discretionary accruals provide less than perfect information about υ_t. The larger σ_n^2, the noisier the discretionary accruals about υ_t. The informativeness of discretionary accruals is determined by the amount of the noise, σ_n^2.

Noisy earnings management includes cases in which earnings management is uninformative (type b) and earnings management contains a lot of noise (large σ_n^2) that is not correlated with managers' private value relevant information (type d). Earnings management can be noisy due to one of two reasons. First, the institutional restrictions such as auditing or accounting rules restrain managers from communicating the full dimension of their private information and these institutional restrictions are randomly applied. Sometimes they are very strict and sometimes they are not. Furthermore, the larger the magnitude of earnings management, the more difficult it is to circumvent the restrictions. For example, it will be hard to provide reasonable explanations for excessive earnings management. Second, under certain circumstances, underlying incentives faced by managers may induce them to make earnings management that is due to factors unrelated to the other value relevant information. For example, assume that a firm's long term prospects are very good. Under information enhancing motive, managers usually take income increasing earnings management to communicate the favorable information. However, they find that the labor union will be particularly tough next year. In that case, they also have income decreasing earnings management incentives to have a better position in negotiating with the labor union. If the latter incentives dominate the information enhancing earnings management incentives, then earnings management becomes unrelated to managers' other value relevant information.

Under the assumption that managers do not have other channels to effectively communicate their private value relevant information, accounting can have an impact on the market value of the firm since discretionary accruals may reflect other value relevant information. Therefore, what matters is the correlation between managers' private value relevant information and discretionary accruals. Assume that the other information about sales (υ_t) may be correlated with unexpected sales (ε_{st}) and/or discretionary accruals (da_t). It is further assumed that υ_t, ε_{st}, and da_t are normally distributed as follows:

$$\begin{bmatrix} \tilde{\upsilon}_t \\ \tilde{\varepsilon}_{st} \\ \tilde{da}_t \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma_\upsilon^2 & \sigma_{\upsilon,s} & \xi\sigma_\upsilon^2 \\ \sigma_{\upsilon,s} & \sigma_s^2 & \xi\sigma_{\upsilon,s} \\ \xi\sigma_\upsilon^2 & \xi\sigma_{\upsilon,s} & \xi^2\sigma_\upsilon^2 + \sigma_n^2 \end{bmatrix}\right).$$

The conditional expectation of υ_t given ε_{st} and da_t is as follows:[15]

$$E[\upsilon_t|\varepsilon_{st}, da_t] = \frac{\sigma_{\upsilon,s}\sigma_n^2\varepsilon_{st} + \xi(\sigma_s^2\sigma_\upsilon^2 - \sigma_{\upsilon,s}^2)da_t}{\sigma_s^2\sigma_n^2 + \xi^2(\sigma_s^2\sigma_\upsilon^2 - \sigma_{\upsilon,s}^2)}. \tag{2.8}$$

If there is no earnings management, or it is uninformative, then ε_{st} is the investors' only information about υ_t. In those cases, $E[\upsilon_t|\varepsilon_{st}, da_t] = E[\upsilon_t|\varepsilon_{st}]$. Furthermore, if $\sigma_{\upsilon,s} = 0$, then the

[15] $E[\upsilon_t|\varepsilon_{st}, da_t]$ is calculated by:

$$\begin{bmatrix} \sigma_{\upsilon,s} & \xi\sigma_\upsilon^2 \end{bmatrix} \begin{bmatrix} \sigma_s^2 & \xi\sigma_{\upsilon,s} \\ \xi\sigma_{\upsilon,s} & \xi^2\sigma_\upsilon^2 + \sigma_n^2 \end{bmatrix}^{-1} \begin{bmatrix} \varepsilon_{st} \\ da_t \end{bmatrix}.$$

conditional expectation of υ_t is equal to the prior mean of υ_t, 0. The value relevant information set for investors are represented as follows:

$$I_t^i = [s_t, cr_t, ci_t, io_t, E[\upsilon_t | \varepsilon_{st}, da_t]]^T.$$

Note that υ_t is not known to investors at time t, therefore, the conditional expectation of υ_t is used. If ε_{st} and da_t are independent of υ_t, then the prior mean of υ_t is used. If ξ is zero, discretionary accruals are not informative about υ_t. On the other hand, if there is a perfect correlation between υ_t and ε_{st}, there is no room for the discretionary accruals to provide new information about υ_t. Therefore, discretionary accruals are valuation relevant if, and only if, ξ is not zero and the correlation between υ_t and ε_{st} is not perfect.

Definition 2.1 *Discretionary accruals are informative with respect to the value of the firm if, and only if, discretionary accruals are correlated with managers' private value relevant information, which is not perfectly correlated with other available information.*

If υ_t and ε_{st} are perfectly correlated, then the two terms can be combined and relabeled as a single term. Therefore, it is assumed that υ_t and ε_{st} are not perfectly correlated. From now on, non-zero ξ implies that discretionary accruals are informative about υ_t. The degree of the informativeness of discretionary accruals is determined by the variance of the noise.

As was noted by Feltham and Ohlson (1996), υ_t can be interpreted in two ways. One is that υ_t represents time t information about events that have not influenced time t sales but will influence time $t+1$ sales (setting I). The other is that υ_t represents time t information about events that have influenced time t sales but will not influence time $t+1$ sales (setting II). An analysis of the former setting is followed by an analysis of the latter.

Setting I: Information about Future Sales

In the first setting, we assume that υ_t is not correlated with random factors affecting current period's sales, but is informative about random factors affecting next period's sales. More specifically, the other information (υ_t) is assumed to be uncorrelated with unexpected sales (ε_{st}), $\sigma_{\upsilon,s} = 0$. No correlation implies that current period's sales are not influenced by the other information, and that the conditional expectation of υ_t does not depend on ε_{st}.

$$E[\upsilon_t|\varepsilon_{st}, da_t] = \frac{\xi\sigma_\upsilon^2 da_t}{\sigma_n^2 + \xi^2\sigma_\upsilon^2}.$$

An example of this type of information is sales orders for next period.[16] Sales orders received for the next period have not influenced the current period's sales, but definitely will influence beliefs about next period's sales. In our setting, υ_t represents above (or below) normal sales orders which are expected to persist in the future. It is assumed that managers communicate the persistent earnings by letting $\xi = \rho$ since one dollar in sales generates ρ dollar of operating free cash flow.

Setting II: Information about Current Sales

In the second setting, we assume that the unexpected sales ($\tilde{\varepsilon}_{st}$) can be decomposed into persistent and transitory components:

$$\tilde{\varepsilon}_{st} = \tilde{\varepsilon}_{st}^p + \tilde{\varepsilon}_{st}^t,$$

where ε_{st}^p = persistent component of unexpected sales,

ε_{st}^t = transitory component of unexpected sales.

[16]This type of information can be public or private. This type of information is publicly available for some industries. For example, the Semiconductor Industry Association provides industry level monthly order information (Fargher et al. (1998)).

The transitory and persistent components are assumed to be uncorrelated, and the variances of the transitory and persistent components are σ_t^2 and σ_p^2, respectively. For valuation purpose, the persistent component of unexpected sales is more important than the transitory component. By definition, the persistent sales shock affects future sales while the transitory sales shock does not. Note that in setting I, the sales shock is all permanent. In order to consider management information about the transitory sales shock, υ_t is assumed to take the following form.

$$\tilde{\upsilon}_t = -\gamma\tilde{\varepsilon}_{st}^t.$$

Then, the sales dynamics are represented as follows:[17]

$$\tilde{s}_{t+1} = \gamma(s_t - \varepsilon_{st}^t) + \kappa ci_t + \tilde{\varepsilon}_{st+1}. \tag{2.9}$$

Next period's sales are not influenced by the transitory component of current sales. $\tilde{\varepsilon}_{st}^t$ represents a sales shock that has influenced current sales, but not future sales. It is assumed that managers communicate the persistent earnings by taking $\xi = \frac{\rho}{\gamma}$, i.e., $da_t = -\rho\varepsilon_t^t + \varepsilon_t^n$. Since the covariance between υ_t and unexpected sales is $-\gamma\sigma_t^2$, the conditional expectation of υ_t is:

$$E[\upsilon_t|\varepsilon_{st}, da_t] = \frac{-\gamma\sigma_t^2(\sigma_n^2\varepsilon_{st} - \xi\sigma_p^2 da_t)}{\xi^2\sigma_p^2\sigma_t^2 + \sigma_n^2(\sigma_p^2 + \sigma_t^2)}.$$

2.5 Earnings Management and Income Smoothing

Many empirical accounting studies argue that firms manage earnings to report smooth earnings (e.g., Ronen and Sadan (1981), Gaver et al. (1995), and DeFond and Park (1997)). Income

[17] Alternatively, if we let $\hat{\upsilon}_t$ denote transitory sales at time t, i.e., $\upsilon_t = -\gamma\hat{\upsilon}_t$, then the sales dynamics are represented as follows:

$$\tilde{s}_{t+1} = \gamma(s_t - \hat{\upsilon}_t) + \kappa ci_t + \hat{\upsilon}_{t+1} + \tilde{\varepsilon}_{st+1}.$$

In this setting $\tilde{\varepsilon}_{st+1}$ is not directly observable at time $t+1$, only the sum of $\hat{\upsilon}_{t+1}$ and $\tilde{\varepsilon}_{st+1}$ is observable. Setting II is a special case in which $\hat{\upsilon}_{t+1}$ and $\tilde{\varepsilon}_{st+1}$ are not correlated.

smoothing is defined as management's intentional intervention to reduce the ex-ante variance of unexpected operating earnings.

Definition 2.2 *Income smoothing is a type of earnings management which induces a decrease in the ex-ante variance of unexpected operating earnings.*

In this section, the impact of earnings management on the variance of unexpected operating earnings is examined. The unexpected operating earnings for period t (uox_t) are calculated by subtracting the expected earnings for period t at time $t-1$ from the operating earnings for period t (2.6):

$$\begin{aligned} uox_t &\equiv ox_t - E_{t-1}[ox_t | I^i_{t-1}] \\ &= \rho(\varepsilon_{st} + \upsilon_{t-1} - E[\upsilon_{t-1} | \varepsilon_{st-1}, da_{t-1}]) + \varepsilon_{rt} + da_t. \end{aligned} \tag{2.10}$$

The unexpected earnings are determined by unexpected sales, resolution of uncertainty about υ_t, unexpected operating free cash flows, and discretionary accruals.

Type a: If there is no earnings management, then

$$uox_t = \rho(\varepsilon_{st} + \upsilon_{t-1} - \frac{\sigma_{\upsilon,s}}{\sigma_s^2}\varepsilon_{st-1}) + \varepsilon_{rt}.$$

Type b: If discretionary accruals are uninformative, then

$$uox_t = \rho(\varepsilon_{st} + \upsilon_{t-1} - \frac{\sigma_{\upsilon,s}}{\sigma_s^2}\varepsilon_{st-1}) + \varepsilon_{rt} + \varepsilon^n_t.$$

That is, uninformative earnings management is characterized by adding noise (ε^n_t) to pre-managed earnings.

Type c: If discretionary accruals are perfectly informative, then $E[\upsilon_{t-1} | \varepsilon_{st-1}, da_{t-1}] = \upsilon_{t-1}$. Therefore, $uox_t = \rho\varepsilon_{st} + \xi\upsilon_t + \varepsilon_{rt}$. Compared to the non earnings management (type a), υ_{t-1} is replaced with υ_t, and the ε_{st-1} term drops. That is, perfectly informative earnings management eliminates the uncertainty about υ_{t-1}, but brings new uncertainty, the future information (υ_t), into current earnings.

The variance of unexpected earnings (2.10) is as follows:[18]

$$VAR(uox_t) = \rho^2(\sigma_s^2 + \sigma_\upsilon^2 - \sigma_{\hat{\upsilon}}^2) + \sigma_r^2 + \xi^2\sigma_\upsilon^2 + \sigma_n^2 + 2\rho\xi\sigma_{\upsilon,s}, \tag{2.11}$$
$$\text{where} \quad \sigma_{\hat{\upsilon}}^2 = \frac{\sigma_{\upsilon,s}^2\sigma_n^2 + \xi^2\sigma_\upsilon^2(\sigma_s^2\sigma_\upsilon^2 - \sigma_{\upsilon,s}^2)}{\sigma_s^2\sigma_n^2 + \xi^2(\sigma_s^2\sigma_\upsilon^2 - \sigma_{\upsilon,s}^2)}.$$

Type a: If there is no earnings management, then the variance of the unexpected operating earnings is:

$$VAR(uox_t|_{\xi=0,\sigma_n^2=0}) = \rho^2(\sigma_s^2 + \sigma_\upsilon^2 - \sigma_{\upsilon,s}^2/\sigma_s^2) + \sigma_r^2.$$

Type b: If discretionary accruals are not informative, then the variance of the unexpected operating earnings is:

$$VAR(uox_t|_{\xi=0}) = \rho^2(\sigma_s^2 + \sigma_\upsilon^2 - \sigma_{\upsilon,s}^2/\sigma_s^2) + \sigma_r^2 + \sigma_n^2.$$

That is, uninformative earnings management increases the variance of the unexpected operating earnings due to the noise of earnings management (σ_n^2). It can be shown that the variance of unexpected operating earnings (2.11) is an increasing function of the variance of the noise (σ_n^2). Differentiating $VAR(uox_t)$ with respect to the variance of the noise yields:

$$\frac{\partial VAR(uox_t)}{\partial\sigma_n^2} = \frac{\xi^2(\sigma_s^2\sigma_\upsilon^2 - \sigma_{\upsilon,s}^2)^2}{[\sigma_s^2\sigma_n^2 + \xi^2(\sigma_s^2\sigma_\upsilon^2 - \sigma_{\upsilon,s}^2)]^2} + 1 > 0. \tag{2.12}$$

Type c: If earnings management is perfectly informative, then

$$VAR(uox_t|_{\sigma_n^2=0}) = \rho^2\sigma_s^2 + 2\rho\xi\sigma_{\upsilon,s} + \xi^2\sigma_\upsilon^2 + \sigma_r^2.$$

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[18]The variance of $E[\upsilon_{t-1}|\varepsilon_{st-1}, da_{t-1}]$, $\sigma_{\hat{\upsilon}}^2$, is calculated by:

$$\begin{bmatrix}\sigma_{\upsilon,s} & \xi\sigma_\upsilon^2\end{bmatrix}\begin{bmatrix}\sigma_s^2 & \xi\sigma_{\upsilon,s} \\ \xi\sigma_{\upsilon,s} & \xi^2\sigma_\upsilon^2 + \sigma_n^2\end{bmatrix}^{-1}\begin{bmatrix}\sigma_{\upsilon,s} \\ \xi\sigma_\upsilon^2\end{bmatrix}.$$

In addition, it can be shown that the covariance between υ_{t-1} and $E[\upsilon_{t-1}|\varepsilon_{st-1}, da_{t-1}]$ is equal to the variance of $E[\upsilon_{t-1}|\varepsilon_{st-1}, da_{t-1}]$.

The information dynamics assumed in the chapter are quite general, therefore they can be applicable to a wide range of settings. In order to provide more explicit implications, this chapter focuses on two representative settings described in the previous section. The perfectly informative earnings management case will be compared to non earnings management case in order to examine whether earnings management can induce income smoothing.

Setting I: $\sigma_{\upsilon,s} = 0$ and $\xi = \rho$. The variances of unexpected earnings under non earnings management and under perfectly informative earnings management are as follows:

$$\text{CASE Ia:} \qquad VAR(uox_t|_{\xi=0,\sigma_n^2=0}) = \rho^2(\sigma_s^2 + \sigma_\upsilon^2) + \sigma_r^2$$

$$\text{CASE Ic:} \qquad VAR(uox_t|_{\sigma_n^2=0}) = \rho^2(\sigma_s^2 + \sigma_\upsilon^2) + \sigma_r^2,$$

where CASE Ia refers to setting I and type a (i.e., non) earnings management and CASE Ic refers to setting I and type c (i.e., perfectly informative) earnings management. Observe that the variance of unexpected operating earnings does not decrease even if discretionary accruals are perfectly informative about υ_t. Note that under the perfectly informative earnings management, υ_{t-1} is replaced with υ_t. Since υ_t is assumed to be identically distributed over time, there is no change in the variance of unexpected operating earnings. For example, if next period's permanent sales orders are recorded early in current period, then the current period's unexpected sales increase as much as the next period's unexpected sales decrease. There is a shift in unexpected sales across periods, but there is no net change in total unexpected sales across periods. Since there is no change in the total amount of surprise, there will be no decrease in the variance of unexpected operating earnings.

Setting II: $\sigma_s^2 = \sigma_p^2 + \sigma_t^2$, $\sigma_\upsilon^2 = \gamma^2\sigma_t^2$, $\sigma_{\upsilon,s} = -\gamma\sigma_t^2$, and $\xi = \frac{\rho}{\gamma}$. The variances of unexpected earnings under non earnings management (CASE IIa) and under perfectly informative earnings management (CASE IIc) are as follows:

CASE IIa:

$$VAR(uox_t|_{\xi=0,\sigma_n^2=0}) = \rho^2(\sigma_s^2+\sigma_\upsilon^2-\sigma_{\upsilon,s}^2/\sigma_s^2)+\sigma_r^2$$
$$= \rho^2(\sigma_s^2+\sigma_\upsilon^2-\frac{\gamma^2\sigma_t^4}{\sigma_t^2+\sigma_p^2})+\sigma_r^2$$

CASE IIc:

$$VAR(uox_t|_{\sigma_n^2=0}) = \rho^2(\sigma_s^2+\frac{1}{\gamma^2}\sigma_\upsilon^2+\frac{2}{\gamma}\sigma_{\upsilon,s})+\sigma_r^2$$
$$= \rho^2(\sigma_s^2+\frac{1}{\gamma^2}\sigma_\upsilon^2-2\sigma_t^2)+\sigma_r^2.$$

It can be easily seen that the perfectly informative earnings management decreases the variance of unexpected operating earnings. In the case in which earnings management is intended to report persistent earnings by removing transitory earnings, the variance of unexpected earnings will decrease because transitory earnings cancel each other over time and do not emerge as unexpected earnings.

The following proposition summarizes the impact of the noise in the discretionary accruals on the variance of unexpected operating earnings, which is derived in equation (2.12), and the above discussion of the differential impact of the two representative settings on income smoothing.

Proposition 2.1 *(1) The variance of unexpected operating earnings is an increasing function of the noise of the discretionary accruals. (2) If discretionary accruals are perfectly informative and the covariance between discretionary accruals and other information is negative (zero), then the variance of unexpected operating earnings under earnings management is lower than (the same as) that under no earnings management.*

Even if discretionary accruals are informative ($\xi \neq 0$), the variance of the unexpected operating earnings is not reduced unless the covariance between the unexpected sales (ε_{st}) and other information (υ_t) is negative. In particular, if the covariance between the other information (υ_t) and unexpected sales (ε_{st}) is zero (setting I), compared to non earnings management case, the variance of unexpected operating earnings does not decrease regardless of whether earnings management is informative or not. Only when the covariance between υ_t and ε_{st} is negative (setting II), is there a possibility of variance reduction. Note that proposition (2.1) implies that there exists a cutoff of $\bar{\sigma}^2$ such that if σ_n^2 is less than $\bar{\sigma}^2$, then the variance of the unexpected operating earnings under earnings management is less than that under non earnings management. Therefore, if discretionary accruals are not too noisy, earnings management decreases the variance of the unexpected operating earnings.

The variance of unexpected operating earnings decreases only when temporary earnings shocks are unraveled (setting II). If earnings shocks are permanent (setting I), any attempt to communicate managers' private information increases the variance of the unexpected operating earnings unless it is perfectly informative. Therefore, income smoothing is not achieved if all earnings shocks are permanent. For example, if earnings follow a random walk, all earnings shocks are permanent. In that case, income smoothing is not possible.

2.6 Earnings Response Coefficient

In this section, the impact of earnings management on the earnings response coefficient is examined. When the unexpected returns (ur_t) are regressed on the unexpected operating earnings (uox_t), the coefficient on the unexpected operating earnings is called the earnings response coefficient (ERC). The earnings response coefficient is:

$$ERC = \frac{COV(ur_t, uox_t)}{VAR(uox_t)}.$$

To begin with, unexpected return is computed. If there is no information asymmetry between managers and investors, the unexpected return is calculated as follows:[19]

$$\begin{aligned}
ur_t(I_t) &\equiv V_t(I_t) + d_t - RV_{t-1}(I_{t-1}) \\
&= \pi I_t + DI_t - R\pi I_{t-1} \\
&= (\pi\Omega + D\Omega - R\pi)I_{t-1} + (\pi + D)\varepsilon_t \\
&= (\pi + D)\varepsilon_t,
\end{aligned}$$

where $D = [0, 1, -1, 0, 0]$. The second equality is obtained by substituting the assumed information dynamics (IFD), and the last equality comes from $\pi\Omega + D\Omega = R\pi$. The unexpected return is a function of only news, ε_t. That is, the anticipated earnings do not affect the unexpected return.

If there is information asymmetry and accounting is used to communicate managers' private value relevant information, then the unexpected return is represented as follows:

$$\begin{aligned}
ur_t(I_t^i) &\equiv V_t(I_t^i) + d_t - RV_{t-1}(I_{t-1}^i) \\
&= (\pi + D)news_t + \frac{\rho}{R-\gamma}(\upsilon_{t-1} - E[\upsilon_{t-1}|\varepsilon_{st-1}, da_{t-1}]), \qquad (2.13)
\end{aligned}$$

where $news_t$ is the same as ε_t except that υ_t is replaced with $E[\upsilon_t|\varepsilon_{st}, da_t]$. $(\pi + D)news_t$ represents the impact of new information on the value of the firm and expected dividend. The last term denotes the resolution of the uncertainty about υ_{t-1}, which is known to investors before the earnings announcement date. If there is no information asymmetry, the last term vanishes and *news* becomes identical to ε_t.

In an empirical setting in which the focus is to examine the impact of new information on stock returns, it is important to know when information arrives. If some information about $news_t$ is revealed before the earnings announcement date, some of $news_t$ is already stale. In

[19] The correct definition of unexpected return is $[V_t + d_t - RV_{t-1}]/V_{t-1}$. For simplicity, the undeflated difference is used.

that case, only part of $news_t$ will be new information to investors. In reality, accounting reports are not the only source of information. Investors receive information through many different channels. A substantial portion of the uncertainty about $news_t$ may be resolved well before the earnings announcement date. In an attempt to take care of this informational problem, many accounting and finance studies use analysts' forecasts close to earnings announcement date rather than time series based earnings forecasts. The unexpected return in equation (2.13) can be interpreted as unexpected return for a long window, that is, from $t-1$ to t. The unexpected return for a short window such as the day before and the day of earnings announcement should consider some portion of $news_t$ which is already known to investors before earnings announcement date as well as υ_t, which is assumed to be known to investors before earnings announcement date. Therefore, the unexpected return for the short window is represented as follows:

$$ur_t(I_t^i) = (\pi + D)(news_t - E[news_t | I_{t-}^i]),$$

where I_{t-}^i represents information available right before earnings announcement date. In the model in this chapter, however, we assume that all valuation relevant information including accounting information arrives at a discrete time except for υ_t, which is assumed to arrive between t and $t+1$. Therefore, the unexpected return for the short window is:

$$ur_t(I_t^i) = (\pi + D)news_t. \tag{2.14}$$

The short window approach is appropriate in examining the effect of new information on unexpected returns while the long window approach is appropriate in examining the association of accounting information and unexpected returns. This chapter focuses on the informational role of accounting. Hence, the short window ERC will be examined.[20] In the previous section,

[20] See appendix for the long window ERC.

the unexpected earnings for the long window is shown in equation (2.10). The corresponding unexpected earnings for the short window are:

$$uox_t = \rho\varepsilon_{st} + \varepsilon_{rt} + da_t. \tag{2.15}$$

First, the earnings response coefficient under non earnings management (ERC^0) is computed.

$$ERC^0 = \frac{\rho^2(R\sigma_s^2 + \sigma_{\upsilon,s})/[R(R-\gamma)] + \sigma_r^2}{\rho^2\sigma_s^2 + \sigma_r^2}. \tag{2.16}$$

Consistent with Collins and Kothari (1989), it can be shown that ERC^0 is an increasing function of the persistence of sales (γ), and that ERC^0 is a decreasing function of the discount rate (R). Differentiating (2.16) with respect to γ and R yields:

$$\frac{\partial ERC^0}{\partial \gamma} = \frac{\rho^2(R\sigma_s^2 + \sigma_{\upsilon,s} + (R-\gamma)\frac{\partial \sigma_{\upsilon,s}}{\partial \gamma})}{R(R-\gamma)^2(\rho^2\sigma_s^2 + \sigma_r^2)},$$
$$\frac{\partial ERC^0}{\partial R} = -\frac{\rho^2(R\sigma_s^2 + 2R\sigma_{\upsilon,s} - \gamma\sigma_{\upsilon,s})}{R^2(R-\gamma)^2(\rho^2\sigma_s^2 + \sigma_r^2)}.$$

In setting I where $\sigma_{\upsilon,s} = 0$, it is trivial to show that $\frac{\partial ERC^0}{\partial \gamma} > 0$ and $\frac{\partial ERC^0}{\partial R} < 0$.

In setting II where $\sigma_{\upsilon,s} = -\gamma\sigma_t^2$ and $\sigma_s^2 = \sigma_t^2 + \sigma_p^2$, $R\sigma_s^2 + \sigma_{\upsilon,s} + (R-\gamma)\frac{\partial \sigma_{\upsilon,s}}{\partial \gamma} = R\sigma_p^2$ and $R\sigma_s^2 + 2R\sigma_{\upsilon,s} - \gamma\sigma_{\upsilon,s} = (R-\gamma)^2\sigma_t^2 + R\sigma_p^2$. Therefore, $\frac{\partial ERC^0}{\partial \gamma} > 0$ and $\frac{\partial ERC^0}{\partial R} < 0$. In addition, for a given σ_s^2, the ERC^0 is an increasing function of $\sigma_{\upsilon,s}$. Since the variance of the transitory earnings shock is negatively associated with $\sigma_{\upsilon,s}$, the ERC^0 is a decreasing function of the proportion of the total sales variance that is attributable to the transitory sales shock. Equivalently, the ERC^0 is an increasing function of the proportion of the total sales variance that is attributable to the persistent sales shock. Under non earnings management, the proportion of the total sales variance that is attributable to the persistent sales shock is equal to the persistent sales shock percentage perceived by investors ($E[\varepsilon_{st}^t|\varepsilon_{st}]/\varepsilon_{st}$). Therefore, the ERC^0 will be an increasing function of the persistent sales shock percentage.

The persistence of sales is determined by two factors. One is the persistence rate, and the other is the persistent component of the current period's sales. The following next period expected sales equation, which is derived from the sales dynamics defined in equation (2.9), clearly shows the two factors.

$$E[\tilde{s}_{t+1}] = \gamma(s_t - \varepsilon^t_{st}) + \kappa c i_t.$$

If there is no capital investment, the next period expected sales are determined by the persistent component of the current period's sales ($s_t - \varepsilon^t_{st}$) times the persistent rate of sales (γ). The higher γ , the more persistent the current sales. If all sales are persistent (as in setting I), then the persistence of sales is determined by the current period sales times the persistence rate of sales. But if sales also contain a transitory (non-persistent) component, then the persistence rate does not apply to the transitory component (ε^t_{st}). More precisely, γ is the rate of persistence for the persistent component of sales. The persistent component of the current period's sales is the sum of the expected current period's sales and the persistent component of unexpected sales ($E[s_t] + \varepsilon^p_{st}$) or the realized current period's sales minus the transitory component of unexpected sales ($s_t - \varepsilon^t_{st}$). The following proposition summarizes the factors affecting the earnings response coefficient under non earnings management.

Proposition 2.2 *When there is no discretion over accruals, the earnings response coefficient is an increasing function of the rate of persistence for the persistent sales, and a decreasing function of the discount rate. In addition, for a given sales shock, the higher the persistent sales shock variance percentage, the higher the earnings response coefficient.*

The concept of the persistence of sales and unexpected sales may be generalized into the persistence of earnings and unexpected earnings. If other things such as the persistence rate of earnings and the discount rate are equal, firms with a higher persistent earnings shock percentage have a higher earnings response coefficient.

Under earnings management, the earnings response coefficient (ERC) is represented as follows.

$$ERC = \frac{[\rho^2(R\sigma_s^2 + \sigma_{\upsilon,s}) + \xi\rho(\sigma_\upsilon^2 + R\sigma_{\upsilon,s})]/[R(R-\gamma)] + \sigma_r^2}{\rho^2\sigma_s^2 + \sigma_r^2 + \xi^2\sigma_\upsilon^2 + \sigma_n^2 + 2\rho\xi\sigma_{\upsilon,s}}. \tag{2.17}$$

It can be seen that the ERC is a decreasing function of σ_n^2. By definition, the smaller σ_n^2, the more informative earnings management. Therefore, as discretionary accruals become more informative, the earnings response coefficient becomes larger. If other things are equal, information enhancing earnings management increases the ERC while noisy earnings management decreases the ERC.

Proposition 2.3 Ceteris paribus, *the more informative the discretionary accruals, the higher the earnings response coefficient.*

The ERC derived in (2.17) gives some empirical implications. In setting II where $da_t = -\rho\varepsilon_t^t + \varepsilon_t^n$, the earnings response coefficient is as follows:

$$ERC = \frac{\rho^2\sigma_p^2/(R-\gamma) + \sigma_r^2}{\rho^2\sigma_p^2 + \sigma_r^2 + \sigma_n^2}. \tag{2.18}$$

It can be seen that the *ERC* is a decreasing function of σ_n^2. In addition, it can be shown that the ERC under perfectly informative earnings management is greater than the ERC under non earnings management. Therefore, there exists a cutoff of $\bar{\sigma}^2$ such that if σ_n^2 is less than $\bar{\sigma}^2$, then the ERC under earnings management is greater than the ERC under non earnings management. If a firm is perceived to smooth earnings by unraveling the transitory earnings shock, the ERC of the firm will be higher than others which do not manage earnings. Equation (2.18) also implies that the ERC is an increasing function of the persistent earnings shock percentage. The persistent earnings shock percentage increases as the firm is more aggressively engaged in income smoothing. Therefore, the ERC will be higher for firms which are more aggressively engaged in income smoothing.

On the other hand, if $\sigma_{\upsilon,s} = 0$ (setting I), then the ERCs under non earnings management and under perfectly informative earnings management are as follows:

$$\text{CASE Ia:} \qquad ERC^0 = \frac{\rho^2\sigma_s^2/(R-\gamma)+\sigma_r^2}{\rho^2\sigma_s^2+\sigma_r^2}$$

$$\text{CASE Ic:} \qquad ERC = \frac{\rho^2(R\sigma_s^2+\sigma_\upsilon^2)/[R(R-\gamma)]+\sigma_r^2}{\rho^2\sigma_s^2+\sigma_r^2+\rho^2\sigma_\upsilon^2}.$$

It can be shown that the ERC under perfectly informative earnings management is not always greater than the ERC under non earnings management. If γ is close to zero, the ERC under perfectly informative earnings management becomes smaller than the *ERC* under non earnings management. Therefore, the ERC is not an exact measure of the informativeness of reported earnings. However, if all firms are engaged in earnings management and only the magnitude and characteristic of earnings management differ, Proposition (2.3) applies. The ERC for informative earnings management is greater than that for less informative earnings management. That is, within earnings management firms, the *ERC* correctly measures the degree of the informativeness of discretionary accruals.

Finally, it should be emphasized that investors are assumed to know the management's discretionary accrual policy, but not the realization of its random component. That is, investors know that some firms' discretionary accruals are *on average* more informative than others. But, the realized discretionary accruals for the former firms can be less informative than the latter. The ERC depends on the perceived informativeness of discretionary accrual policy, not the informativeness of the realized accruals.

2.7 Conclusions

This chapter examines the impact of earnings management on the variance of unexpected earnings and the earnings response coefficient in a setting where managers can communicate their private value relevant information through discretionary accruals.

The analysis shows that the variance of unexpected earnings is an increasing function of the noise contained in the discretionary accruals, but information enhancing earnings management does not necessarily decrease the variance of unexpected earnings. It depends on the nature of the information communicated through the discretionary accruals. If earnings management is intended to eliminate the transitory component of current earnings shock, then the variance of unexpected earnings decreases. But, if earnings management is to communicate persistent future information, the variance of unexpected earnings is not reduced. When income smoothing is defined as a type of earnings management which induces a decrease in the ex-ante variance of unexpected earnings, income smoothing is achieved by information enhancing earnings management that unravels the transitory component of earnings shock.

With respect to the earnings response coefficient, the analysis shows that the ERC is not an exact measure for the informativeness of reported earnings. In fact, it is a statistical measure of how strongly the market reacts to one dollar of unexpected earnings. The ERC depends on the persistence of earnings and the discount rate as well as the informativeness of the discretionary accruals. This poses a problem since many empirical accounting studies use the earnings response coefficient as a proxy for the information content of reported earnings. In assessing the information content of reported earnings, researchers must carefully control for other factors affecting the earnings response coefficient. However, the ERC for informative earnings management is higher than that for less informative earnings management. Therefore, if other things are equal, the ERC is at least a good measure for the informativeness of reported earnings within earnings management firms.

This chapter has some empirical implications. First, this chapter has an implication for the earnings response coefficient research. In contrast to the extant earnings response coefficient research, this chapter explicitly examines the impact of earnings management, and shows that the nature of earnings management is another important factor in the earnings response coefficient. Second, this chapter has an implication for income smoothing research. Information enhancing earnings management leads to income smoothing only when earnings management eliminates the transitory component of earnings shock. If earnings follow a random walk, it is not possible to decrease the volatility of earnings. Finally, providing a new piece of information is not the only role for accounting. The low R^2 reported in many empirical returns-earnings studies[21] implies that the informational role of accounting is minimal. In fact, accounting is used for many other purposes. For example, accounting numbers are used for executive compensation, debt covenants, pricing, etc. Therefore, researchers should not evaluate accounting earnings only from an ex-ante informational perspective.

[21] See table 1 of Lev (1989).

Chapter 3

Measurement of Earnings Management and Income Smoothing

3.1 Introduction

Many empirical accounting studies examine whether managers manage earnings and under what conditions earnings management is expected. Earnings management studies require a measure of earnings management. Some studies examine a specific accounting method choice or a single accrual (e.g., Zmijeswki and Hangerman (1981) and McNichols and Wilson (1988)). Recently earnings management studies have focused on total accruals.[1] In assessing earnings management, total accruals are decomposed into non-discretionary (normal) accruals and discretionary accruals. As pointed out by Healy (1985), management exercise discretion over discretionary accruals only. Since discretionary accruals are not directly observable, many proxies and estimation techniques for detecting discretionary accruals have been suggested. For example, Healy (1985) uses total accruals as a proxy for discretionary accruals and DeAngelo (1986) uses the change in total accruals as a proxy for discretionary accruals. The Jones (1991) model

[1] Total accruals are defined as the difference between cash from operations and net income. Accounting accruals are affected by accounting method choices and accounting estimates made by managers in the past and currently.

uses a more sophisticated approach to estimating earnings management. Recently most earnings management studies use the Jones model or one of its variants. This chapter critically evaluates the strengths and weakness of the Jones model and its variants in providing an estimate of earnings management, and discusses the measurement of earnings management and income smoothing. It will be the foundation for the subsequent empirical chapters.

In earnings management studies, it is important to segregate discretionary accruals out of total accruals. For example, in his information content study, Subramanyam (1996) regresses annual stock returns on operating cash flows, non-discretionary income, and discretionary accruals. He finds that discretionary accruals are associated with annual stock returns, and interprets this as implying that discretionary accruals are informative with respect to annual stock returns. Many studies have shown that accrual based accounting earnings are more informative with respect to stock returns than cash flows (e.g., Rayburn (1986) and Dechow (1994)). Under the assumption that accounting accruals mainly consist of non-discretionary accruals, this can be interpreted as implying that non-discretionary accruals have incremental information content above cash flows. However, if discretionary accruals erroneously contain a non-discretionary component, then discretionary accruals are expected to be positively associated with annual stock returns. That is, even if discretionary accruals are uninformative, measurement error can make researchers conclude that discretionary accruals are informative.[2] Bernard and Skinner (1996, p. 317) state that:

> "Mismeasurement of discretionary accruals will *at best* lower the power of the research design to detect earnings management, and at worst cause the researcher to conclude that there is earnings management when none actually exits."

Since the measurement error in discretionary accruals can result in incorrect conclusions,

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[2] Subramanyam (1996) is aware of this potential problem, but assumes that the discretionary accrual model correctly decomposes total accruals into the discretionary and non-discretionary components.

the power of a test for earnings management critically depends on the adopted discretionary accrual model. The rest of the chapter is organized as follows. Section 2 reviews the Jones model and its variants and suggests an alternative discretionary model. Section 3 explains the measurement of earnings management and income smoothing used in the subsequent empirical chapters.

3.2 Discretionary Accrual Models

Total accruals are the difference between cash from operations and net income and are operationally defined as the sum of depreciation (including amortization) and the change in working capital excluding change in cash and short term debt. Under earnings management, total accruals are decomposed into non-discretionary accruals and discretionary accruals:

$$TA_{it} \equiv NDA_{it} + DA_{it}, \tag{3.1}$$

where, for firm i in year t,

$$TA_{it} = \text{Total accruals,}$$

$$NDA_{it} = \text{Non-discretionary accruals,}$$

$$DA_{it} = \text{Discretionary accruals.}$$

In order to examine whether earnings management exists and to identify the impact of earnings management on stock returns, empirical earnings management studies require either a discretionary or non-discretionary accrual model in order to decompose total accruals. Jones (1991) proposes a model which controls for changes in the economic circumstances of a firm. Unlike Healy (1985) and DeAngelo (1986) which assume that non-discretionary accruals are zero or constant, non-discretionary accruals are modeled as a linear function of the change in revenues and fixed assets. It is assumed that the unmanaged change in working capital is proportional to the unmanaged change in revenues, and depreciation is proportional to the level of gross property, plant, and equipment. The change in revenues is used as a proxy for the unmanaged change in revenues. The Jones model for total accruals is represented as follows:

$$TA_{it} = \beta_{0t} + \beta_{1t}\Delta REV_{it} + \beta_{2t}PPE_{it} + \varepsilon_{it}, \tag{3.2}$$

where, for firm i in year t,

$$\Delta REV_{it} = \text{Change in revenues from the prior period},$$

$$PPE_{it} = \text{Gross property, plant, and equipment.}$$

The non-discretionary and discretionary accruals are computed as the forecasted value and the prediction error, respectively.

$$NDA_{it} = \hat{\beta_{0t}} + \hat{\beta_{1t}}\Delta REV_{it} + \hat{\beta_{2t}}PPE_{it},$$

$$DA_{it} = TA_{it} - NDA_{it}.$$

The Jones model implicitly assumes that managers do not exercise discretion over revenues. Dechow et al. (1995) raise a question about this assumption and further consider the change in receivables since revenues may be shifted across periods by adjusting recognition timing. They use the change in revenues minus the change in receivables as a proxy for the unmanaged change in revenues.

$$TA_{it} = \beta_{0t} + \beta_{1t}(\Delta REV_{it} - \Delta REC_{it}) + \beta_{2t}PPE_{it} + \varepsilon_{it}, \tag{3.3}$$

where $\Delta REC_{it} = $ Change in receivables from the prior period for firm i in year t.

Key (1997) proposes a refinement on the estimation of deprecation and amortization expense. The Jones model does not differentiate between depreciation and amortization. That is, it is assumed that the level of gross property, plant, and equipment explains both depreciation and amortization. Since amortization expense can be better explained by intangible assets, she explicitly includes gross intangible assets as an additional explanatory variable.

$$TA_{it} = \beta_{0t} + \beta_{1t}\Delta REV_{it} + \beta_{2t}PPE_{it} + \beta_{3t}IA_{it} + \varepsilon_{it}, \tag{3.4}$$

where ΔIA_{it} = Gross intangible assets for firm i in year t.

The improvements proposed by Dechow et al. (1995) and Key (1997) lead to the following modified Jones model:

$$TA_{it} = \beta_{0t} + \beta_{1t}(\Delta REV_{it} - \Delta REC_{it}) + \beta_{2t}PPE_{it} + \beta_{3t}IA_{it} + \varepsilon_{it}. \tag{3.5}$$

DeFond and Jiambalvo (1994) propose a cross-sectional Jones model rather than time-series model. The cross sectional Jones model has some advantages over the original time-series model. The cross-sectional model usually yields larger samples, and does not assume the stationarity of the discretionary accrual model. (Subramanyam (1996)). The cross-sectional model is usually estimated by year and industry. Therefore, the cross-sectional Jones model controls for year and industry specific effects. On the other hand, the cross-sectional model has some problems. Researchers may have an ex-post data advantage over investors. That is, the data required for the cross-sectional model may not be available to investors when they assess total accruals. However, investors are assumed to hold a rational expectation about the firm's accrual policy and industry factors. Hence, they are assumed to consider the year and industry effects when they assess total accruals. Another problem is the implicit assumption made by the cross-sectional model. The cross-sectional model assumes that the discretionary accrual model is the same for all firms in an industry regardless of their operating strategy or their stage in their product life cycle. If firms in an industry are not homogeneous, the estimated discretionary accrual model will suffer from measurement error.

Some studies have examined the relative performance of discretionary accrual models. For example, Dechow et al. (1995) examine five discretionary accrual models including Healy (1985), DeAngelo (1986), the industry model by Dechow and Sloan (1991), the Jones (1991) model and the modified version of Jones model suggested by Dechow et al. (1995). They compare the performance of the five representative discretionary accrual models using four samples: (i) a random sample; (ii) a sample of firm-years experiencing extreme financial performance; (iii) a sample of firm-years with artificially induced earnings management; and (iv) a sample of firm-years in which the SEC alleges earnings are overstated. They find that the Jones model and Dechow et al.'s (1995) modified Jones model best detect earnings management. Guay et al. (1996) also compare the relative performance of the five representative discretionary accrual models by regressing annual stock returns on operating cash flows, non-discretionary accruals, and discretionary accruals. If the adopted discretionay accrual model randomly divides total accruals into discretionary and non-discretionary accruals, then there will be no difference in the coefficients on the discretionary accruals and the non-discretionary accruals. They find that the estimated coefficients employing the Healy, DeAngelo, and industry models are indistinguishable from those assuming a random decomposition of accruals into non-discretionary and discretionary accruals. They conclude that the Jones model and Dechow et al.'s (1995) modified Jones model perform best in segregating discretionary accruals out of total accruals, but still the power of test is low due to the measurement error. Hansen (1998) examines the relative performance of the Jones model, the modified Jones model proposed by Dechow et al. (1995), and the DeAngelo model by regressing aggregate future earnings on operating cash flows, discretionary accruals, and non-discretionary accruals. He finds that the coefficient on non-discretionary accruals is significantly higher than that on discretionary accruals in the Jones and modified Jones models, but not in the DeAngelo model. He concludes that the Jones and modified Jones models perform better than the DeAngelo model in isolating discretionary accruals out of total accruals, but still contain very little manipulation content. He also examines the working capital discretionary accrual proxy used by DeFond and Jiambalvo (1994), and reports that the result is insensitive to whether total accruals or working capital accruals are used as a proxy for earnings management.[3]

Even if the Jones and Dechow et al.'s (1995) modified Jones model perform better than the Healy, DeAngelo, and industry models in separating total accruals into non-discretionary and discretionary accruals, they have a lot of deficiencies. Bernard and Skinner (1996) point out that the Jones model misclassifies some non-discretionary accruals as discretionary accruals. For example, gains or losses from lawsuit are not likely to be discretionary, but the Jones model treats them as discretionary.[4] Since the Jones model and its variants assume that the non-discretionary change in working capital is explained by the change in revenues, other non-discretionary accruals which do not depend on revenues are misclassified. Healy (1996) criticizes that the existing accrual models do not properly incorporate the effect of accounting principles such as conservatism. For example, the existing models do not reflect the asymmetric treatment of gains and losses. He also points out that accounting rules constrain accruals to reverse over time, but most accrual models do not capture this feature. Chapter 2 of this thesis suggests this line of improvement by taking $\varepsilon_{it} = \upsilon_{it} - \eta_{it}\upsilon_{it-1}$.

$$TA_{it} = \beta_{0t} + \beta_{1t}(\Delta REV_{it} - \Delta REC_{it}) + \beta_{2t}PPE_{it} + \upsilon_{it} - \eta_{it}\upsilon_{it-1},$$

where υ_{it} denotes the discretionary accruals taken by firm i in year t, and η_{it} denotes the reversion parameter. The reversion of discretionary accruals made last year is captured by

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[3]There is no study testing the power of Key's (1997) modification to the Jones model. Table 4 of Key (1997), who examines earnings management by firms in the cable television industry during periods of Congressional scrutiny, reports negative coefficients on gross property, plant, and equipment, gross intangible assets and the change in revenues. Only the coefficients on gross property, plant, and equipment and gross intangible assets are significant.

[4]Recall that, in this thesis, total accruals are measured by the change in working capital minus depreciation (see section 3). If gains or losses from lawsuits are received or paid in the same period in which they are recognized, then they are not captured in total accruals. In that case, there is no misclassification problem. Only when the gains or losses from lawsuits are recorded in working capital accounts before they are received or paid, they are miss-classified as discretionary accruals. If total accruals are measured from cash flow statement, then the gains or losses from lawsuits will always be captured as accruals. In that case, the misclassification problem always exists since the gains or losses from lawsuits are classified as discretionary rather than non-discretionary under the Jones model.

$\eta_{it}\upsilon_{it-1}$. The error term, however, does not need to be of first-order moving average type. It may be generalized into an ARMA (m,n) type error term. Combining this line of improvement with the one suggested in equation (3.5) leads to the following non-discretionary accrual model:

$$TA_{it} = \beta_{0t} + \beta_{1t}(\Delta REV_{it} - \Delta REC_{it}) + \beta_{2t}PPE_{it} + \beta_{3t}IA_{it} + \sum_{j=1}^{m} \zeta_{itj}\varepsilon_{it-j} + \upsilon_{it} - \sum_{j=1}^{n} \eta_{itj}\upsilon_{it-j}, \tag{3.6}$$

where ζ_{itj} represents the j^{th} autoregressive parameter for firm i in year t and η_{itj} represents the j^{th} moving average parameter for firm i in year t. In this model, only υ_{it} constitutes discretionary accruals while $\sum_{j=1}^{m} \zeta_{itj}\varepsilon_{it-j} - \sum_{j=1}^{n} \eta_{itj}\upsilon_{it-j}$ are part of non-discretionary accruals. A drawback of the above model is that it is specified for time-series data, not for cross-sectional data.

It is an empirical question whether the cross-section model outperforms the time-series based model or vice versa. For example, Subramanyam (1996) compares the time-series and cross-sectional versions of the Jones and the modified Jones model proposed by Dechow et al. (1995). He finds that the cross-sectional based models have less average standard error of the estimated coefficients than the time-series based models, and that the proportion of the correct signs of the estimated coefficients is higher for the cross-sectional based models than for the time-series based models. Based on this, he concludes that the cross-sectional model is better specified than the time-series based model. Dechow et al. (1995) and Guay et al. (1996) consider a naive cross-sectional industry model, but do not directly compare the time-series based Jones model and the cross-sectional based Jones model. Hence, the question as to whether the cross-sectional based model better detects earnings management than the time-series based model remains open.

To summarize, this section evaluates the strengths and weakness of the existing non-discretionary accruals model. There are two types of measurement errors.

(i) Incorrectly including non-discretionary items in discretionary accruals.

(ii) Incorrectly including discretionary items in non-discretionary accruals.

Even if the Jones model and its variants perform better than other availalbe models, measurement error can induce incorrect conclusions about the existence of earnings management and the nature of discretionary accruals. If the error introduce by (i) is uncorrelated with the event of interest, then type (i) measurement error will just lead to noise in the estimate of discretionary accruals and lower power of a test. However, if the misclassified non-discretionary item is correlated with the event of interest to the researcher, then type (i) measurement error could lead to erroneous results that lead to incorrectly accepting or rejecting the null hypothesis. If type (ii) measurement error occurs, then some discretionary accruals are not properly identified. In that case, researchers may fail to identify earnings management even if earnings management exists.

3.3 Measurement of Discretionary Accruals and Income Smoothing

3.3.1 Measurement of Discretionary Accruals

Consistent with previous studies (e.g., Jones (1991), Dechow et al. (1995), and Subramanyam (1996)), the total accruals for firm i in year t (TA_{it}) are calculated from COMPUSTAT as follows.

$$TA_{it} = (\Delta CA_{it} - \Delta CASH_{it}) - (\Delta CL_{it} - \Delta CD_{it}) - DEP_{it}, \tag{3.7}$$

where, for firm i in year t,

ΔCA_{it} = Change in current assets (COMPUSTAT item #4),

$\Delta CASH_{it}$ = Change in cash and cash equivalents (COMPUSTAT item #1),

ΔCL_{it} = Change in current liabilities (COMPUSTAT item #5),

ΔCD_{it} = Change in debt in current liabilities (COMPUSTAT item #34),

DEP_{it} = Depreciation and amortization (COMPUSTAT item #14).

Note that ΔCD_t is added back since it is an item of cash from financing activities.

The modified Jones model proposed by Dechow et al. (1995) is used to disaggregate total accruals into discretionary and non-discretionary accruals. In order to reduce the heteroscedasticity and to enhance comparability across firms, variables are deflated by the lagged total assets. In order to consider the industry differences, each regression is run by year and two digit SIC code as in DeFond and Jiambalvo (1994). That is, a cross-sectional version of the modified Jones model is used.

$$\frac{TA_{ijt}}{A_{ijt-1}} = \beta_{0jt}\frac{1}{A_{ijt-1}} + \beta_{1jt}\frac{\Delta REV_{ijt} - \Delta REC_{ijt}}{A_{ijt-1}} + \beta_{2jt}\frac{PPE_{ijt}}{A_{ijt-1}} + \varepsilon_{ijt}, \tag{3.8}$$

where, for firm i in industry j for year t,

ΔREV_{ijt} = Change in revenues from the prior period (COMPUSTAT item #35),

ΔREC_{ijt} = Change in net receivables from the prior period (COMPUSTAT item #2),

PPE_{ijt} = Gross property, plant, and equipment (COMPUSTAT item #7),

A_{ijt-1} = Lagged total assets (COMPUSTAT item #6).

Firms in the same industry j are assumed to have the same coefficients, β_{0jt}, β_{1jt}, and β_{2jt} for a given year t. It is predicted that β_{1jt} is positive and β_{2jt} is negative since an increase in working capital increases total accruals and an increase in depreciation decreases total accruals.

The non-discretionary and discretionary accruals are computed as the forecasted value and the prediction error, respectively.

$$\frac{NDA_{ijt}}{A_{ijt-1}} = \hat{\beta}_{0jt}\frac{1}{A_{ijt-1}} + \hat{\beta}_{1jt}\frac{\Delta REV_{ijt} - \Delta REC_{ijt}}{A_{ijt-1}} + \hat{\beta}_{2jt}\frac{PPE_{ijt}}{A_{ijt-1}},$$
$$\frac{DA_{ijt}}{A_{ijt-1}} = \frac{TA_{ijt}}{A_{ijt-1}} - \frac{NDA_{ijt}}{A_{ijt-1}}.$$

3.3.2 Measurement of Income Smoothing

The variability of earnings can be represented by the standard deviation of earnings. The smoothness of earnings, therefore, is measured by the negative of the variability of earnings. Before measuring the smoothness of earnings, the earnings generating process must be identified. It can be independent of current earnings, a random walk, or more possibly in-between (see Watts and Zimmerman (1986)). If the earnings generating process is independent of the current period's earnings, that is, next period's earnings are not affected by the realization of the current period's earnings, then it can be represented as follows:

$$E_t = \rho_0 + \rho_1 t + \varepsilon_t,$$

where E_t = Earnings in year t,

ε_t = Disturbance term, *iid* with mean zero.

A simple variance of E_t cannot be used to measure the variability of earnings because the trend term (ρ_1) influences the variance. The impact of growth can be eliminated by considering the change in earnings ($E_t - E_{t-1}$), which is represented by $\rho_1 + (\varepsilon_t - \varepsilon_{t-1})$. The average of the change in earnings is ρ_1, which can be used as a measure of growth of earnings. Note that the variance of the change in earnings does not depend on growth (ρ_1).

On the other hand, if the earnings generating process follows a random walk with a trend, ρ, it is represented as follows:

$$E_t = E_{t-1} + \rho + \varepsilon_t.$$

If ε_t is assumed to be independent and identically distributed with mean zero, then the average of the change in earnings is ρ and the variance of the change in earnings is independent of growth (ρ).

Under the assumption that the earnings generating process is independent of the realization of the current period's earnings or follows a random walk,[5] the smoothness of reported earnings for firm i in year t (SRE_{it}) is calculated over the ten year period preceding year t as the negative of the standard deviation of the change in reported earnings per share deflated by the average of

[5] If the earnings generating process is $E_t = \xi E_{t-1} + \rho + \varepsilon_t$ or other variations, then the use of the change in earnings does not solve the problem arising from growth. Researchers have to identify the earnings generating process for each firm, which is very costly to implement in a large scale study. Unless the earnings generating process follows a random walk or is independent of current earnings, the measure of smoothness used in this thesis suffers from measurement error.

the beginning of the fiscal period stock prices.[6] In this thesis, the primary earnings per share is used for earnings per share (EPS). Growth is measured as the average of the change in earnings per share.[7]

$$SRE_{it} = -\frac{SD(\Delta EPS_{it})}{AVG(P_{it-1})},$$
$$GROWTH_{it} = \frac{AVG(\Delta EPS_{it})}{AVG(P_{it-1})}, \tag{3.9}$$

where, for firm i in year t,

$SD(\Delta EPS_{it})$ = Standard deviation of changes in EPS,

$AVG(\Delta EPS_{it})$ = Average of changes in EPS,

$AVG(P_{it-1})$ = Average of beginning stock prices per share .

In order to measure the degree of earnings management, a measure of pre-managed earnings is needed. The pre-managed earnings are calculated by subtracting discretionary accruals from reported earnings. The pre-managed earnings per share for firm i in year t (EPS^0_{it}) is measured as follows:

$$EPS^0_{it} = EPS_{it} - \frac{DA_{it}}{\text{No. of shares Outstanding}}.$$

Based on the pre-managed earnings per share, the smoothness of pre-managed earnings for firm i in year t (SPE_{it}) is measured as follows:

$$SPE_{it} = -\frac{SD(\Delta EPS^0_{it})}{AVG(P_{it-1})}.$$

[6] In this thesis, all years refer to COMPUSTAT years. A COMPUSTAT year starts June 1 and ends May 31 of the following year.

[7] Some research uses the market to book value of the equity as a proxy for growth (i.e., Teoh and Wong (1993) and Shevlin and Shores (1993)). Note that factors other than growth can affect the market to book ratio. The average of changes in EPS is a straightforward measure for growth, but it may not reflect unrealized growth potential which the market already recognizes.

The subsequent empirical analysis requires a measure of income smoothing. Income smoothing for firm i in year t (IS_{it}) is measured by the difference between the smoothness of reported earnings and the smoothness of pre-managed earnings.

$$IS_{it} = SRE_{it} - SPE_{it}.$$

Firms are categorized into income smoothing firms and variance increasing earnings management firms by the sign of IS_{it}. By definition, income smoothing firms manage earnings so as to reduce the variance of unexpected earnings while the variance of reported earnings for variance increasing earnings management firms increases as a result of earnings management. Therefore, a firm is classified as an income smoothing firm in year t if IS_{it} is positive whereas a firm is classified as a variance increasing earnings management firm if IS_{it} is negative.

The measures of smoothness of reported and pre-managed earnings are also estimated over the entire data period from 1978 to 1995. In order to increase the probability of identifying the adopted earnings announcement policy, the maximum number of years available on COMPUSTAT are used.[8] The long estimation window assumes that earnings announcement policy is stable over the examination period. If the long estimation window is used, the measures of smoothness of reported and pre-managed earnings are represented by SRE_i and SPE_i. Similarly, $GROWTH_i$ represents a measure of growth esitmated over the period from 1978 to 1995.[9]

3.4 Concluding Remarks

This chapter reviews the existing discretionary accrual models, focusing on the Jones model and its variants. For the subsequent empirical chapters, a cross-sectional version of the De-

[8] The COMPUSTAT PC Plus 96 CD ROM contains most recent 20 years of annual data. Since the measure of smoothness of earnings requires variables that are twice lagged, at most 18 years of data are available.

[9] As a primary measure of smoothness of earnings and growth, chapter 4 uses SRE_{it}, SPE_{it}, and $GROWTH_{it}$ whereas chapter 5 uses SRE_i, SPE_i, and $GROWTH_i$.

chow et al.'s (1995) modified Jones model is adopted to decompose total accruals into non-discretionary and discretionary components. Even if the Jones model and its variants are the most sophisticated discretionary accrual models available today, they have many shortcomings. In particular, measurement error in estimating discretionary accruals can lead to incorrect conclusions about the existence and nature of earnings management. Therefore, researchers must be very careful in interpreting their results. In an attempt to improve the existing discretionary accrual model, a modified Jones model, which incorporates the reversal aspect of accruals and the suggestions of Dechow et al. (1995) and Key (1997), is proposed. This thesis does not examine whether the proposed model will perform better than other existing discretionary accrual models. It will be left for future research.

Chapter 4

The Information Content of Earnings Announcements

4.1 Introduction

This chapter examines the impact of earnings management on the relation between stock returns and unexpected earnings. The flexibility of Generally Accepted Accounting Principles gives managers some discretion over accounting accruals. If this discretion is exercised to its extreme, then the resulting accrual based earnings can be uninformative about firm value (Schipper (1989)). However, it is well documented that accrual based accounting earnings are more informative about stock returns than operating cash flows (e.g., Rayburn (1986) and Dechow (1994)). Consistent with other earnings management studies (e.g., Healy (1985), Jones (1991), and DeFond and Park (1997)), it is assumed that accruals can be decomposed into non-discretionary and discretionary components, and that earnings management is implemented through the selection of discretionary accruals.[1] Subramanyam (1996) finds that discretionary accruals are associated with annual stock returns after controlling for non-discretionary accruals and operating cash flows. He concludes that discretionary accruals are on average

[1] See chapter 2 for a discussion about the conceptual framework and related empirical issues regarding the decomposition of total accruals into non-discretionary and discretionary accruals.

informative about stock returns. Rather than examining the *on average* nature of earnings management, this chapter focuses on the individual firm's discretionary accrual policy and examines its impact on the earnings response coefficient, which represents the association between unexpected earnings and abnormal share returns.

In examining the relation between earnings management and the earnings response coefficient, this study focuses on the smoothness of reported earnings, which is measured by the negative of the ex-ante variance of unexpected earnings shock (see section 4.2.2 for details). Depending on the nature of the chosen discretionary accrual policy, reported earnings can be smoother or more volatile than pre-managed earnings, which are defined as operating cash flows plus non-discretionary accruals. A firm is classified as an income smoothing firm if reported earnings are smoother than pre-managed earnings. Otherwise, the firm is classified as a variance-increasing earnings management firm. Many studies consider income smoothing as the main motive for earnings management. For example, Trueman and Titman (1988) model a firm that is going to issue debt and has an incentive to smooth earnings in order to lower the cost of capital. In addition, consumption smoothing and job security are also mentioned as motives for income smoothing (e.g., Lambert (1984) and Fudenberg and Tirol (1995)). DeFond and Park (1997) find that if current earnings are low (high), but expected future earnings are high (low), managers take income increasing (decreasing) discretionary accruals.

A firm's choice of discretionary accruals depends on the incentives faced by the firm or managers. As evidenced in the empirical section, most firms are engaged in income smoothing. However, there are circumstances in which incentives other than income smoothing dominate. Under these circumstances, a firm will take discretionary accruals that are not intended to smooth earnings. If these circumstances are expected to happen more frequently for a given firm, then investors will assess that this firm is more likely to select accruals that deviate from income smoothing. In this thesis, the term "discretionary accrual policy" is used to refer to what investors perceive as the on average nature of discretionary accruals. If there are more occasions under which a firm takes discretionary accruals that deviate from the default income smoothing policy, then the firm's discretionary accrual policy will be classified as variance increasing earnings management.

A short window event study is employed to examine the relation between the degree of income smoothing and the earnings response coefficient. The degree of income smoothing is measured by the change in smoothness between reported and pre-managed earnings. The regression results indicate that the earnings response coefficient is an increasing function of the degree of income smoothing. The more actively a firm is engaged in income smoothing, the stronger the stock price reaction to one dollar of unexpected earnings. This result is consistent with Chaney et al. (1998), who report that income smoothing firms have higher earnings response coefficients than non-income smoothing firms in their annual window study.[2] In order to check whether the type of earnings management affects the relation between the degree of income smoothing and the earnings response coefficient, the same analyses are performed separately on the income smoothing and variance-increasing earnings management subgroups. It is found that income smoothing increases the stock price reaction to unexpected earnings. However, the hypothesis that variance-increasing earnings management decreases the stock price reaction to one dollar of unexpected earnings is not supported by the data.

This study has two features that differ from other earnings management and earnings response coefficient studies. First, this study employs a short window (the day before and the day of earnings announcements) event study design rather than a long window association study design. For example, Ramakrishnan and Thomas (1998) use an annual window in investigating the relation between the time series characteristics of excess earnings and the earnings response

[2] Chaney et al. (1998) use a different classification scheme. A firm is assumed to be engaged in income smoothing if the firm takes a positive (negative) discretionary accrual when the firm's pre-managed earnings are below (above) the last year's reported earnings. A firm is classified as income smoothing firms if the frequency of their measure of income smoothing is greater than that of the median firm in their sample.

coefficient.[3] Subramanyam (1996) also uses an annual window in his examination of the informativeness of discretionary accruals with respect to firm value. The long window research design provides evidence that discretionary accruals reflect value relevant information, but not necessarily new information. In investigating the impact of new information on stock returns, the short window study design is more relevant than the long window association test design (Jeter and Chaney (1992) and Easton (1998)). Since the focus of this chapter is to examine whether discretionary accruals are informative about stock returns, the short window event study design is more appropriate. Secondly, this study examines variance increasing earnings management firms as well as income smoothing firms. By using a dummy variable design, Chaney et al. (1998) focus on income smoothing, but do not examine the differential impact of income smoothing and variance-increasing earnings management on the earnings response coefficient. By decomposing earnings management into income smoothing and variance increasing earnings management, this study provides a more complete picture about the impact of the nature and magnitude of earnings management on the information content of earnings reports.

The rest of the chapter is organized as follows. Section 2 develops empirical hypotheses and the research design is explained in section 3. Data and empirical results are presented in section 4 and conclusions are reached in section 5.

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[3]Ramakrishnan and Thomas (1998) define excess earnings as the change in reported earnings minus expected return due to dividend retention. They develop a model that links unexpected earnings and unexpected returns, and provide empirical evidence consistent with the hypothesis that the market uses non-earnings information to identify the components of an earnings shock. However, their focus is not earnings management.

4.2 Development of Hypotheses

4.2.1 Classification of Firms

Pre-managed earnings are defined as operating cash flows plus non-discretionary accruals. Therefore, (managed) reported earnings can be viewed as the sum of pre-managed earnings and discretionary accruals. If investors can identify the discretionary accruals, then they effectively know both pre-managed earnings and reported earnings. It is assumed that investors can identify the discretionary accruals by using the Jones (1991) model, which is one of the most widely used discretionary accrual model in accounting research.[4] In order to estimate the discretionary accruals, investors need data such as operating cash flows and detailed line items. These data are not usually available to investors at the time of an earnings announcement. Therefore, investors cannot identify the discretionary accruals until they have access to the full set of financial statements. Investors are assumed to form a rational expectation about the nature and magnitude of the discretionary accruals based on their beliefs about the ex-ante characteristics of the earnings shock. Even if the ex post realization of discretionary accruals may be different from the investors' ex ante expectation, investors will on average correctly assess the informativeness of the discretionary accruals.

In a setting where earnings are managed through discretionary accruals, the information content of the reported earnings relative to pre-managed earnings depends on the nature of discretionary accruals. If the discretionary accruals reflect value relevant information, which are not captured by pre-managed earnings, then managed earnings will be more useful for valuation.[5] On the other hand, if the discretionary accruals are not correlated with other value

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[4]This chapter uses a modified version of the Jones model proposed by Dechow et al. (1995).

[5]For example, the explicit and implicit contracts with shareholders or managerial reputation in the labor market may induce managers to disclose value relevant information.

relevant information, then managed earnings will not be as useful as pre-managed earnings for valuation purposes. In that case, managed earnings can be characterized as the garbling of unmanaged earnings.[6] In a more general setting in which discretionary accruals imperfectly reveal other value relevant information, the discretionary accruals can be modeled as the sum of the informative and noisy components. In this setting, the usefulness of discretionary accruals depends on the relative weight of the informative and noisy components. The more informative earnings management, the more weight is put on the informative component. The informativeness of discretionary accruals is endogenously determined by the incentives faced by managers.

A firm is deemed to manage earnings if the smoothness of reported earnings is different from the smoothness of pre-managed earnings, as classified in Figure 4.1. The horizontal axis represents the degree of smoothness of pre-managed earnings (SPE) and the vertical axis the degree of smoothness of reported earnings (SRE). Firms off the 45 degree line are engaged in earnings management whereas firms on the 45 degree line are not engaged in earnings management. For example, firm A and firm B do not manage earnings whereas firm C and firm D do manage earnings. Firm A and firm B will be referred to as non-earnings management firms, and firm C and firm D will be referred to as earnings management firms. Earnings management firms are further decomposed into income smoothing and variance-increasing earnings management firms. Depending on the nature of earnings management, earnings management leads either to smoother earnings or to more volatile earnings. Firm C will be referred to as an income smoothing firm because (managed) reported earnings are smoother than pre-managed

[6] If debt covenants use accounting numbers, then managers have incentives to circumvent covenant restrictions by managing reported earnings, which may result in garbling. Key (1997) reports that firms in the cable television industry managed earnings in order to mitigate Congressional scrutiny in late 1980s and early 1990s. The cable TV managers used discretionary accruals to relieve the political pressure of rate regulation, not to communicate managers' private information. Big baths by incoming CEOs or large income increasing discretionary accruals by IPO firms are other examples of the garbling of pre-managed earnings.

earnings. Firm D will be referred to as a variance-increasing earnings management firm because reported earnings are more volatile than pre-managed earnings.

4.2.2 Hypotheses

This subsection presents a simplified version of earnings management model developed in chapter 2, which is used to develop empirical hypotheses about the relation between earnings management and the earnings response coefficient.

Assume that a firm's pre-managed earnings (X_t) are represented by expected earnings given the information available to investors before the earnings announcement ($E[X_t|I_t]$) plus an unexpected shock to pre-managed earnings ($\dot{\varepsilon}_t$), $X_t = E[X_t|I_t] + \dot{\varepsilon}_t$. The unexpected shock to pre-managed earnings is further decomposed into persistent and transitory components:

$$\dot{\varepsilon}_t = \varepsilon_t^p + \varepsilon_t^t,$$

where ε_t^p and ε_t^t represent persistent and transitory earnings shocks, respectively. The persistent earnings shock (ε_t^p) affects both current earnings and expected future earnings whereas the transitory earnings shock (ε_t^t) affects only current earnings. It is assumed that the firm has private information about the components of the pre-managed earnings shock, and that earnings management is implemented through the selection of discretionary accruals. The unexpected shock to (managed) reported earnings (ε_t) can be viewed as consisting of pre-managed earnings shock ($\dot{\varepsilon}_t$) and discretionary accruals (d_t):

$$\varepsilon_t = \varepsilon_t^p + \varepsilon_t^t + d_t.$$

A firm chooses its discretionary accrual policy based on the incentives faced by the firm. The discretionary accrual is modeled as follows:

$$d_t = \xi\varepsilon_t^t + \varepsilon_t^n,$$

where ε_t^n is a disturbance term with mean zero, and $\xi \in [-1, 0]$ is the weight on the transitory earnings shock. The discretionary accrual policy adopted by a firm is fully characterized by ξ and ε_t^n. By taking $d_t = -\varepsilon_t^t$, a firm can effectively report persistent earnings by eliminating all of the transitory earnings shock. If a firm takes $d_t = \varepsilon_t^n$, then the resulting reported earnings will be the garbling of pre-managed earnings. The structure of the discretionary accrual is chosen to highlight the impact of earnings management on the smoothness of earnings. The smoothness of earnings is measured by the negative of the volatility of earnings. In particular, the volatility of earnings is measured by the ex-ante variance of earnings shock. Under the assumption that persistent earnings shock (ε_t^p), transitory earnings shock (ε_t^t), and noise (ε_t^n) are independent and normally distributed with variances σ_p^2, σ_t^2, and σ_n^2 respectively, the ex-ante variances of the pre-managed and reported earnings shocks are as follows:

$$Var(\dot{\varepsilon}_t) = \sigma_p^2 + \sigma_t^2$$
$$Var(\varepsilon_t) = \sigma_p^2 + (1+\xi)^2\sigma_t^2 + \sigma_n^2.$$

Depending on the nature of the adopted discretionary accrual, reported earnings can be smoother or more volatile than pre-managed earnings. Chapter 2 shows that reported earnings can be smoother than pre-managed earnings only if the discretionary accrual is negatively correlated with the transitory earnings shock.[7] For example, if the discretionary accrual is the negative of the transitory earnings shock ($d_t = -\varepsilon_t^t$), then the discretionary accrual effectively eliminates all of the transitory earnings shock. In that case, the reported earnings are smoother than the pre-managed earnings. On the other hand, if a firm's earnings management effectively adds noise to pre-managed earnings ($d_t = \varepsilon_t^n$), the reported earnings become more volatile than the pre-managed earnings. Note that income smoothing is characterized by a negative value of ξ and variance-increasing earnings management is characterized by a positive value of σ_n^2.

[7]It is well known that if a firm's earnings generating process follows a random walk, it is not possible to smooth earnings because the earnings shock is all persistent.

It is assumed that investors observe the total earnings shock, but do not observe the components of the earnings shock at the time of an earnings announcement. However, investors hold beliefs about the composition of the earnings shock. The conditional expectation of the persistent earnings shock given the total observed earnings shock ($\bar{\varepsilon}_t^p \equiv E[\varepsilon_t^p|\varepsilon_t]$) is calculated by $\bar{\varepsilon}_t^p = \sigma_p^2 \varepsilon_t / Var(\varepsilon_t)$.[8] Similarly, the conditional expectations of the transitory earnings shock ($\bar{\varepsilon}_t^t$), and the noise ($\bar{\varepsilon}_t^n$) are calculated by $\bar{\varepsilon}_t^t = (1+\xi)^2 \sigma_t^2 \varepsilon_t / Var(\varepsilon_t)$, and $\bar{\varepsilon}_t^n = \sigma_n^2 \varepsilon_t / Var(\varepsilon_t)$, respectively. The price reaction to an earnings announcement depends on the beliefs about the composition of the earnings shock. Firm value is only affected by the unexpected shock to reported earnings, not by the anticipated earnings. The unexpected change in firm value (ur_t) can be represented as follows:[9]

$$ur_t = \Phi \bar{\varepsilon}_t^p + \bar{\varepsilon}_t^t, \tag{4.1}$$

where $\Phi > 1$ is the multiplier for the conditional expectation of the persistent earnings shock.[10] $\Phi > 1$ implies that the value implication of one dollar of persistent earnings shock is greater than that of one dollar of transitory earnings shock. Note that firm value is not affected by the noise component. When the unexpected changes in firm value are regressed on the unexpected earnings, the coefficient on the unexpected earnings is called the earnings response coefficient

[8] It is assumed that the discretionary accruals are not observable at the time of the earnings announcement (see section 4.2.1). If the discretionary accruals are known to investors, then the conditional expectation of the persistent earnings is $E[\varepsilon_t^p|\dot{\varepsilon}_t, d_t] = \frac{\sigma_n^2 \sigma_t^2 \dot{\varepsilon}_t + \xi \sigma_p^2 \sigma_t^2}{\sigma_n^2(\sigma_p^2+\sigma_t^2)+\xi^2\sigma_p^2\sigma_t^2}$.

[9] The model assumes that transitory earnings have a dollar for dollar impact on firm value. Ramakrishnan and Thomas (1998) derive a similar function.

[10] The magnitude of Φ is affected by many factors including the persistence parameter of earnings and interest rate. See chapter 2 for details.

(ERC). The earnings response coefficient is:

$$
\begin{aligned}
ERC &= \frac{COV(ur_t, \varepsilon_t)}{Var(\varepsilon_t)} \\
&= \frac{\Phi\sigma_p^2 + (1+\xi)^2\sigma_t^2}{\sigma_p^2 + (1+\xi)^2\sigma_t^2 + \sigma_n^2}.
\end{aligned} \tag{4.2}
$$

If there is no earnings management (i.e., $\xi = 0$ and $\sigma_n^2 = 0$), then the corresponding earnings response coefficient (ERC^0) is as follows:

$$ERC^0 = \frac{\Phi\sigma_p^2 + \sigma_t^2}{\sigma_p^2 + \sigma_t^2}.$$

If a firm smooths earnings by taking $\xi = -1$ and $\sigma_n^2 = 0$, the ERC becomes Φ, which is greater than the ERC^0. If a firm adds noise to pre-managed earnings (i.e., $\xi = 0$ and $\sigma_n^2 > 0$), then the ERC is less than the ERC^0. It can be seen that the ERC is a decreasing function of ξ and the variance of noise (σ_n^2). Since income smoothing is characterized by a negative value of ξ, income smoothing will increase the earnings response coefficient. On the other hand, variance-increasing earnings management is characterized by a positive value of σ_n^2. Therefore, variance-increasing earnings management will decrease the earnings response coefficient.

The following example depicts the four points in Figure 4.1.

Firm	**PE** (σ_p^2, σ_t^2)	**RE** $(\sigma_p^2, (1+\xi)^2\sigma_t^2, \sigma_n^2)$	**Change in firm value**	$\bar{\varepsilon}_t^p/\varepsilon_t$	**ERC**
A	(5,5)	(5,5,0)	4.0 ε_t	50.00 %	4.0
B	(8,8)	(8,8,0)	4.0 ε_t	50.00 %	4.0
C	(8,8)	(8,2,0)	5.8 ε_t	80.00 %	5.8
D	(5,5)	(5,5,6)	2.5 ε_t	31.25 %	2.5

PE: Composition of the variance of pre-managed earnings shock

RE: Composition of the variance of (managed) reported earnings shock

Firms A and B do not manage earnings, hence the smoothness of reported earnings is the same as that of pre-managed earnings. Firms C and D do manage earnings, hence the smoothness of reported earnings is different from that of pre-managed earnings. Firm C reports smoother earnings by taking $d_t = -0.5\varepsilon_t^t$. As a result, the perceived variance of the reported earnings decreases by 6. Firm D adds noise by taking $d_t = \varepsilon_t^n$ with $\sigma_n^2 = 6$. As a result, the reported earnings become more volatile than the pre-managed earnings. Note that firm A has the same smoothness of reported earnings as firm C, and firm B has the same smoothness of reported earnings as firm D. For simplicity, assume that the value implication of one dollar of persistent earnings shock (Φ) equals 7. The change in firm value given the total earnings shock (ε_t) is computed by equation (4.1). The earnings response coefficient is computed by equation (4.2). It can be seen that the earnings response coefficient is a weighted average of the market's reaction to beliefs about the persistent, transitory, and noise components. For example, the ERC for firm D is calculated by $(\frac{5}{16} \times 7) + (\frac{5}{16} \times 1) + (\frac{6}{16} \times 0) = 2.5$.

In examining the impact of earnings management on the earnings response coefficient, firms that manage earnings are compared to those that do not manage earnings. First, earnings management firms are compared to non-earnings management firms after controlling for the smoothness of pre-managed earnings. For example, firm C is compared to firm B. Firm C has the same smoothness of pre-managed earnings as firm B, but as a result of income smoothing, firm C reports smoother earnings than firm B. Since smoother earnings are achieved by eliminating the transitory component of unexpected earnings, the ERC of firm C is greater than that of firm B ($5.8 > 4.0$). That is, income smoothing increases the percentage of the total earnings shock that is expected to be persistent, hence the price reaction to one dollar of unexpected earnings is higher for income smoothing firms than for non-earnings management firms. It is predicted that income smoothing firms will have a higher earnings response coefficient than non-earnings management firms.

Hypothesis 4.1 *If the smoothness of pre-managed earnings is equal, income smoothing firms have a higher ERC than non-earnings management firms.*

Similarly, firm D is compared with firm A. As a result of earnings management, firm D reports more volatile earnings than pre-managed earnings. Due to the noise added to pre-managed earnings, the ERC of firm D is less than that of firm A ($2.5 < 4.0$). Variance-increasing earnings management reduces the market reaction to one dollar of unexpected earnings since the anticipated noise component does not affect firm value. It is predicted that variance-increasing earnings management firms will have a lower earnings response coefficient than non-earnings management firms.

Hypothesis 4.2 *If the smoothness of pre-managed earnings is equal, variance-increasing earnings management firms have a lower ERC than non-earnings management firms.*[11]

Next, earnings management firms are compared with non-earnings management firms after controlling for the smoothness of reported earnings. If the smoothness of the reported earnings for earnings managers is the same as that for non-earnings managers, what matters is the persistent earnings shock percentage ($\frac{\tilde{\varepsilon}_t^p}{\varepsilon_t} \equiv \frac{\sigma_p^2}{var(\varepsilon_t)}$). If other things are equal, the earnings response coefficient is an increasing function of the persistent earnings shock percentage. If income smoothing eliminates transitory earnings shocks, then the persistent earnings shock percentage will increase. For example, firm C has the same smoothness of reported earnings as firm A, but the persistent earnings shock percentage of firm C is higher than that of firm A ($80\% > 50\%$). The ERC of firm C is greater than that of firm A ($5.8 > 4.0$). On the other hand, if discretionary accruals contain a lot of noise, then the persistent earnings shock percentage will decrease. For

[11] Variance-increasing earnings management can be viewed as a negative income smoothing (or income de-smoothing), and the ERC is an increasing function of the degree of income smoothing. Therefore, hypotheses (4.1) and (4.2) can be combined: "If the smoothness of pre-managed earnings is equal, the ERC is an increasing function of the degree of income smoothing."

example, firm D has the same smoothness of reported earnings as firm B, but the persistent earnings shock percentage of firm D is lower than that of firm B (31.25% < 50%). The ERC of firm D is less than that of firm B (2.5 < 4). If the smoothness of reported earnings is equal, it is predicted that income smoothing firms will have a higher earnings response coefficient than non-earnings management firms, and that variance-increasing earnings management firms will have a lower earnings response coefficient than non-earnings management firms.

Hypothesis 4.3 *If the smoothness of reported earnings is equal, income smoothing firms have a higher ERC than non earnings management firms.*

Hypothesis 4.4 *If the smoothness of reported earnings is equal, variance-increasing earnings management firms have a lower ERC than non-earnings management firms.*[12]

4.3 Research Design

In this study, the measurement of discretionary accruals and the smoothness of earnings is important. As pointed out by Bernard and Skinner (1996), if non-discretionary accruals are erroneously classified as discretionary accruals, it is not surprising to find that discretionary accruals are associated with annual returns. This study does not directly use discretionary accruals as an explanatory variable, but uses estimates of discretionary accruals in the estimation of pre-managed earnings. Since the measurement error will decrease the power of the test, this study jointly tests the efficacy of the model used to identify discretionary accruals and the information content of discretionary accruals.

The measures of smoothness of pre-managed earnings (SPE_{it}) and reported earnings (SRE_{it}), and growth ($GROWTH_{it}$) for firm i in year t are estimated over ten year period preceding year t

[12] As in hypotheses (4.1) and (4.2), hypotheses (4.3) and (4.4) can be combined: "If the smoothness of reported earnings is equal, the ERC is an increasing function of the degree of income smoothing."

(see chapter 3 for detail). In the previous modeling section, the volatility of earnings is defined as the ex-ante variance of earnings shocks. In the empirical measurement of the volatility of earnings, earnings shocks are proxied for by the change in earnings. As explained in chapter 3, the adopted proxy is valid under the assumption that the earnings generating process is independent of the realization of the current period's earnings or follows a random walk. Unless the earnings generating process follows a random walk or is independent of current earnings, the measure of smoothness used in this thesis suffers from measurement error. Measurement error can be reduced by identifying the earnings generating process for each individual firm. However, it is very costly to identify the earning generating process for each firm in a large scale study like this. Therefore, this thesis uses the change in earnings as a noisy proxy for an earnings shock.

A short window event study is employed to examine the differences in the informativeness of reported earnings between firms with different degrees of earnings management and smoothness of reported earnings. The informativeness is measured by the earnings response coefficient (ERC), which represents the association between unexpected earnings and stock price movements. The following pooled time-series cross-sectional regression is used to investigate differences in the ERCs:

$$CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 SIZE_{it} + \beta_3 GROWTH_i + \varepsilon_{it}, \tag{4.3}$$

where CAR_{it} = Cumulative abnormal returns,

UE_{it} = Unexpected earnings,

$SIZE_{it}$ = ln(market value of the equity at the fiscal period end).

The cumulative abnormal returns are measured around the earnings announcement date (from day -1 to day 0). The abnormal return is calculated as the excess return above the equally weighted market return.[13] The unexpected earnings are calculated as reported earnings minus expected earnings scaled by the beginning of the fiscal period stock price. Expected earnings are proxied for by the last I/B/E/S analysts' consensus (median) forecast before the earnings announcement. The earnings response coefficient (β_1) is expected to be positive. Size and growth are further included as control variables for risk.[14] Since size is more likely to be negatively related to risk, the sign of β_2 is predicted to be negative.[15] Similarly, β_3 is predicted to be positive since growth firms are generally riskier than non growth firms.

In the regression that examines the impact of earnings management on earnings response coefficient, firms are ranked by the smoothness of pre-managed earnings (SPE_{it}) and reported earnings (SRE_{it}), and the ranks are converted into percentiles by (rank - 1)/(number of firms in year t - 1).[16] The percentiles of the smoothness of reported and pre-managed earnings of firm i in year t are represented by SRE_{it}^p and SPE_{it}^p, respectively. Hypotheses 4.1 and 4.2 predict that income smoothing increases the ERC while variance-increasing earnings management decreases the ERC after controlling for the variance of pre-managed earnings. These hypotheses

[13]For simplicity, the residual of the market model is not used. This procedure can be justified by Fama and French (1992) which report that systematic risk (β) is not successful in explaining the cross-sectional variation of the expected rates of return. Rather size and book-to-market equity better explain the cross sectional differences of average stock returns. In regression tests, market-to-book is also considered as an alternative proxy for growth.

[14]The capital market requires a higher return for riskier firms. However, in a short window event study like this study, the adjustment for risk has less effect on the required return than in long window association tests.

[15]In contrast, Teoh and Wong (1993) state that there is no consensus on the predicted sign of the size variable.

[16]The same analyses are repeated using raw SPE and SRE scores rather than percentiles. After winsorizing the most volatile 5 percent of the observations, the results are similar to those using percentiles. Winsorizing is performed to abate the impact of influential data. Lang and Lundholm (1996) use the same percentile transformation in their rank regression. Rank regression does not assume the linearity between independent variables and dependent variables. In particular, if the relation is monotonic, but non-linear, then the rank regression works better than OLS (Iman and Conover (1979)). Rank regression is also less vulnerable to extreme observations and violations of the distributional assumptions regarding error term (Chaudhury and Ng (1992)).

are tested by the following regression:

$$\begin{aligned} CAR_{it} &= \beta_0 + \beta_1 UE_{it} + \beta_2 (SPE^p_{it} \times UE_{it}) + \beta_3 (IS_{it} \times UE_{it}) \\ &\quad + \beta_4 SIZE_{it} + \beta_5 GROWTH_i + \varepsilon_{it}, \end{aligned} \tag{4.4}$$

where $IS_{it} \equiv (SRE^p_{it} - SPE^p_{it})$ is the change in smoothness between reported and pre-managed earnings. A positive change implies income smoothing while a negative change implies variance-increasing earnings management. A positive β_3 is consistent with hypotheses 4.1 and 4.2.

Similarly, hypotheses 4.3 and 4.4 are tested by the following regression:

$$\begin{aligned} CAR_{it} &= \beta_0 + \beta_1 UE_{it} + \beta_2 (SRE^p_{it} \times UE_{it}) + \beta_3 (IS_{it} \times UE_{it}) \\ &\quad + \beta_4 SIZE_{it} + \beta_5 GROWTH_i + \varepsilon_{it}. \end{aligned} \tag{4.5}$$

After controlling for the variance of the reported earnings, hypotheses 4.3 and 4.4 predict a positive coefficient on the change in smoothness between reported and pre-managed earnings.[17]

4.4 Data and Results

4.4.1 Data and Descriptive Statistics

Data for computing discretionary accruals and the smoothness of earnings were collected from COMPUSTAT PC Plus 96 CD ROM, CRSP, and I/B/E/S 96 CD ROM. An initial sample of

[17] The same tests can be performed using the following single regression.

$$\begin{aligned} CAR_{it} &= \beta_0 + \beta_1 UE_{it} + \hat{\beta}_2 (SRE^p_{it} \times UE_{it}) + \hat{\beta}_3 (SPE^p_{it} \times UE_{it}) \\ &\quad + \beta_4 SIZE_{it} + \beta_5 GROWTH_i + \varepsilon_{it}, \end{aligned}$$

Separate regressions (4.4) and (4.5) are used for expositional convenience. It can be seen that a positive β_3 in regression (4.4) is equivalent to a positive $\hat{\beta}_2$, and that a positive β_3 in regression (4.5) is equivalent to a negative $\hat{\beta}_3$. On the other hand, β_2 in regressions (4.4) will be the same as β_2 in regression (4.5) because β_2 is equal to $\hat{\beta}_2 + \hat{\beta}_3$.

5,975 firm-years was selected in the following manner.

1. A sample of 64,586 firm-years meeting the following criteria was collected.
   (a) SIC is not from 6000 to 6999, that is, financial institutions are excluded.[18]
   (b) Firms are listed on at least one of the New York Stock Exchange, the American Stock Exchange, and the NASDAQ.
   (c) There is no change in fiscal year ends.
   (d) All of the financial data required for estimating the non-discretionary accrual model is available.

2. For the estimation of non-discretionary accrual models, there should be at least 20 data points per two-digit SIC and year. As a result, 680 SIC-year non-discretionary accrual models are estimated. This requirement reduced the sample to 52,542 firm-years. Table 4.1 presents the estimated non-discretionary accrual models. β_1 has an average of 0.076 and β_2 has an average of -0.053. The signs of coefficients are consistent with previous research (Jones (1991), DeFond and Jiambalvo (1994), and Subramanyam (1996)).[19]

3. In calculating measures of smoothness of reported and pre-managed earnings, 10 years of data per firm are required.[20] In addition, earnings announcement dates, last median I/B/E/S analysts forecasts before earnings announcements, CRSP returns data for the day before and the day of earnings announcements, and beginning stock prices must be available. The resulting sample consists of 5,975 firm-years.

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[18] In addition, the same empirical tests are performed after excluding utilities. The empirical results are insensitive to the exclusion of utilities.

[19] For example, Subramanyam (1996) reports that the average coefficients on change in revenues and on the gross property, plant, and equipment are 0.03 and −0.06, respectively.

[20] There is a survivorship bias. That is, recently incorporated firms and de-listed firms are not included.

One of the concerns about the data is the reliability of the EPS provided by I/B/E/S. Philbrick and Ricks (1991) report that the I/B/E/S EPS agrees with the COMPUSTAT EPS in only 33 percent of their sample. Note that in this study, for consistency, the I/B/E/S EPS was converted into the primary basis if I/B/E/S indicates that it is the fully diluted EPS. Table 4.2 presents the distribution of the absolute value of the difference between the COMPUSTAT primary EPS and the I/B/E/S primary EPS. The I/B/E/S primary EPS matches with the COMPUSTAT primary EPS in about 45 percent of firm-year observations.[21] For about 70 percent of the observations, the difference between the I/B/E/S EPS and COMPUSTAT EPS is less than 10 cents. If the same basis (primary in this study) is used for EPS, the magnitude of the difference between two data bases is not so big as that reported by Philbrick and Ricks (1991). After deleting observations in which the COMPUSTAT primary EPS and the I/B/E/S primary EPS differ by more than or equal to one cent, the final sample comprises 2,653 firm-years (926 firms).

Panel A of table 4.3 presents the distribution of the sample by year. The sample is fairly evenly distributed over the examination period except for 1995. The restriction on data availability reduced the number of observations in 1995. Panel B of table 4.3 reports the number of observations per firm. More than 70 percent of firms have more than one observation over the examination period. Table 4.4 reports the industry composition of the sample. Thirty five industry groups are represented in the sample. Utilities represent 14% of the sample. The sample contains a high proportion of manufacturing firms (SIC 2000s, 3000s, and 4000s).

Descriptive statistics are reported in table 4.5. Panel A reports that firms in the sample are quite large on average. The average market value of equity and annual sales are $1,832.5 million and $1,945.5 million, respectively. The average discretionary accruals deflated by the

[21] The I/B/E/S EPS and the COMPUSTAT EPS differ in precision and the conversion from the fully diluted EPS to the primary EPS results in a round-off error. In this study, if the absolute value of the difference is less than one cent, those observations are treated as the same.

beginning of the fiscal period total assets is -0.0022 and is not significantly different from zero. The average smoothness of reported earnings is -0.0561 while the average smoothness of pre-managed earnings is -0.1451. The magnitude of change in smoothness between reported and pre-managed earnings is quite large. The average absolute change in smoothness between reported and pre-managed earnings is 0.093. As a result of earnings management, the variance of reported earnings decreased by more than 60 percent. The measure of growth indicates that earnings per share has increased over the estimation period.

The sample is partitioned into income smoothing and variance increasing earnings management firms. More than 95 percent of firm-years (2,532 out of total 2,653) are classified as income smoothing firms, while only 121 firm-years are classified as variance-increasing earnings management firms. This extreme result must be interpreted with caveats since the classification of firms is affected by two factors. One is the efficacy of the Jones model, which is used to identify discretionary accruals. The measurement error (or bias) of the Jones model will affect the classification of firms. A second factor is the way the smoothness of reported earnings is measured. The smoothness of reported earnings is measured over the ten year period preceding earnings announcement. Since it is based on past earnings information, it does not reflect other information about expected future earnings that investors may have at the time of an earnings announcement.[22]

Panel B of table 4.5 reports descriptive statistics of income smoothing firms and variance-increasing earnings management firms. The two groups of firms are very similar in terms of size. The t-test implies that there is no difference between the two groups in the market value of equity and total assets. However, the Wilcoxon rank sum test shows that the median annual sales are greater for income smoothing firms than for variance-increasing earnings management

[22] This concern is partially dealt with in section 4.4 by measuring the smoothness of earnings using future earnings as well as past earnings.

firms. While both groups start out with very similar smoothness of pre-managed earnings, not surprisingly, the income smoothing firms end up with much smoother reported earnings than the variance-increasing earnings management firms. The Wilcoxon rank sum test shows that variance-increasing earnings management firms use more discretionary accruals than income smoothing firms, and that the growth of earnings per share is higher for income smoothing firms than for variance-increasing earnings management firms.

4.4.2 A Preliminary Examination of Earnings Response Coefficients

In order to examine the impact of earnings management on earnings response coefficients, firms are partitioned into a four by four matrix by the smoothness of reported and pre-managed earnings. Table 4.6 reports earnings response coefficients, number of observations, and adjusted R^2 of each cell. The top leftmost cell (IVA) represents a group of firms that report the smoothest earnings, but pre-managed earnings are the most volatile. The bottom rightmost cell (ID) represents a group of firms that report the most volatile earnings, but their pre-managed earnings are identified as smooth. The cells in the top left represent income smoothing firms whereas the cells in the bottom right represent variance-increasing earnings management firms.

Hypotheses 4.1 and 4.2 predict that the earnings response coefficient (ERC) is an increasing function of the degree of income smoothing after the smoothness of pre-managed earnings is controlled for.[23] That is, for each column, the ERC will increase as we move up. In the first column (A) which includes firms with the most volatile pre-managed earnings, cell (IIA) has a greater ERC than cell (IA), and cell (IIIA) has a greater ERC than cell (IIA). The ERC of the top cell (IVA) is also greater than those of other cells below, but the estimated ERC is not

[23]Note that variance-increasing earnings management can be thought of as a negative income smoothing.

significant due to the small sample size. A similar trend can be found in the second column (B). However, in the last two columns (C and D), which include firms with relatively smooth pre-managed earnings, the predicted trend is weak or reversed. Observe that the predicted trend is weak or reversed for cells that contain a relatively high proportion of variance-increasing earnings management firms, for example, cells in the bottom right. It should be noted that the sample contains only 121 variance-increasing earnings management firms and these firm-years show up in the first row (I), the last column (D), and cell (IIC). For example, cell (ID) consists entirely of variance-increasing earnings management firms, while cell (IVD) includes two variance-increasing earnings management firm-years out of a total of 428 firm-years.

Hypotheses 4.3 and 4.4 predict that earnings response coefficient is an increasing function of the degree of income smoothing after controlling for the smoothness of reported earnings. Therefore, for each row, the ERC will increase as we move to the left. In the top row (IV) which includes firms with the smoothest reported earnings, the ERCs of cells on the left are greater than that of the rightmost cell (IVD) although the earnings response coefficient for cell (IVA) is not greater than that for cell (IVB). A similar trend can be found in other rows. However, as before, the trend is weak for cells that contain relatively high proportion of variance increasing earnings management firms. Overall, the result is consistent with hypotheses 4.3 and 4.4.

To summarize, it seems that the ERC is an increasing function of the degree of income smoothing. However, it is difficult to draw a definitive conclusion for variance-increasing earnings management firms due to the small sample size.

4.4.3 Regression Tests

Table 4.7 reports the results of the regression of abnormal returns on earnings surprise, change in smoothness between reported and pre-managed earnings, size, and growth after controlling for either the smoothness of pre-managed earnings or the smoothness of reported earnings. Regressions are estimated using 2,653 firm-year observations. The adjusted R^2 is 1.92 percent.[24] Consistent with previous research, the coefficient on the unexpected earnings is significantly positively correlated with abnormal stock returns.

In regression (1), which controls for the smoothness of pre-managed earnings, the coefficient on the change in smoothness between reported and pre-managed earnings is significantly positive as predicted. That is, income smoothing increases market reaction. However, it is also consistent with the view that smooth earnings have stronger market reaction than volatile earnings regardless of earnings management. What matters may be the smoothness of reported earnings, not earnings management. That is, the effect of earnings management on the ERC might be secondary rather than primary. This concern is taken into account in regression (2) by controlling for the smoothness of reported earnings. It is found that the coefficient on the change in smoothness between reported and pre-managed earnings is significantly positive.

Measurement error with respect to discretionary accruals can also affect the results. If the discretionary accrual model used in this chapter (the modified Jones model) actually randomly divides total accruals into discretionary and non-discretionary components, there will be no difference between firms with different degrees of income smoothing if the smoothness of reported earnings is equal. However, the results show that there are significant differences among firms, implying that the discretionary accrual model adopted in this study does not randomly divide total accruals into discretionary and non-discretionary components. On the other hand, it is quite possible that the fundamental characteristics of income smoothing firms and non-earnings management firms are different. Firms may smooth earnings because they have naturally more transitory earnings shocks. If that is the case, even after earnings management, the proportion of transitory earnings shocks for income smoothing firms can be higher than that for non earnings management firms. This should work against finding that income smoothing

[24] The low R^2 is not surprising in return-earnings studies (Lev (1989)).

firms have a higher ERC than non-earnings management firms.

There is no prediction about the smoothness of reported and pre-managed earnings. However, it is found that the ERC is positively associated with the smoothness of earnings after controlling for the change in smoothness between reported and pre-managed earnings. As predicted, the coefficient on size is significantly negative, which is consistent with the hypothesis that size is negatively associated with risk. The coefficient on growth is insignificant.[25]

4.4.4 Sensitivity Analyses

Additional analyses are performed to check on the robustness of the results. First, the smoothness of reported and pre-managed earnings are measured differently. In the original regression, the smoothness of earnings was measured over the ten year period preceding earnings announcement. That is, only past reported earnings are used. However, the investors' information set is not confined to past reported earnings, and includes information from many different sources. In an attempt to consider whether the investors' information set is richer than past reported earnings, the estimation window is extended such that the smoothness of reported and pre-managed earnings is measured using future earnings as well as past earnings. This extended estimation window assumes that investors' richer information is better captured by future realized earnings. It does not assume that investors have a perfect foresight, but that investors' rational expectation about the nature of earnings management on average matches with the realization of earnings. In addition, if the earnings generating process is stable over time, it will be better estimated by using a longer estimation window.

Table 4.8 reports the results of the regression when SRE and SPE are measured over the period from 1978 to 1995. The coefficient on the change in smoothness between reported and

[25] As an alternative proxy for growth, the market-to-book value of equity was also used, and the results are qualitatively similar to the ones presented in table 4.7.

pre-managed earnings is significantly positive as in the original regression. Overall, the results are very similar to those of the original regressions. The increase in the adjusted R^2 from 1.92% to 3.16% is consistent with the argument that investors' information set is richer than past reported earnings, and that the long window better captures what investors know at the time of the earnings announcement.

Next, the restriction on the difference between the I/B/E/S primary EPS and COMPUSTAT primary EPS is relaxed. The tolerance level of the discrepancy is increased from one cent to 10 cents. Observations are retained as long as the absolute difference between the I/B/E/S primary EPS and COMPUSTAT primary EPS is less than 10 cents. As a result, the sample size increased from 2,653 firm-years to 4,073 firm-years. Table 4.9 reports that the adjusted R^2 dropped from 1.92% to 1.66%. This may be due to the increased noise in unexpected earnings. Regression results are similar to those of the original regression.

Finally, fiscal year dummies were also included in the original regressions in order to consider possible fixed time effects. The regression results are very similar to those of the original regressions (not reported here).

4.4.5 Further Classification of Firms

Earnings management firms are further decomposed into income smoothing and variance-increasing earnings management firms. In order to examine the differential impact of income smoothing and variance-increasing earnings management, the following piecewise regression is used:

$$\begin{aligned} CAR_{it} = {} & \beta_0 + \beta_1 UE_{it} + \beta_2 (SPE_{it}^{p} \times UE_{it}) + \beta_3^{+} (IS_{it}^{+} \times UE_{it}) \\ & + \beta_3^{-} (IS_{it}^{-} \times UE_{it}) + \beta_4 SIZE_{it} + \beta_5 GROWTH_{it} + \varepsilon_{it} \end{aligned} \tag{4.6}$$

where IS_{it}^{+} equals $IS_{it} \equiv SRE_{it}^{p} - SPE_{it}^{p}$ for income smoothing firms, otherwise, zero. Similarly, IS_{it}^{-} equals IS_{it} for variance-increasing earnings management firms, otherwise, zero. Since income smoothing increases the ERC and variance increasing earnings management decreases the ERC, both β_3^+ and β_3^- are expected to be positive. The original regression (4.4) can be viewed as a restricted regression since β_3^+ and β_3^- are assumed to be equal. However, if there is no difference between income smoothing and variance-increasing earnings management, β_3^+ will be the same as β_3^-.

Similarly, regression (4.5) is modified as follows:

$$CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 (SRE_{it}^p \times UE_{it}) + \beta_3^+ (IS_{it}^+ \times UE_{it})$$
$$+ \beta_3^- (IS_{it}^- \times UE_{it}) + \beta_4 SIZE_{it} + \beta_5 GROWTH_{it} + \varepsilon_{it} \tag{4.7}$$

Table 4.10 reports the results of the piecewise regressions. The coefficient on $IS_{it}^+ \times UE_{it}$ is significantly positive in both regressions, but the coefficient on $IS_{it}^- \times UE_{it}$ is only significantly positive for the regression that controls for the smoothness of pre-managed earnings. It seems that the impact of earnings management on the earnings response coefficient is weak for variance-increasing earnings management firms. However, it should be noted that there are only 121 variance-increasing earnings management firm-years.

The four by four partition analysis reported in table 4.6 suggests that the impact of earnings management is weak for firms below the 45 degree line. For the next test, firms are partitioned into income smoothing and variance increasing earnings management firms by the relative measure of SRE and SPE rather than the raw value of SRE and SPE. A firm is classified as income smoothing firms if the rank of smoothness of reported earnings is higher than the rank of smoothness of pre-managed earnings. Otherwise, the firm is classified as variance-increasing earnings management. Under the original classification scheme, 95 percent of the sample are identified as smoothing earnings. Under the new classification scheme, income smoothing firms include firms that are extensively engaged in income smoothing whereas variance increasing earnings management firms include variance-increasing earnings management firms and income smoothing firms that are less aggressively engaged in income smoothing.

Table 4.11 reports descriptive statistics of these two groups. They differ in size when proxied for by market value of equity or total assets or annual sales. the Wilcoxon rank sum test reports that income smoothing firms are bigger than variance-increasing earnings management firms. However, the average test shows that variance-increasing earnings management firms are bigger than income smoothing firms. It should be noted that the average test is affected by large firms that are classified as variance-increasing earnings management firms. The growth of earnings per share is greater for income smoothing firms than for variance increasing earnings management firms. There is no significant difference in discretionary accruals between the two groups.

Table 4.12 reports the piecewise regression results when firms are partitioned by the relative measure. The coefficient on $IS_{it}^{+} \times UE_{it}$ is significantly positive for both regressions, but the coefficient on $IS_{it}^{-} \times UE_{it}$ is not significant for both regressions. It seems that earnings management has an impact on the earnings response coefficient for income smoothing firms, but not for variance-increasing earnings management firms. For aggressive income smoothing firms, the ERC is found to be an increasing function of the degree of income smoothing, but not for less aggressive income smoothing firms. It should be noted that the classification of firms is sensitive to the measurement error (or bias) of the Jones model, which is used to identify discretionary accruals and pre-managed earnings. A more sophisticated discretionary accrual model may provide more conclusive evidence.

4.5 Conclusions

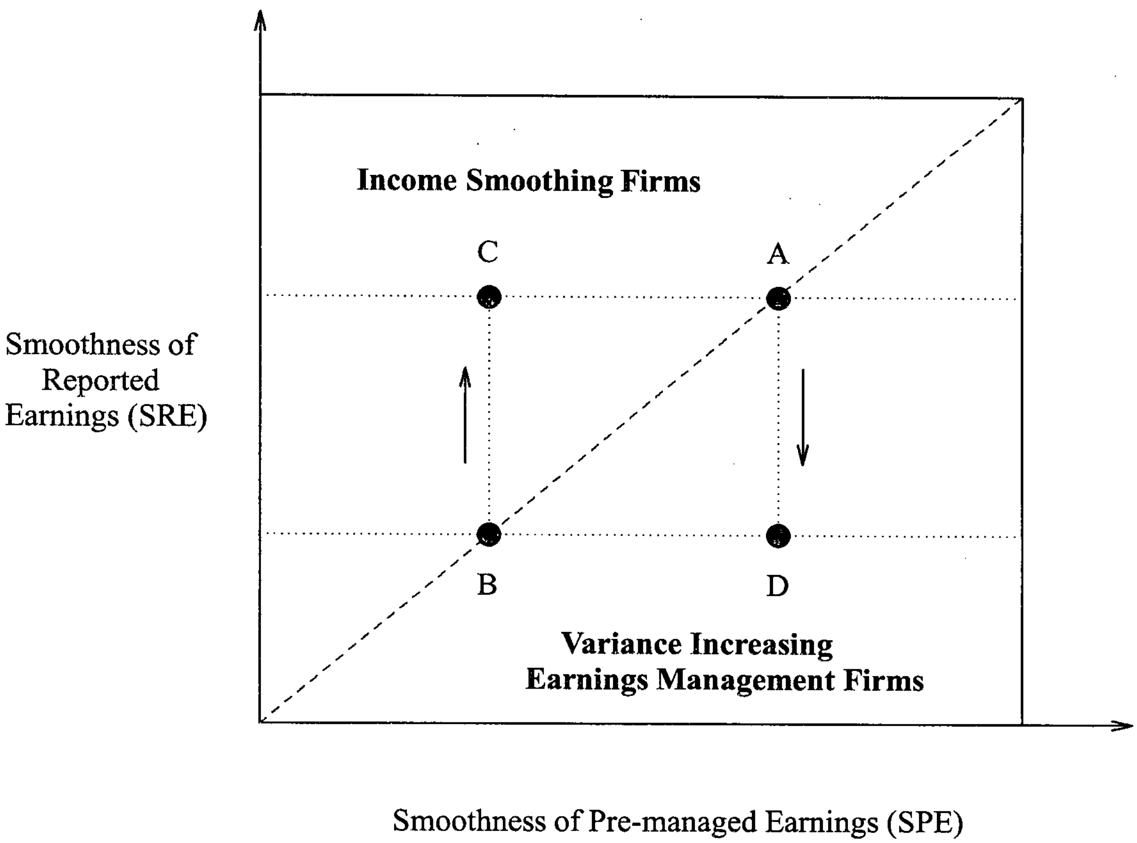
This chapter contributes to the earnings response coefficient literature by providing evidence that the earnings response coefficient is an increasing function of the degree of income smoothing. Rather than examining the *on average* nature of earnings management as in Subramanyam (1996), this chapter classifies earnings management into income smoothing and variance-increasing earnings management, and examines the differential impact of these two different types of earnings management on the earnings response coefficient. Consistent with Chaney et al. (1998), most firms are found to be engaged in income smoothing. For the income smoothing subsample, it is found that income smoothing increases the earnings response coefficient. However, for the variance-increasing earnings management subsample, the relation between earnings management and earnings response coefficient is not significant.

This study has some caveats. First, this chapter critically depends on the measurement of discretionary accruals and the classification of firms by the nature of earnings management. If the discretionary accrual model and the measure for smooth earnings used in this chapter do not have enough discriminatory power, the power of the tests will be low.[26] A more sophisticated estimation model might sharpen the results. Second, the positive economic consequences of variance-increasing earnings management are not considered. For example, variance-increasing earnings management may be necessary to alleviate the incentive problems or to reduce political costs, or to minimize or delay the payment of taxes. It is quite possible that earnings management increases the value of the firm. It may be an alternative explanation why variance increasing earnings management does not decrease the earnings response coefficient. In order to understand better about the nature of variance-increasing earnings management, it will be useful to further break down variance-increasing earnings management firms by some metric that captures value implication. Finally, there is no attempt to explain why some firms manage earnings and some do not. It is not explicitly modeled why some firms are engaged in income smoothing and others do not. Rather it is implicitly assumed that each firm is endowed with different earnings management opportunities and incentives. It will be interesting

[26]Guay et al. (1996) compare five non-discretionary accrual models and conclude that the performance of all models is not satisfactory in estimating discretionary accruals even though the Jones and the modified Jones models perform better than other models. They consider Healy (1985), DeAngelo (1986), Jones (1991), Dechow et al. (1995), and Dechow and Sloan (1991).

to investigate what characteristics of firms determine the nature of earnings management.

Figure 4.1: Classification of Firms by the Smoothness of Reported and Pre-managed Earnings



A: Non-earnings management firm.
B: Non-earnings management firm.
C: Income smoothing firm.
D: Variance-increasing earnings management firm.

Table 4.1: Non-discretionary Accrual Estimation Models (by Year and two-digit SIC)

Non-discretionary accruals are estimated as the expected value of the following two-digit SIC and year regression.

$$\frac{TA_{ijt}}{A_{ijt-1}} = \beta_{0jt}\frac{1}{A_{ijt-1}} + \beta_{1jt}\frac{\Delta REV_{ijt} - \Delta REC_{ijt}}{A_{ijt-1}} + \beta_{2jt}\frac{PPE_{ijt}}{A_{ijt-1}} + \varepsilon_{ijt}.$$

Year	N	mean of $\hat{\beta}_0$	mean of $\hat{\beta}_1$	mean of $\hat{\beta}_2$
1977	36	0.148	0.076	-0.053
1978	36	0.079	0.097	-0.050
1979	35	0.008	0.080	-0.038
1980	35	0.027	0.066	-0.053
1981	34	0.028	0.060	-0.060
1982	34	0.160	0.059	-0.063
1983	35	0.113	0.086	-0.045
1984	35	0.057	0.080	-0.043
1985	36	0.059	0.074	-0.050
1986	36	0.284	0.078	-0.041
1987	36	0.254	0.091	-0.049
1988	36	0.123	0.078	-0.048
1989	36	-0.067	0.059	-0.052
1990	36	0.135	0.087	-0.076
1991	37	-0.002	0.061	-0.078
1992	39	0.012	0.077	-0.055
1993	39	0.136	0.075	-0.051
1994	39	0.066	0.083	-0.062
1995	30	-0.290	0.066	-0.041
Whole Period	680	0.073	0.076	-0.053

Variables used to estimate the non-discretionary accruals are as follows:
For firm i in industry j for year t,

- TA_{ijt}: Total accruals,
- ΔREV_{ijt}: Change in revenues from the prior period,
- ΔREC_{ijt}: Change in net receivables from the prior period,
- PPE_{ijt}: Gross property, plant, and equipment,
- A_{ijt-1}: Lagged total assets.

Table 4.2: Difference between the COMPUSTAT Primary EPS and the I/B/E/S Primary EPS

Absolute Difference	Frequency	Percent	Cumulative Frequency	Cumulative Percent
< \$0.01	2,653	44.4	2,653	44.4
0.01 - 0.1	1,477	24.7	4,130	69.1
0.1 - 0.2	430	7.2	4,560	76.3
0.2 - 0.3	233	3.9	4,793	80.2
0.3 - 0.4	160	2.7	4,953	82.9
0.4 - 0.5	115	1.9	5,068	84.8
0.5 - 0.6	99	1.7	5,167	86.5
0.6 - 0.7	86	1.4	5,253	87.9
0.7 - 0.8	84	1.4	5,337	89.3
0.8 - 0.9	69	1.2	5,406	90.5
0.9 - 1.0	52	0.9	5,458	91.3
≥ 1.0	517	8.7	5,975	100.0

Table 4.3: Distribution of the Sample

Panel A: Number of observations by year

YEAR	Frequency	Percent	Cumulative Frequency	Cumulative Percent
88	409	15.4	409	15.4
89	359	13.5	768	28.9
90	380	14.3	1,148	43.3
91	347	13.1	1,495	56.4
92	328	12.4	1,823	68.7
93	335	12.6	2,158	81.3
94	411	15.5	2,569	96.8
95	84	3.2	2,653	100.0

Panel B: Number of observations per firm

No. of obs. per firm	Frequency	Percent	Cumulative Frequency	Cumulative Percent
1	272	29.4	272	29.4
2	188	20.3	460	49.7
3	165	17.8	625	67.5
4	119	12.9	744	80.3
5	88	9.5	832	89.8
6	67	7.2	899	97.1
7	24	2.6	923	99.7
8	3	0.3	926	100.0

Table 4.4: Industry Composition

2-digit SIC	Frequency	Percent	Cumulative Percent
10 (Metal Mining)	9	0.3	0.3
13 (Oil and Gas Extraction)	75	2.8	3.2
20 (Food and Kindred Products)	112	4.2	7.4
22 (Textile Mill Products)	38	1.4	8.8
23(Apparel)	40	1.5	10.3
24 (Lumber and Wood Products)	17	0.6	11.0
25 (Furniture and Fixtures)	60	2.3	13.2
26 (Paper and Allied Products)	58	2.2	15.4
27 (Printing and Publishing)	96	3.6	19.0
28 (Chemicals)	218	8.2	27.3
29 (Petroleum Refining)	42	1.6	28.8
30 (Rubber & Misc. Plastics)	68	2.6	31.4
32 (Stone, Clay, Glass & Concrete)	14	0.5	31.9
33 (Primary Metal)	73	2.8	34.7
34 (Fabricated Metal)	91	3.4	38.1
35 (Machinery & Computer Equipment)	262	9.9	48.0
36 (Electrical & Electronics)	239	9.0	57.0
37 (Transportation Equipment)	73	2.8	59.7
38 (Measurement Instruments)	179	6.7	66.5
39 (Misc. Manufacturing)	48	1.8	68.3
42 (Trucking and Warehouse)	15	0.6	68.9
45 (Air Transportation)	18	0.7	69.5
48 (Communications)	33	1.2	70.8
49 (Utilities)	377	14.2	85.0
50 (Wholesale - Durable Goods)	68	2.6	87.6
51 (Wholesale - Nondurable Goods)	61	2.3	89.9
53 (General Merchandise Store)	22	0.8	90.7
54 (Food Stores)	35	1.3	92.0
56 (Apparel and Accessory Stores)	5	0.2	92.2
58 (Eating and Drinking Places)	42	1.6	93.8
59 (Misc. Retail)	45	1.7	95.5
73 (Business Services)	84	3.2	98.6
79 (Amusement Services)	1	0.0	98.7
80 (Health Services)	10	0.4	99.1
87 (Engineering & Mgt. Services)	25	0.9	100.0

Table 4.5: Descriptive Statistics

Panel A: Whole Sample (N = 2,653)

Variable	Mean	Std Dev	Median	Minimum	Maximum
MKVALF	1,832.5	4,857.9	450.6	3.6	75,605.4
ASSET	1,978.0	5,424.9	451.4	6.9	87,707.0
SALE	1,945.5	5,426.2	552.1	1.0	105,519.0
LEVERAGE	0.5157	0.7811	0.2440	-0.0000	9.8949
SRE	-0.0561	0.1055	-0.0314	-2.8948	-0.0021
SPE	-0.1451	0.1672	-0.0980	-2.4298	-0.0072
$SRE - SPE$	0.0890	0.1311	0.0563	-1.4407	1.915
$\|SRE - SPE\|$	0.0930	0.1283	0.0575	0.0001	1.9157
GROWTH	0.0049	0.0200	0.0051	-0.1318	0.7985
TA	-0.0316	0.0756	-0.0372	-0.3599	1.2333
DA	-0.0022	0.0764	-0.0010	-0.4441	1.2553
NDA	-0.0294	0.0516	-0.0338	-0.4358	0.4989
CAR	0.0006	0.0452	-0.0006	-0.2419	0.7059
UE	-0.0029	0.0442	0	-0.7464	1.2857

Panel B: Income Smoothing Firms and Variance-increasing Earnings Management Firms

Group I: Income smoothing firms (N = 2,532).
Group II: Variance-increasing earnings management firms (N= 121).

	Group I		Group II			
Variable	Mean	Median	Mean	Median	T-test	Wilcoxon
MKVALF	1,838.3	452.6	1,710.9	372.7	0.42	0.33
ASSET	1,977.0	457.9	1,998.0	351.1	-0.07	0.68
SALE	1,955.9	558.1	1,727.5	379.5	0.75	2.04**
LEVERAGE	0.5086	0.2435	0.6631	0.2687	-1.60	-0.64
SRE	-0.0496	-0.0299	-0.1927	-0.1189	4.34***	12.37***
SPE	-0.1449	-0.0979	-0.1488	-0.0983	0.16	-1.44
$SRE - SPE$	0.0954	0.0595	-0.0439	-0.0196	11.06***	2.49**
$\|SRE - SPE\|$	0.0954	0.0595	0.0439	0.0196	4.09***	18.61***
GROWTH	0.0048	0.0053	0.0057	-0.0012	-0.11	7.14***
TA	-0.0308	-0.0369	-0.0486	-0.0441	2.70***	2.51**
DA	-0.0016	-0.0006	-0.0150	-0.0072	1.95	2.12**
NDA	-0.0292	-0.0337	-0.0336	-0.0346	0.99	1.09
CAR	0.0006	-0.0006	0.0001	-0.0001	-0.10	0.23
UE	-0.0026	0	-0.0093	0	1.16	0.37

*** (**): Significant at 1% (5%) level (two-tailed test).

continued on next page

Table 4.5: continued from previous page

MKVALF:	market value of equity in millions.
ASSET:	total assets in millions.
SALE:	annual sales in millions.
LEVERAGE:	long term liabilities plus preferred shares divided by market value of the equity.
SRE:	smoothness of reported earnings is measured by $-\frac{SD(\Delta EPS_{it})}{AVG(P_{it-1})}$.
SPE:	smoothness of pre-managed earnings is measured by $-\frac{SD(\Delta EPS_{it}^{0})}{AVG(P_{it-1})}$.
GROWTH:	growth is measured by $\frac{AVG(\Delta EPS_{it})}{AVG(P_{it-1})}$.
TA:	total accruals deflated by lagged total assets.
DA:	discretionary accruals deflated by lagged total assets.
NDA:	non-discretionary accruals deflated by lagged total assets.
CAR:	cumulative abnormal returns (from -1 to 0).
UE:	unexpected earnings $(\frac{actual\ EPS_{it} - expected\ EPS_{it}}{P_{it-1}})$.

$SD(\Delta EPS_{it})$:	standard deviation of changes in EPS,
$AVG(\Delta EPS_{it})$:	average of changes in EPS,
$AVG(P_{it-1})$:	average of beginning stock prices.

Table 4.6: Comparison of Earnings Response Coefficients

Firms are partitioned into a four by four matrix based on the measures of smoothness of reported earnings (SPE) and smoothness of pre-managed earnings (SRE).

$$CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 SIZE_{it} + \beta_3 GROWTH_{it} + \varepsilon_{it}$$

	A SPE (low)	B	C	D SPE (high)
SRE (high) IV	2.0405 N = 14 R^2 = -0.153	2.2308** N = 49 R^2 = 0.011	0.8978*** N = 174 R^2 = 0.049	0.0953 N =428 $[2^a]$ R^2 = -0.007
III	1.4096*** N = 66 R^2 = 0.349	0.6207** N = 170 R^2 = 0.002	0.5059 N = 256 R^2 = -0.005	-0.1730*** N =172 $[9^a]$ R^2 = 0.041
II	0.8304*** N = 162 R^2 = 0.075	0.4286*** N = 259 R^2 = 0.046	0.3959*** N = 179 $[3^a]$ R^2 = 0.034	1.2272** N =60 $[19^a]$ R^2 = 0.046
SRE (low) I	0.0895*** N =422 $[21^a]$ R^2 = 0.020	0.0491 N =182 $[40^a]$ R^2 = -0.001	0.9398*** N =55 $[22^a]$ R^2 = 0.234	0.1818 N =5 $[5^a]$ R^2 = 0.997

[a] No. of firm-years in which SRE is less than SPE.
***(**): Significant at 1% (5%) level (one-tailed test).

CAR_{it}: Cumulative abnormal returns.
UE_{it}: Unexpected earnings.
$SIZE_{it}$: ln(market value of the firm).
$GROWTH_{it}$: $\frac{AVG(\Delta EPS_{it})}{AVG(P_{it-1})}$.
SPE_{it}: The smoothness of the pre-managed earnings, which is measured by $-\frac{SD(\Delta EPS^0_{it})}{AVG(P_{it-1})}$.
SRE_{it}: The smoothness of the reported earnings, which is measured by $-\frac{SD(\Delta EPS_{it})}{AVG(P_{it-1})}$.

Table 4.7: Test of ERC Differences

$$(1)\ CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 (SPE_{it}^p \times UE_{it}) + \beta_3 (IS_{it} \times UE_{it}) + \beta_4 SIZE_{it} + \beta_5 GROWTH_{it} + \varepsilon_{it}$$

and

$$(2)\ CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 (SRE_{it}^p \times UE_{it}) + \beta_3 (IS_{it} \times UE_{it}) + \beta_4 SIZE_{it} + \beta_5 GROWTH_{it} + \varepsilon_{it}$$

Variable	Predicted Sign	Regression (1) Coefficient	t-value	Regression (2) Coefficient	t-value
Intercept	?	0.0106	3.17***	0.0106	3.17***
UE_{it}	+	0.0938	3.86***	0.0938	3.86***
$SPE_{it}^p \times UE_{it}$	?	0.4117	3.35***		
$SRE_{it}^p \times UE_{it}$	?			0.4117	3.35***
$IS_{it} \times UE_{it}$	+	1.0815	4.84***	0.6698	4.05***
$SIZE_{i}t$	−	-0.0015	-2.91***	-0.0015	-2.91***
$GROWTH_{it}$	+	-0.0560	-1.29	-0.0560	-1.29
N =		2,653		2,653	
Adjusted R^2		0.0192		0.0192	

*** Significant at 1% level (one-tailed test when the sign is predicted; two-tailed otherwise).
** Significant at 5% level (one-tailed test when the sign is predicted; two-tailed otherwise).

CAR_{it}: Cumulative abnormal returns.
UE_{it}: Unexpected earnings.
SPE_{it}^p: Percentile of the smoothness of the pre-managed earnings, which is measured by $-\frac{SD(\Delta EPS_{it}^0)}{AVG(P_{it-1})}$.
SRE_{it}^p: Percentile of the smoothness of the reported earnings, which is measured by $-\frac{SD(\Delta EPS_{it})}{AVG(P_{it-1})}$.
IS_{it}: A measure of income smoothing, which is measured by $SRE_{it}^p - SPE_{it}^p$.
SIZE_{it}: ln(market value of the firm).
GROWTH_{it}: $\frac{AVG(\Delta EPS_{it})}{AVG(P_{it-1})}$.

Table 4.8: Test of ERC Differences (SPE and SRE are measured over the period from 1978 to 1995)

$$(1)\ CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 (SPE_i^p \times UE_{it}) + \beta_3 (IS_i \times UE_{it}) + \beta_4 SIZE_{it} + \beta_5 GROWTH_i + \varepsilon_{it}$$

and

$$(2)\ CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 (SRE_i^p \times UE_{it}) + \beta_3 (IS_t \times UE_{it}) + \beta_4 SIZE_{it} + \beta_5 GROWTH_i + \varepsilon_{it}$$

Variable	Predicted Sign	Regression (1) Coefficient	Regression (1) t-value	Regression (2) Coefficient	Regression (2) t-value
Intercept	?	0.0107	3.22***	0.0107	3.22***
UE_{it}	+	0.0607	2.50***	0.0607	2.50***
$SPE_i^p \times UE_{it}$	?	1.3404	6.75***		
$SRE_i^p \times UE_{it}$	?			1.3404	6.75***
$IS_i \times UE_{it}$	+	2.0870	7.60***	0.7466	4.81***
$SIZE_{it}$	–	-0.0016	-3.10***	-0.0016	-3.10***
$GROWTH_i$	+	0.0732	0.62	0.0732	0.62
N =		2,653		2,653	
Adjusted R^2		0.0316		0.0316	

*** Significant at 1% level (one-tailed test when the sign is predicted; two-tailed otherwise).
** Significant at 5% level (one-tailed test when the sign is predicted; two-tailed otherwise).

CAR_{it}: Cumulative abnormal returns.
UE_{it}: Unexpected earnings.
SPE_i^p: Percentile of the smoothness of the pre-managed earnings, which is measured by $-\frac{SD(\Delta EPS_{it}^0)}{AVG(P_{it-1})}$.
SRE_i^p: Percentile of the smoothness of the reported earnings, which is measured by $-\frac{SD(\Delta EPS_{it})}{AVG(P_{it-1})}$.
IS_i: A measure of income smoothing, which is measured by $SRE_i^p - SPE_i^p$.
$SIZE_{it}$: ln(market value of the firm).
$GROWTH_i$: $\frac{AVG(\Delta EPS_{it})}{AVG(P_{it-1})}$.

Table 4.9: Test of ERC Differences (the difference between COMPUSTAT primary EPS and I/B/E/S primary EPS is less than 0.1)

$$(1)\ CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 (SPE^p_{it} \times UE_{it}) + \beta_3 (IS_{it} \times UE_{it}) + \beta_4 SIZE_{it} + \beta_5 GROWTH_{it} + \varepsilon_{it}$$

and

$$(2)\ CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 (SRE^p_{it} \times UE_{it}) + \beta_3 (IS_{it} \times UE_{it}) + \beta_4 SIZE_{it} + \beta_5 GROWTH_{it} + \varepsilon_{it}$$

Variable	Predicted Sign	Regression (1) Coefficient	Regression (1) t-value	Regression (2) Coefficient	Regression (2) t-value
Intercept	?	0.0086	3.31***	0.0086	3.31***
UE_{it}	+	0.1010	4.99***	0.1010	4.99***
$SPE^p_{it} \times UE_{it}$	?	0.1955	2.42**		
$SRE^p_{it} \times UE_{it}$	?			0.1955	2.41**
$IS_{it} \times UE_{it}$	+	0.7884	5.27***	0.5928	5.18***
$SIZE_{it}$	−	-0.0013	-3.16***	-0.0013	-3.16***
$GROWTH_{it}$	+	0.0639	1.14	0.0639	1.14
N =		4,073		4,073	
Adjusted R^2		0.0166		0.0166	

*** Significant at 1% level (one-tailed test when the sign is predicted; two-tailed otherwise).
** Significant at 5% level (one-tailed test when the sign is predicted; two-tailed otherwise).

CAR_{it}: Cumulative abnormal returns.
UE_{it}: Unexpected earnings.
SPE^p_{it}: Percentile of the smoothness of the pre-managed earnings, which is measured by $-\frac{SD(\Delta EPS^0_{it})}{AVG(P_{it-1})}$.
SRE^p_{it}: Percentile of the smoothness of the reported earnings, which is measured by $-\frac{SD(\Delta EPS_{it})}{AVG(P_{it-1})}$.
IS_{it}: A measure of income smoothing, which is measured by $SRE^p_{it} - SPE^p_{it}$.
SIZE_{it}: ln(market value of the firm).
GROWTH_{it}: $\frac{AVG(\Delta EPS_{it})}{AVG(P_{it-1})}$.

Table 4.10: Test of ERC Differences Between Income Smoothing and Variance-increasing Earnings Management Firms

$$(1)\ CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2(SPE^p_{it} \times UE_{it}) + \beta_3^+(IS^+_{it} \times UE_{it}) + \beta_3^-(IS^-_{it} \times UE_{it}) + \beta_4 SIZE_{it} + \beta_5 GROWTH_{it} + \varepsilon_{it}$$

and

$$(2)\ CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2(SRE^p_{it} \times UE_{it}) + \beta_3^+(IS^+_{it} \times UE_{it}) + \beta_3^-(IS^-_{it} \times UE_{it}) + \beta_4 SIZE_{it} + \beta_5 GROWTH_{it} + \varepsilon_{it}$$

	Predicted	Regression (1)		Regression (2)	
Variable	Sign	Coefficient	t-value	Coefficient	t-value
Intercept	?	0.0109	3.27***	0.0109	3.27***
UE_{it}	+	0.0880	3.61***	0.0880	3.61***
$SPE^p_{it} \times UE_{it}$	?	0.4607	3.71***		
$SRE^p_{it} \times UE_{it}$	?			0.4607	3.71***
$IS^+_{it} \times UE_{it}$	+	1.5175	5.45***	1.0568	4.78***
$IS^-_{it} \times UE_{it}$	+	0.7303	2.81***	0.2696	1.20
$SIZE_{it}$	−	-0.0016	-3.00***	-0.0016	-3.00***
$GROWTH_{it}$	+	-0.0579	-1.33	-0.0579	-1.33
N =		2,653		2,653	
Adjusted R^2		0.0214		0.0214	

*** Significant at 1% level (one-tailed test when the sign is predicted; two-tailed otherwise).
** Significant at 5% level (one-tailed test when the sign is predicted; two-tailed otherwise).

CAR_{it}: Cumulative abnormal returns.
UE_{it}: Unexpected earnings.
SPE^p_{it}: Percentile of the smoothness of pre-managed earnings, which is measured by $-\frac{SD(\Delta EPS^0_{it})}{AVG(P_{it-1})}$.
SRE^p_{it}: Percentile of the smoothness of reported earnings, which is measured by $-\frac{SD(\Delta EPS_{it})}{AVG(P_{it-1})}$.
IS_{it}: A measure of income smoothing, which is measured by $SRE^p_{it} - SPE^p_{it}$.
IS^+_{it}: If $SRE_{it} > SPE_{it}$, then $\text{IS}^+_{it} = IS_{it}$. Otherwise 0.
IS^-_{it}: If $SRE_{it} \leq SPE_{it}$, then $\text{IS}^-_{it} = IS_{it}$. Otherwise 0.
SIZE_{it}: ln(market value of the firm).
GROWTH_{it}: $\frac{AVG(\Delta EPS_{it})}{AVG(P_{it-1})}$.

Table 4.11: Comparison of Income Smoothing and Variance-increasing Earnings Management Firms (based on relative measure)

Group I: Income smoothing firms (N = 1,249).
Group II: Variance-increasing earnings management firms (N = 1,404).

Variable	Group I		Group II			
	Mean	Median	Mean	Median	T-test	Wilcoxon
MKVALF	1,596.1	480.2	2042.9	429.0	-2.45**	2.00**
ASSET	1,730.4	540.2	2198.2	372.5	-2.30**	3.63***
SALE	1,883.6	678.6	2000.5	451.8	-0.57	6.41***
LEVERAGE	0.5378	0.2726	0.4961	0.2244	1.35	2.61***
SRE	-0.0354	-0.0229	-0.0745	-0.0435	10.19***	15.45***
SPE	-0.1788	-0.1180	-0.1151	-0.0804	-9.81***	-13.35***
$SRE - SPE$	0.1434	0.0918	0.0406	0.0304	21.10***	
$\|SRE - SPE\|$	0.1434	0.0918	0.0482	0.0325	19.75***	
GROWTH	0.0065	0.0065	0.0034	0.0033	4.20***	11.40***
TA	-0.0250	-0.0335	-0.0374	-0.0412	4.26***	5.95***
DA	0.0001	-0.0001	-0.0043	-0.0022	1.48	1.65
NDA	-0.0251	-0.0297	-0.0332	-0.0368	4.04***	4.89***
CAR	0.0003	-0.0017	0.0008	0.0002	-0.30	-0.55
UE	-0.0028	0	-0.0030	0	0.17	0.32

*** (**): Significant at 1% (5%) level (two-tailed test).

MKVALF: market value of equity in millions.
ASSET: total assets in millions.
SALE: annual sales in millions.
LEVERAGE: long term liabilities plus preferred shares divided by market value of the equity.
SRE: smoothness of reported earnings is measured by $-\frac{SD(\Delta EPS_{it})}{AVG(P_{it-1})}$.
SPE: smoothness of pre-managed earnings is measured by $-\frac{SD(\Delta EPS^0_{it})}{AVG(P_{it-1})}$.
GROWTH: growth is measured by $\frac{AVG(\Delta EPS_{it})}{AVG(P_{it-1})}$.
TA: total accruals deflated by lagged total assets.
DA: discretionary accruals deflated by lagged total assets.
NDA: non-discretionary accruals deflated by lagged total assets.
CAR: cumulative abnormal returns (from -1 to 0).
UE: unexpected earnings $(\frac{actual\ EPS_{it} - expected\ EPS_{it}}{P_{it-1}})$.

$SD(\Delta EPS_{it})$: standard deviation of changes in EPS,
$AVG(\Delta EPS_{it})$: average of changes in EPS,
$AVG(P_{it-1})$: average of beginning stock prices.

Table 4.12: Test of ERC Differences Between Income Smoothing and Variance-increasing Earnings Management Firms (based on relative measure)

$$(1)\ CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 (SPE_{it}^p \times UE_{it}) + \beta_3^+ (IS_{it}^+ \times UE_{it}) + \beta_3^- (IS_{it}^- \times UE_{it}) + \beta_4 SIZE_{it} + \beta_5 GROWTH_{it} + \varepsilon_{it}$$

and

$$(2)\ CAR_{it} = \beta_0 + \beta_1 UE_{it} + \beta_2 (SRE_{it}^p \times UE_{it}) + \beta_3^+ (IS_{it}^+ \times UE_{it}) + \beta_3^- (IS_{it}^- \times UE_{it}) + \beta_4 SIZE_{it} + \beta_5 GROWTH_{it} + \varepsilon_{it}$$

Variable	Predicted Sign	Regression (1) Coefficient	Regression (1) t-value	Regression (2) Coefficient	Regression (2) t-value
Intercept	?	0.0113	3.41***	0.0113	3.41***
UE_{it}	+	0.0669	2.69***	0.0669	2.69***
$SPE_{it}^p \times UE_{it}$	?	0.0033	0.02		
$SRE_{it}^p \times UE_{it}$	?			0.0033	0.02
$IS_{it}^+ \times UE_{it}$	+	2.5798	6.53***	2.5765	5.77***
$IS_{it}^- \times UE_{it}$	+	-0.0432	-0.13	-0.0465	-0.21
$SIZE_{it}$	−	-0.0016	-3.12***	-0.0016	-3.12***
$GROWTH_{it}$	+	-0.0602	-1.39	-0.0602	-1.39
N =		2,653		2,653	
Adjusted R^2		0.0266		0.0266	

*** Significant at 1% level (one-tailed test when the sign is predicted; two-tailed otherwise).
** Significant at 5% level (one-tailed test when the sign is predicted; two-tailed otherwise).

CAR_{it}: Cumulative abnormal returns.
UE_{it}: Unexpected earnings.
SPE_{it}^p: Percentile of the smoothness of pre-managed earnings, which is measured by $-\frac{SD(\Delta EPS_{it}^0)}{AVG(P_{it-1})}$.
SRE_{it}^p: Percentile of the smoothness of reported earnings, which is measured by $-\frac{SD(\Delta EPS_{it})}{AVG(P_{it-1})}$.
IS_{it}: A measure of income smoothing, which is measured by $SRE_{it}^p - SPE_{it}^p$.
IS_{it}^+: If $IS_{it} > 0$, then $\text{IS}_{it}^+ = IS_{it}$. Otherwise 0.
IS_{it}^-: If $IS_{it} \leq 0$, then $\text{IS}_{it}^- = IS_{it}$. Otherwise 0.
SIZE_{it}: ln(market value of the firm).
GROWTH_{it}: $\frac{AVG(\Delta EPS_{it})}{AVG(P_{it-1})}$.

Chapter 5

The Impact of Earnings Managment on the Properties of Analysts Forecats

5.1 Introduction

Many accounting and finance studies use analysts' forecasts as a proxy for the market's expectation for earnings. It is well known that analysts' forecasts are more accurate than time series based forecasts (e.g., Fried and Givoly (1982), Brown and et al. (1987a), and O'Brien (1988)). Since analysts are considered to be one of the most important channels for transmitting information to capital markets, an investigation of factors affecting analysts' forecasts will enhance the understanding of how the market reacts to financial statements as well as analysts' forecasts. Accounting information is an integral part of the information set used by analysts. Therefore, the characteristics of earnings reports will influence various aspects of analysts' forecasts. Many studies have investigated whether there are firm characteristics that determine the superiority of analysts' forecasts over time series based forecasts (e.g., Brown et al. (1987b) and Wiedman (1996)). Kross et al. (1990) find that an analyst's advantage over a time series model increases with earnings variability, which is measured by the residual standard error from a time series forecast model. They suggest that analysts have greater incentives to gather information for firms with volatile earnings than for firms with smooth earnings. Based on this, this chapter posits that the smoothness of reported earnings plays an important role for the demand for analysts' services and other properties of analysts' forecasts such as the dispersion, the forecast error, and the revision volatility.

Kross et al. (1990) presume that the demand for analysts services is affected by the relative usefulness of analysts' forecasts versus earnings forecasts based on publicly available past reported earnings. The demand for analysts' services will be an increasing function of the superiority of analysts' forecasts as a predictor of future earnings. Analysts will expend more effort to gather information for firms with volatile earnings since the incremental benefit of gathering additional information will be bigger for firms with volatile earnings than for firms with smooth earnings. In that case, the number of analysts following a firm, which is used as a proxy for the demand for analysts' services, will be higher for firms with volatile earnings than for firms with smooth earnings.

Lang and Lundholm (1996) examine the relation between the informativeness of a firm's disclosure policy and the number of analysts following the firm. They measure the informativeness of a firm's disclosure policy using data from the Report of the Financial Analysts Federation Corporate Information Committee (FAF Report 1985-1989). The FAF report evaluates a firm's disclosure policy based on three categories: annual report, other published information (including quarterly filings, press releases and proxy statements) and investor relations. Lang and Lundholm (1996) find that their FAF measure of the informativeness of a firm's disclosure policy is positively correlated with the number of analysts following the firm. Since a firm's disclosure policy can affect the amount of uncertainty that is remaining to be resolved, Lang and Lundholm's (1996) results provide an alternative empirical hypothesis about the relation between the amount of uncertainty and the number of analysts following. In particular, they state that benefits of enhanced disclosures include "reduced uncertainty, lower information asymmetry among stock market participants, fewer extreme earnings surprises and greater investor following."[1] If their FAF measure of informativeness of a firm's disclosure policy is negatively correlated with the amount of uncertainty about future earnings, then their result implies that the number of analysts following and the amount of uncertainty faced by investors are negatively associated. Since there is less uncertainty about future earnings for firms with smooth earnings than for firms with volatile earnings, Lang and Lundholm's (1996)'s result is consistent with the hypothesis that the demand for analysts' services will be positively associated with the smoothness of reported earnings. This is opposite to the prediction based on analysts' incentives to collect information suggested by Kross et al. (1990).

This chapter examines the impact of the smoothness of a firm's reported earnings on the number of analysts following the firm. Consistent with Kross et al. (1990), the evidence indicates that the demand for analysts' services increases with the volatility of reported earnings. That is, the smoother the reported earnings, the lower the equilibrium demand for analysts' services. After controlling for the smoothness of reported earnings, it is further examined whether earnings management has any influence on the number of analysts following. It is found that the number of analysts following is negatively associated with the degree of income smoothing. It is consistent with the view that analysts have less incentives to collect information for firms which use accruals to smooth earnings than for firms that do not manage earnings.

Other properties of analysts' forecasts such as dispersion, forecast errors, and revision volatility of analysts' forecasts are also examined. Consistent with Lang and Lundholm (1996), it is found that the smoothness of reported earnings are negatively associated with the dispersion, the forecast errors, and the revision volatility. This is consistent with smooth earnings being more predictable than volatile earnings.

[1] Welker (1995) uses the same measure of informativeness as Lang and Lundholm (1996) and reports that the rank of a firm's disclosure policy is negatively associated with the bid-ask spread of the firm. He interprets that enhanced disclosure reduces information asymmetry between management and investors and hence increases liquidity of stocks.

The empirical results for the dispersion, the forecast errors, and the revision volatility of analysts' forecasts are consistent with Lang and Lundholm (1996), but the result for the number of analyst following is not consistent. In order to examine whether the differences in the examination period and firm size affect the results, additional tests on the number of analysts following are performed. The sample is divided into 1987 - 1989 and 1990 - 1995 sub-periods, and into small firms and large firms. It is found that the negative association between the number of analysts following a given firm and the smoothness of the firm's reported earnings is less pronounced in the post 1990 period and for small firms.

As a specification check, a simultaneous equations approach is also adopted. If the number of analysts following and other properties of analysts' forecasts interact and are simultaneously determined, the OLS regression will produce inconsistent estimates. As in Alford and Berger (1997), the two stage least squares method is used to estimate the number of analysts following and other properties of analysts' forecasts. The results, however, are very similar to the OLS results which do not consider the interaction between the number of analysts following and other properties of analysts' forecasts.

This chapter examines issues similar to those in Lang and Lundholm (1996), but it differs in its perspective. First, the purpose of this study is not to examine the association between a firm's disclosure policy and characteristics of analysts' forecasts, but to examine the impact of the smoothness of reported earnings and earnings management on the characteristics of analysts' forecasts. Since earnings reports are an important part of overall corporate disclosure, this study provides indirect evidence on the effect of overall corporate disclosure on the characteristics of analysts' forecasts. Second, following Bhushan (1989), the equilibrium demand and supply for analysts' forecasts are explicitly considered. In particular, the smoothness of reported earnings are assumed to affect the marginal production cost of analysts' services and analysts' incentives to collect additional information.

The rest of the chapter is organized as follows. In the next section, hypotheses are developed. Section 3 explains the research design. Data and empirical results are presented in section 4 and 5. Conclusions are reached in section 6.

5.2 Hypotheses

This section starts with a discussion of factors which affect the demand for analysts' services. In particular, this chapter focuses on the impact of the magnitude and composition of uncertainty on the demand for analysts' services. Since there is less uncertainty for firms with smooth earnings than for firms with volatile earnings, the magnitude of uncertainty is proxied for by the smoothness of reported earnings. Section 5.2.1 discusses the impact of the smoothness of reported earnings on the demand for analysts' services. Even after the magnitude of uncertainty is controlled for by the smoothness of reported earnings, the demand for analysts' services may be influenced by the composition of the uncertainty. As in chapter 2, an earnings shock is decomposed into the persistent and transitory components. The composition of an earnings shock can change depending on the types of earnings management. Income smoothing increases the persistent earnings shock percentage whereas variance increasing earnings management decreases the persistent earnings shock percentage (see chapter 2 for details). Section 5.2.2 considers the impact of earnings management on the demand for analysts' services after controlling for the smoothness of reported earnings. Finally, section 5.2.3 discusses the impact of the smoothness of reported earnings on the dispersion, the forecast error, and the revision volatility of analysts' forecasts.

5.2.1 The smoothness of reported earnings and the equilibrium demand for analysts' forecasts

Analysts follow a firm in order to provide buy, sell, or hold recommendations or research reports. Since the incentives faced by analysts differ depending on who hires them, it is useful to distinguish between buy-side and sell-side analysts (Schipper (1991)). Buy-side analysts usually work for institutional investors while sell-side analysts usually work for investment banks or brokerage firms. This study will focus on the incentives faced by sell-side analysts since the I/B/E/S database, which is used in the empirical analysis of this study, predominately contains forecasts of sell-side analysts (Trueman (1996)), and buy-side analysts are also users of sell-side analysts' reports. From now on, analysts refer to sell-side analysts.

Brokerage commissions are an important revenue source for both full service brokers and discount brokers. Full services brokers compete against discount brokers by providing additional services such as security recommendations or research analysis, or access to new stock issues. Analysts' earnings forecasts are usually produced by full service brokers. Forecasting a firm's earnings is an important part of evaluating the firm's value and the financial press pays a lot of attention to earnings forecasts. As in previous studies, it is assumed that investors invest in the securities of firms with which they are familiar (Merton (1987) and Brennan and Hughes (1991)). Therefore, increased interest in a firm by investors is a source of revenue for brokerage firms.

Before I discuss the factors affecting the equilibrium demand for analysts' services, it will be useful to distinguish between what researchers observe (or are interested) and what analysts do. Some confusion arises because there are many studies that focus on analysts' forecasts. Analysts' ultimate objective is not to forecast future earnings, but to produce a research report for a given firm, which contains a buy, sell, or hold recommendation. In order to provide investment advice to their clients, analysts have to assess the intrinsic value of the firm. Analysts' recommendations are based on the discrepancy between their assessment of the intrinsic value of the firm and the observed market price. However, predicting future earnings is an important part of assessing firm value. Analysts' forecasts may be considered to be a by-product of the process of assessing firm value.

Following Bhushan (1989), this chapter explicitly considers how characteristics of earnings reports affect the supply and demand for analysts' services. It is assumed that earnings reports by firms are an important element of the information set used by analysts. The reported earnings are a starting point in predicting future earnings and determining the value of the firm. The supply function for analysts' services is determined by the marginal production cost of analysts' forecasts. It is assumed that the smoother a firm's reported earnings, the lower the marginal production cost of analysts' services about the firm. That is, the supply curve for firms with smooth earnings is located to the right of that for firms with volatile earnings.

Investors may acquire information through analysts in order to achieve abnormal returns. Since there are more opportunities to achieve abnormal returns for firms with more uncertainty about firm value than for firms with less uncertainty, the demand for analysts services will be an increasing function of the magnitude of uncertainty about firm value. Among many factors affecting the magnitude of uncertainty about firm value, this chapter focuses on reported earnings. As in Kross et al. (1990), it is assumed that the demand for analysts' services is an increasing function of the superiority of analysts forecasts as a predictor of future earnings to earnings forecasts based on publicly available past reported earnings. Since there is more uncertainty about future earnings for volatile earnings than for smooth earnings, the demand for analysts services will be greater for firms with volatile earnings than for firms with smooth earnings. If other things are equal, the demand for analysts' services will be a decreasing function of the smoothness of reported earnings. The demand for analysts' services is also affected by the composition of an earnings shock. In chapter 4, an earnings shock is viewed as consisting of persistent and transitory components. The persistent earnings shock affects both current realized earnings and future expected earnings whereas the transitory earnings shock only affects current earnings. Since the value implication of one dollar of persistent earnings shock is greater than for one dollar of transitory earnings shock, it will be more valuable to collect information about the persistent earnings shock rather than the transitory earnings shock. In examining the impact of the smoothness of reported earnings on firm value, it is important to control for the differential value implications of the persistent and transitory earnings shocks. Effectively, this sub-section examines the impact of the smoothness of reported earning by assuming that other things are equal including the composition of an earnings shock. The differential value implications of the persistent and transitory earnings shocks are examined indirectly through income smoothing in section 5.2.2.[2]

The smoothness of reported earnings affects the demand for analysts' services in two ways. One is the direct effect of the smoothness of reported earnings and the other is the indirect effect through analysts' forecasts. The direct effect is related to investors' incentives to collect information. There are more opportunities for firms with more uncertainties than for firms with less uncertainties. There is more uncertainty for firms with volatile earnings than for firms with smooth earnings and the smoothness of reported earnings can be interpreted as an inverse proxy for the magnitude of uncertainty. The demand for analysts' services will be a decreasing function of the smoothness of reported earnings. The indirect effect is related to the precision of analysts' forecasts. As mentioned earlier, investors are interested in assessing firm value, not analysts' forecasts themselves. However, the precision of analysts' forecasts can be important because the information about future earnings is a very important element in assessing firm value. A more precise prediction of future earnings will lead to a more precise assessment of firm value. If other things are equal including the amount of prior uncertainty, then the demand for analysts' services will be an increasing function of the precision of analysts' forecasts.

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[2] See chapter 2 for the impact of income smoothing on the composition of an earnings shock.

The overall impact of the smoothness of reported earnings on the demand for analysts' services is determined by the relative size of the direct and indirect effects. If the direct effect dominates the indirect effect, then the demand will decrease as the smoothness of reported earnings increases. If the indirect effect exceeds the direct effect, then the demand will increase as the smoothness of reported earnings increases. More formally, the supply and demand functions for analysts' services are assumed as follows:

$$\begin{aligned} Q_s &= f(P, SE, \cdots), \\ Q_d &= f(P, Size, SE, AF(SE, PI), \cdots), \end{aligned} \tag{5.1}$$

where $P =$ Implicit price for analysts' services,

$SE =$ Smoothness of reported earnings,

$Size =$ Size of the firm,

$AF =$ Precision of analysts' forecasts,

$PI =$ Other private information collected by analysts.

The supply (Q_s) and demand (Q_d) for analysts' services for a given firm will be proxied for by the number of analysts following the firm. It is assumed that there is no difference in ex-ante precision of forecasts among analysts.

The supply (Q_s) is represented as a function of price, the smoothness of reported earnings, and other factors. The price is an implicit price embedded in services provided by full service brokerage firms. Note that the service charge by full service brokerage firms is higher than discount brokers. The implicit price refers to the premium which investors pay for quality services provided by full service brokers. It is assumed that the supply function is upward sloping with respect to price, and an increase in the smoothness of reported earnings decreases the production cost of analysts' services: $\partial Q_s/\partial P > 0$ and $\partial Q_s/\partial SE > 0$.

The demand function (Q_d) is assumed to depend on price, size, the smoothness of reported earnings, the precision of analysts' forecasts, and other factors. Note that the precision of analysts' forecasts is explicitly expressed as a function of the smoothness of reported earnings. First, it is assumed that the demand function is downward sloping with respect to price, and an increase in the precision of analysts' forecasts raises the demand: $\partial Q_d/\partial P < 0$ and $\partial Q_d/\partial AF > 0$. Second, the precision of analysts' forecasts is an increasing function of the smoothness of reported earnings: $\partial AF/\partial SE > 0$. Consistent with previous studies (Brennan and Hughes (1991) and Lang and Lundholm (1996)), the demand is assumed to be an increasing function of the size of the firm, $\partial Q_d/\partial Size > 0$. The marginal effect of the smoothness of reported earnings on the demand for analysts' services is:

$$\frac{dQ_d}{dSE} = \frac{\partial Q_d}{\partial SE} + \frac{\partial Q_d}{\partial AF}\frac{\partial AF}{\partial SE}.$$

The first term denotes the direct effect and the second term the indirect effect. The direct effect is related to investors' needs for information. There is less uncertainty about future earnings for smooth earnings than for volatile earnings. There will be more demand for information for firms with volatile earnings than for firms with smooth earnings since more uncertainty implies more opportunity. Therefore, the first term is assumed negative, $\partial Q_d/\partial SE < 0$. The second term is positive since both $\partial Q_d/\partial AF$ and $\partial AF/\partial SE$ are assumed to be positive. Since the direct effect and the indirect effect move in the opposite direction, the sign of dQ_d/dSE depends on the relative magnitude of the direct and indirect effects. If the direct effect of earnings management dominates the indirect effect, dQ_d/dSE is negative, otherwise, it is positive.

In equilibrium, the demand and the supply determine the equilibrium number of analysts' services. If the indirect effect dominates the direct effect, then an increase in the smoothness of reported earnings increases both the demand and supply. In that case, the equilibrium number of analysts following will be an increasing function of the smoothness of reported earnings. On the other hand, if the direct effect dominates the indirect effect, then an increase in the smoothness of reported earnings decreases the demand for analysts' services, but increases the supply of analysts' services. The equilibrium number of analysts following decreases only when the effect of demand is bigger than the effect of supply.

As an example, consider the following demand and supply functions:

$$Q_d = [\alpha + \beta SE + \gamma AF(SE, PI) - Price] * Size,$$

$$Q_s = \zeta + \xi SE + Price,$$

where α, γ, ζ and ξ are positive, and β is negative. For simplicity, it is assumed that $\partial AF/\partial SE$ is 1. In equilibrium, the demand and supply are equal. The equilibrium number of analysts' services is as follows:

$$Q^* = \frac{Size}{Size+1}[\alpha + \zeta + (\beta + \xi)SE + \gamma AF(SE, PI)].$$

It can be easily seen that the sign of dQ^*/dSE depends on the relative magnitude of $|\beta|$ and $(\xi + \gamma)$. If $|\beta|$ is greater than $(\xi + \gamma)$, then dQ^*/dSE is negative whereas if $|\beta|$ is less than $(\gamma + \xi)$, then dQ^*/dSE is positive. Note that the condition for a decrease in the equilibrium number of analysts' services is more stringent than that of a decrease in the demand for analysts' services, that is, $|\beta| > \gamma$.

This chapter assumes that the direct effect dominates the indirect effect. That is, the demand for analysts' services are primarily determined by the incremental benefit of analysts' forecasts over earnings forecasts based on past earnings. In addition, the effect of demand is assumed to be more important than the effect of supply. That is, the demand is a determining factor for the equilibrium number of analysts' services.[3] Under these assumptions, it is predicted that the number of analysts following a given firm is negatively associated with the smoothness of the firm's reported earnings.

[3] The consequences of the violation of these assumptions are discussed later.

Hypothesis 5.1 Ceteris paribus, *the number of analysts following a given firms is negatively associated with the smoothness of the firm's reported earnings.*

Lang and Lundholm (1996) find that the number of analysts following a given firm is positively associated with the informativeness of the firm's disclosure policy. If Lang and Lundholm (1996)'s measure of the informativeness is negatively correlated with uncertainty about future earnings, then their result can be interpreted such that analysts prefer following firms with less uncertainty about future earnings. Since there is less uncertainty about future earnings for smooth earnings than for volatile earnings, Lang and Lundholm (1996)'s result is consistent with the hypothesis that the number of analysts following a given firm will be higher for firms with smooth reported earnings than for firms with volatile reported earnings. It is in sharp contrast to hypothesis 5.1. Note that hypothesis 5.1 is based on the assumptions that the direct effect dominates the indirect effect, and that the effect of demand is more important than the effect of supply. Therefore, Lang and Lundholm (1996)'s result can be explained as a failure of one of these assumptions.

On the other hand, it is possible that a firm's disclosure level is influenced by the amount of uncertainty about the firm. A firm with smooth earnings may disclose less than a firm with volatile earnings simply because there is less to disclose for smooth earnings than for volatile earnings. If Lang and Lundholm (1996)'s measure of informativeness of a firm's disclosure policy is negatively associated with the smoothness of reported earnings, then hypothesis 5.1 is consistent with their result.

5.2.2 Earnings Management and the equilibrium demand for analysts' forecasts

Earnings can be viewed as consisting of persistent and transitory components. By definition, the persistent component affects the future expected earnings while the transitory component does not. The transitory component has a dollar for dollar impact on the value of the firm while the persistent component has more than a one dollar impact. Since the impact of the two components on the value of the firm is different, it is important to identify the composition of earnings. A problem faced by investors or analysts is that it is not easy to identify the persistent component of earnings.

Under information asymmetry, it is assumed that managers are better informed about the composition of earnings. Ideally, managers would communicate their private information about the composition of earnings by reporting the persistent and transitory components separately. Under the assumption that it is very costly to communicate the persistent and transitory earnings separately, this chapter focuses on income smoothing, in which managers communicate only the persistent earnings by eliminating the transitory component.[4,5] Under income smoothing, managers may not communicate the full dimension of value relevant information, but the loss of not communicating the transitory earnings may be less than the value of clearly communicating the persistent earnings. In this chapter, income smoothing refers to management's deliberate reporting strategy to communicate only persistent earnings.

It is important to understand that the ultimate goal of analysts is not to forecast earnings,

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[4]Under income smoothing, the transitory component of earnings is eventually offset by other transitory earnings that have the opposite effect, hence, the transitory component of earnings is not reported.

[5]There are other alternatives. Managers may convert all earnings either into persistent equivalent earnings or into transitory equivalent earnings. The persistent equivalent earnings may be enough for valuation purpose, but for analysts, it will pose a difficulty in predicting future earnings. In predicting future earnings, analysts need two pieces of information: the persistent component of current earnings and the random component of future earnings. If the random component is not easy (or costly) to predict, the useful piece of information is the persistent current earnings, that is, the component that is expected to persist in the future. If a firm reports the persistent equivalent earnings, then investors or analysts have to identify transitory earnings that are converted into persistent equivalent since transitory earnings do not affect future expected earnings. On the other hand, if transitory equivalent earnings are reported, the book value of equity will be the same as the market value of the firm as in mark-to-market accounting (see Feltham and Ohlson (1996)). In fact, this reporting scheme is equivalent to reporting the value of the firm. Under the conservatism prevailing in accounting principles, this scheme will be too radical to implement. That is, it is not allowed to recognize future unrealized earnings under the conservatism principle.

but to assess the value of the firm. The model in chapter 2 suggests a valuation implication of income smoothing. Compared to firms that do not manage earnings, income smoothing firms might have a higher persistent earnings shock percentage.[6] Since the impact of a dollar of persistent earnings on the value of the firm is much larger than a dollar of transitory earnings and only persistent earnings are relevant for predicting future earnings, the identification of persistent earnings is more important than transitory earnings. For firms that do not manage earnings, investors or analysts have uncertainty about the composition of earnings whereas for income smoothing firms, the transitory component is already suppressed by management's reporting strategy, therefore there is less uncertainty about the composition of an earnings shock. For income smoothing firms, investors are better informed about the proportion of the total earnings shock that is expected to persist in the future, therefore they can forecast future earnings more accurately. The amount of uncertainty that is available to be resolved by analysts is less for income smoothing firms than for firms that do not manage earnings. It is predicted that the number of analysts following a given firm is a decreasing function of the degree of income smoothing. On the other hand, if a firm is engaged in variance increasing earnings management, then the reported earnings can be characterized as a garbling of pre-managed earnings. For variance increasing earnings management firms, analysts have to predict the noise intentionally added by firms. There is more uncertainty about the composition of earnings for variance increasing earnings management firms than for firms that do not manage earnings. It is predicted that the number of analysts following will be higher for variance increasing earnings management firms than for firms that do not manage earnings. Since variance increasing

[6] It is possible that firms that have inherently more transitory earnings are more likely to be engaged in income smoothing. In that case, the persistent earnings shock percentage is not necessarily higher for income smoothing firms than firms that do not manage earnings. However, chapter 4 shows that the earnings response coefficient for firms that use accruals to smooth earnings is higher than that for firms that do not manage earnings. It is consistent with income smoothing firms having a higher persistent earnings shock percentage than firms that do not manage earnings.

earnings management can be thought of as income de-smoothing, the following hypothesis summarizes both income smoothing and variance increasing earnings management cases.

Hypothesis 5.2 Ceteris paribus, *the number of analysts following a given firms is negatively associated with the degree of income smoothing.*

5.2.3 Other properties of analysts' forecasts

In this subsection, other properties of analysts' forecasts such as dispersion, forecast errors, and revision volatility of analysts' forecasts are considered.[7] The information available to analysts consists of publicly available information such as earnings reports and private information collected by analysts. The private information collected by analysts affects the total information available to them. The discussion of the demand for analysts' services suggests that there will be more demand for analysts' services for firms with volatile reported earnings than for firms with smooth reported earnings. Analysts may collect more information for firms with volatile earnings than for firms with smooth earnings. Therefore, it is possible that the amount of information available to analysts can be greater for firms with volatile reported earnings than for firms with smooth reported earnings. As a result of analysts' private information collection, it is possible that the remaining uncertainty about future earnings can be lower for firms with volatile earnings than for firms with smooth earnings. However, it is assumed that the remaining uncertainty about future earnings is less for firms with smooth reported earnings than for firms with volatile reported earnings.

When analysts forecast earnings, they use their private information as well as publicly available earnings reports. If analysts' private information is more informative about the future earnings than publicly available earnings reports, then less weight will be given to the pub-

[7] See section 5.3.1 for measurement of these variables.

licly available earnings reports. Under the assumption that analysts hold (or acquire) diverse private information, less weight on the common earnings reports means more diversity. If analysts' private information is more useful for firms with volatile earnings than for firms with smooth earnings, then the publicly available common earnings reports will have less impact on investors' beliefs about future expected earnings for firms with volatile earnings than for firms with smooth earnings. Therefore, it is hypothesized that the dispersion among analysts' forecasts is negatively associated with the smoothness of reported earnings. It is also consistent with the argument that earnings announcements themselves are a source of the dispersion among analysts' forecasts. Interpretations for the same earnings reports can be quite varied among analysts, but interpretations among analysts will be more diverse for volatile earnings than for smooth earnings.

Hypothesis 5.3 Ceteris paribus, *the dispersion of analysts' forecasts is negatively associated with the smoothness of reported earnings.*

The forecast error is defined as the absolute difference between reported earnings and consensus analysts' forecast. The forecast error will be influenced by the amount of uncertainty inherent in the earnings generating process. In the model in chapter 2, the uncertainty is represented by unexpected earnings. The forecast accuracy of analysts will be higher for firms with smooth reported earnings than for firms with volatile reported earnings since smooth earnings are easier to predict and the amount of surprise is less for firms with smooth earnings. Therefore, it is expected that the forecast error is smaller for firms with smooth reported earnings than for firms with volatile reported earnings.

Hypothesis 5.4 Ceteris paribus, *analyst forecast errors are negatively associated with the smoothness of reported earnings.*

Finally, the revision volatility of analysts' forecasts is hypothesized to be an increasing function of the smoothness of reported earnings. The frequency and magnitude of the revision of analysts' forecasts may be affected by the amount of uncertainty about future earnings. There is less uncertainty for firms with smooth earnings than for firms with volatile earnings. Therefore, the revision of analysts' forecasts will be less intense for firms with smooth earnings than for firms with volatile earnings.

Hypothesis 5.5 Ceteris paribus, *the volatility of analyst earnings forecast revision is negatively associated with the smoothness of reported earnings.*

Unlike the demand for analysts' services, the properties of analysts' forecasts are directly related to reported earnings *per se*, not the intrinsic value of the firm. Therefore, the other properties of analysts' forecasts are not likely to be affected by the composition of the unexpected earnings shock. The composition of the unexpected earnings may be useful for the determination of the firm value, but not likely for the prediction of future earnings. Therefore, the impact of income smoothing is not explicitly considered in the analysis of the other properties of analysts' forecasts.

5.3 Research Design

This section describes the measurement of dependent and control variables other than the smoothness of reported (managed) and pre-managed earnings and growth, and the regressions used to examine the differences in the number of analysts following and the other properties of analysts' forecasts. The measures of smoothness of pre-managed earnings (SPE_i) and reported earnings (SRE_i), and growth ($GROWTH_i$) of firm i are explained in chapter 3. These variables are measured over the period from 1978 to 1995.

5.3.1 Measurement of Analysts Properties and Control Variables

The number of analysts following, the standard deviation, the forecast error, and the revision volatility are considered as the dependent variables.[8] Dependent variables are measured from I/B/E/S monthly summary files.

Number of Analysts (NA_{it}): the number of analysts providing annual earnings forecasts for firm i in year t. It is measured as the mean of the number of analysts following the firm for the twelve month period preceding the earnings announcement.

$$NA_{it} = Mean(NA_{imt}),$$

where NA_{imt} represents the number of analysts following firm i for the month m of year t.

Std. Dev. of Forecasts (SD_{it}): the standard deviation of analysts' forecasts for firm i in year t, which is deflated by the beginning of the fiscal period stock price. It is measured as the mean of the standard deviation for the twelve month period preceding the earnings announcement.

$$SD_{it} = \frac{Mean(SD_{imt})}{P_{it-1}},$$

where SD_{imt} represents the standard deviation of analysts' forecasts for firm i for the month m of year t, and P_{it-1} represents the beginning of the fiscal period stock price of firm i.

Forecast Error (FE_{it}): the absolute value of the analyst forecast error for firm i in year t, which is deflated by the beginning of the fiscal period stock price. It is measured as

[8]These variables are the same as those considered by Lang and Lundholm (1996) except that forecast errors are used rather than forecast accuracy and the standard deviation of forecasts and the forecast errors are deflated by the beginning of the fiscal period stock price rather than the ending stock price.

the mean of the forecast errors for the twelve month period preceding the earnings announcement.

$$FE_{it} = \frac{Mean(|FE_{imt}|)}{P_{it-1}},$$

where FE_{imt} represents the forecast error for firm i for the month m of year t. The forecast error is computed by reported earnings per share minus the consensus analysts' forecasts.

$$FE_{imt} = EPS_{it} - E_m[EPS_{it}],$$

where EPS_{it} represents the actual earnings per share for firm i in year t, and $E_m[EPS_{it}]$ represents the consensus (median) analysts' forecast for the month m of year t.

Revision Volatility (RV_{it}): the standard deviation of changes in consensus (median) analysts' forecasts from the previous month deflated by the beginning of the fiscal period stock price.

$$RV_{it} = \frac{\text{Standard Deviation}(E_m[EPS_{it}] - E_{m-1}[EPS_{it}])}{P_{it-1}}$$

As in Lang and Lundholm (1996), size, the standard deviation of annual return on equity (ROE), the correlation between the market returns and earnings are considered as control variables. Earnings surprise and percentage of new forecasts are further considered in the regressions of other properties of analysts' forecasts such as the dispersion, the forecast error, and the revision volatility.

Consistent with Bhushan (1989) and Brennan and Hughes (1991), size is expected to be positively associated with the number of analysts following since size proxies for the investor base. Other properties of analysts' forecasts such as the dispersion, the forecast error, and the revision volatility will be negatively associated with size if size proxies for the amount of information available to analysts. If size proxies for the complexity of the firm's operations, then size will be positively associated with the dispersion, the forecast error, and the revision volatility. The standard deviation of ROE and the correlation between the market returns and earnings are included in order to control for the impact of firm's performance variability and information content of earnings. If higher standard deviation of ROE and lower correlation between the market returns and earnings represent less precise information about the firm, then the dispersion, the forecast error, and the revision volatility are expected to be positively associated with the standard deviation of return on equity and to be negatively associated with the correlation between the market returns and earnings. Growth is further considered since growth potential may affect the demand for analysts' forecasts. If growth firms attract greater market attention, then the demand for analysts' services for growth firms will be higher. On the other hand, if analysts are faced with more uncertainty with growth firms, then the dispersion, the forecast error, and the revision volatility will be negatively associated with the measure of growth.

Earnings surprise (represented by the change in earnings) is included to control for the magnitude of the new information in the reported earnings. It is expected that earnings surprise is positively associated with the dispersion, the forecast error, and the revision volatility since uncertainty is likely to decrease the consensus among analysts and increase the forecast errors and revision volatility. The percentage of new forecasts is included in order to control for the impact of stale forecasts. If a low percentage of new forecasts proxies for the staleness of information or the lack of new information, the percentage of new forecasts will be positively associated with the revision volatility.

Size$_{it}$**:** log (market value of firm *i* at the beginning of the fiscal period).

Std. Dev. of ROE ($STROE_{it}$**):** the standard deviation of annual return on equity calculated over the previous ten years.

Return-earnings correlation ($CORR_{it}^{RE}$): the correlation coefficient between cumulative abnormal returns (from -8 month to +3 month after fiscal year end) and annual earnings before extraordinary items and discontinued operations calculated over the previous ten years.

Earnings surprise ($|ES_{it}|$): the absolute value of the change in earnings per share before extraordinary items from the previous year's earnings per share deflated by the beginning of the fiscal period stock price.

$$|ES_{it}| = \frac{|EPS_{it} - EPS_{it-1}|}{P_{t-1}}.$$

Percentage of new forecasts ($PNEW_it$): mean of new forecasts deflated by the total number of analysts' forecasts.

$$PNEW_{it} = Mean\left(\frac{NEW_{imt}}{NA_{imt}}\right),$$

where NEW_{imt} represents the number of new forecasts for firm i for the month m of year t. The number of new forecasts is measured by the number of forecasts revised during the month plus the number of first-time forecasts[9] issued during the month.

5.3.2 Regressions

Firms are partitioned by the smoothness of reported and pre-managed earnings. The pre-managed earnings are calculated as the reported earnings minus discretionary accruals measured using the modified Jones model (see chapter 3 for details). Firms are ranked by the degree of smoothness of reported and pre-managed earnings, and the ranks are converted into percentiles by (rank - 1)/(number of firms - 1).

[9]The first-time forecasts are computed by the change in the number of analysts' forecasts from the previous month. If it is negative, it is set to zero.

The regression for number of analysts following is represented as follows:

$$\begin{aligned}\text{NA}_{it} &= \beta_0 + \beta_1 SRE_i + \beta_2(SRE_i - SPE_i) + \beta_3 SIZE_{it} \\ &+ \beta_4 STROE_{it} + \beta_5 CORR_{it}^{RE} + \beta_6 GROWTH_i + \varepsilon_{it}. \qquad (5.2)\end{aligned}$$

Hypotheses 5.1 and 5.2 predict that both β_1 and β_2 are negative.[10]

Other properties of analysts' forecasts are regressed on the absolute value of the change in earnings per share and percentage of new forecasts in addition to the control variables considered in the number of analysts regression.[11]

$$\begin{aligned}\text{Dep. Var.}_{it} &= \beta_0 + \beta_1 SRE_i + \beta_2 |SRE_i - SPE_i| + \beta_3 SIZE_{it} + \beta_4 STROE_{it} \\ &+ \beta_5 CORR_{it}^{RE} + \beta_6 GROWTH_i + \beta_7 |ES_{it}| + \beta_8 PNEW_{it} + \varepsilon_{it}, \qquad (5.3)\end{aligned}$$

where Dep. Var = SD, FE, and RV.

β_1 is predicted to be negative since smooth earnings are hypothesized to decrease the dispersion of analysts' forecasts, the forecast errors, and the revision volatility. Unlike the number of analysts following regression (5.2), the magnitude of earnings management measured by the absolute value of the difference between the smoothness of reported and pre-managed earnings

[10] The following regression is equivalent to regression (5.2).

$$\begin{aligned}\text{NA}_{it} &= \beta_0 + \hat{\beta}_1 SRE_i + \hat{\beta}_2 SPE_i + \beta_3 SIZE_{it} \\ &+ \beta_4 STROE_{it} + \beta_5 CORR_{it}^{RE} + \beta_6 GROWTH_i + \varepsilon_{it}.\end{aligned}$$

It can be easily seen that $\hat{\beta}_1 = \beta_1 + \beta_2$ and $\hat{\beta}_2 = -\beta_2$. Therefore, the test whether β_1 is negative is equivalent to the test whether the sum of $\hat{\beta}_1$ and $\hat{\beta}_2$ is negative and the test whether β_2 is negative is equivalent to the test whether $\hat{\beta}_2$ is positive. Regression (5.2) rather than the above regression is used to highlight the effect of the smoothness of reported earnings and the degree of income smoothing.

[11] Regression (5.3) implicitly assumes that the effect of the magnitude of earnings management is equal regardless of the type of earnings management. That is, the same coefficient β_2 is assumed to apply to both income smoothing firms ($SRE_i - SPE_i \geq 0$) and variance increasing ($SRE_i - SPE_i < 0$). In general, it will be better to estimate an unrestricted regression in which the coefficient on $|SRE_i - SPE_i|$ is not restricted to be the same between income smoothing firms and variance increasing (see section 5 for details).

is used. Unlike the demand for analysts' services, which is concerned about determining the intrinsic value of the firm, the dispersion, the forecast error, and the revision volatility of analysts' forecasts are closely related to the earnings *per se*. The amount of uncertainty in earnings is controlled for by the smoothness of reported earnings. Therefore, once the smoothness of reported earnings is controlled for, the nature of earnings management is less likely to affect the properties of analysts' forecasts. That is, the composition of the earnings shock is not likely to affect the dispersion, the forecast errors, and the revision volatility of analysts' forecasts. It is, however, quite possible for those properties of analysts' forecasts to be affected by the magnitude of earnings management. Therefore, the magnitude of earnings management is further controlled for. No prediction is made about β_2. However, a positive β_2 implies that earnings management increases the dispersion, the forecast errors, and the revision volatility, and a negative β_2 implies that earnings management decreases the dispersion, the forecast errors, and the revision volatility.

5.4 Data

Data for calculating discretionary accruals and the measure of the smoothness of earnings is collected from COMPUSTAT PC Plus Jan. 97 CD ROM. In order to be included in the sample, a firm is required (i) to be listed on at least one of the New York Stock Exchange, the American Stock Exchange, and the NASDAQ; (ii) to have no change in fiscal year ends; (iii) SIC is not from 6000 to 6999. Non-discretionary accrual models are estimated per two-digit SIC and year. At least 20 data points ought to be available for the estimation of each two-digit SIC and year non-discretionary estimation model. In calculating the measure of smoothness of earnings, each firm should have at least ten years of data. Once firms are classified by the measures of smoothness of earnings, additional data is collected from 96 Oct. I/B/E/S CD ROM and 96 CRSP monthly tape. The number of analysts following is required to be at least three. The resulting sample consists of 6,447 firm-years.[12]

Table 5.1 presents the distribution of the sample by year. The sample is evenly distributed from 1987 to 1995.[13] Table 5.2 reports the descriptive statistics on the dependent variables and other key variables. A firm in the sample is on average followed by 13.4 analysts. The averages of the standard deviation, the forecast error, and the revision volatility are 0.8%, 1.8%, and 0.4% of the beginning of the period share price, respectively. Firms in the sample are on average large. The average market value of the equity is $2.9 billion and the median is $905 million. The measure of growth is positive, which implies that the firms in the sample are on average successful and growing. The measure of smoothness of reported earnings is greater than that of pre-managed earnings, implying that firms in the sample are on average engaged in income smoothing.

Panel A of table 5.3 presents Spearman rank correlations among the independent and dependent variables. The number of analysts following is positively associated with the measure of smoothness of reported earnings, and negatively associated with the measure of income smoothing, which is calculated by the difference in the smoothness of reported versus pre-managed earnings.[14] The standard deviation, the forecast error, and the revision volatility of analyst forecasts are negatively correlated with the measure of smoothness of reported earnings. The standard deviation of return on equity, the correlation between annual returns and earnings, earnings surprise, and the percentage of new forecasts are negatively correlated with

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[12]The sample in this chapter is different from that in chapter 4 due to the different data requirements. For example, the sample in chapter 4 requires that I/B/E/S EPS matches with COMPUSTAT EPS while the sample in this chapter does not impose this restriction.

[13]Years refer to COMPUSTAT years. A COMPUSTAT year starts from June and ends May of the next year. If calendar years are used, the sample year ranges from 1987 to 1996. But there is only one observation in 1996. Moreover, its fiscal period end is January. In a specification check which controls for fixed effects for year, COMPUSTAT year is used rather than calendar year.

[14]However, the next section shows that the number of analysts' following is negatively associated with the smoothness of reported earnings once size is controlled for.

the number of analysts, but positively correlated with other properties of analysts' forecasts.

Consistent with the previous research, the number of analysts following is highly correlated with size, which is proxied for by the market value of equity at the beginning of the fiscal period. The correlation is 0.75. The market value of equity is highly negatively correlated with the standard deviation, the forecast errors, and the revision volatility, ranging from -0.42 to -0.32, but the correlations are lower than that for the number of analysts following. The measure of growth is positively associated with the number of analysts following and negatively associated with the standard deviation, the forecast errors, and the revision volatility of analyst forecasts. The correlations among the dependent variables show that the number of analysts following is negatively correlated with other properties of analyst forecasts, but the absolute correlation is less than 0.3. The standard deviation, the forecast error, and the revision volatility are highly correlated, ranging from 0.65 to 0.79.

Panel B of table 5.3 reports the correlations among the independent variables. The highest absolute correlation occurs between the measure of smoothness of reported earnings and the standard deviation of return on equity (-0.68).[15] The measure of smoothness of reported earnings is also highly correlated with earnings surprise (-0.50). If the measure of smoothness of reported earnings is excluded, the correlations among the control variables are relatively low, ranging from -0.20 to 0.36. The results are comparable with those reported in table 2 and 3 of Lang and Lundholm (1996).

[15] The high correlation between the measure of smoothness of reported earnings and the standard deviation of return on equity (ROE) is partially dealt with in section 5.5.4 by performing regression analysis after excluding the standard deviation of ROE.

5.5 Empirical Tests

5.5.1 Univariate Tests

Panel A of table 5.4 reports the tests of differences in key variables between firms with smooth reported earnings and firms with volatile reported earnings. Two tests are performed. One is a t-test and the other is a Wilcoxon rank-sum test. Inconsistent with hypothesis 5.1, the number of analysts following is greater for firms with smooth reported earnings than for firms with volatile reported earnings. Prior research shows that the number of analysts following is positively associated with the size of the firm. Firms with smooth reported earnings are significantly larger than firms with volatile reported earnings. It is possible that more analysts follow firms with smooth reported earnings than firms with volatile reported earnings since firms with smooth reported earnings are bigger.

Panel B and C of table 5.4 report univariate test results when the sample is further partioned into small and large sub-samples. For the sample of small firm-years, the mean of the number of analysts following is significantly less for firms with smooth reported earnings than firms with volatile reported earnings even though the size of firms with smooth reported earnings, measured by the market value of the equity, is bigger than firms with volatile reported earnings, which is consistent with hypothesis 5.1. The result using a non-parametric test of the difference in the median, however, is insignificant. For the sub-sample of large firm-years, the number of analysts following is greater for firms with smooth reported earnings than for firms with volatile reported earnings. Test statistics are significant for both mean and median. Since the size of firms with smooth reported earnings measured by the market value of the equity is bigger than firms with volatile reported earnings, it is inconclusive whether hypothesis 5.1 holds after controlling for firm size.

The rest of table 5.4 reports that the dispersion, the forecast errors, and the revision volatility of analysts' forecasts are greater for firms with volatile reported earnings than for firms with smooth reported earnings, suggesting that those properties are negatively associated with the smoothness of reported earnings. The basic associations hold even after the sample is partioned into small and large firms.

5.5.2 Number of Analysts Following

Panel A of table 5.5 reports the result of regressing the number of analysts following on the smoothness of reported earnings and control variables. In the first regression, only the smoothness of reported earnings is considered whereas in the second regression, the change in the smoothness of reported earnings is further considered. The adjusted R^2s of the number of analysts following regressions are 59.0% and 59.1%, respectively. The overall result is consistent with the hypotheses 5.1 and 5.2. This result is different from the simple correlations reported in table 5.3. That is, once other control variables such as size and growth are considered, the demand for analysts' services is a decreasing function of the smoothness of reported earnings and the degree of income smoothing. This result is contrasted to the result in Lang and Lundholm (1996), which suggests that the demand for analysts' services is greater for firms with smooth reported earnings than for firms with volatile reported earnings. The result is consistent with Kross et al.'s (1990) argument that analysts have greater incentives to collect more information for firms with volatile reported earnings than for firms with smooth reported earnings.

Consistent with the previous research, the coefficient on size is significantly positive. That is, the number of analysts following is greater for large firms than small firms. The number of analysts following is negatively associated with the correlation between annual returns and earnings. The insignificant coefficient on the standard deviation of ROE implies that the standard deviation of ROE has no impact on the number of analysts following once other variables are controlled for.[16] The coefficient on growth is significantly positive, which is consistent with growth firms attracting more attention from investors.

In summary, the number of analysts following is less for firms with smooth reported earnings than for firms with volatile reported earnings. In addition, the number of analysts following is a decreasing function of the degree of income smoothing.[17,18]

5.5.3 Other Properties of Analysts' Forecasts

Panel B of table 5.5 reports the results of regressing the dispersion of analysts' forecasts on the smoothness of reported earnings and control variables. The adjusted R^2s are around 16.5%. The coefficient on the smoothness of reported earnings is significantly negative, which is consistent with hypothesis 5.3 that there is more consensus among analysts for smooth earnings than for volatile earnings. The second regression also reports a significant negative coefficient on the magnitude of earnings management, which is measured by the absolute value of the difference in the smoothness of reported versus pre-managed earnings. The result suggests that the consensus among analysts is higher for firms that use accruals to manage earnings

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[16]See section 5.5.4 for the discussion of the high correlation between the standard deviation of ROE and the smoothness of reported earnings (SRE).

[17]In order to examine whether there is any difference in the number of analysts following between income smoothing and variance increasing earnings management firms, the following piecewise regression is estimated:

$$\begin{aligned} \mathrm{NA}_{it} &= \beta_0 + \beta_1 SRE_i + \beta_2^+ d_{IS^+}(SRE_i - SPE_i) + \beta_2^- d_{IS^-}(SRE_i - SPE_i) \\ &\quad + \beta_3 SIZE_{it} + \beta_4 STROE_{it} + \beta_5 CORR_{it}^{RE} + \beta_6 GROWTH_i + \varepsilon_{it}, \end{aligned}$$

where d_{IS^+} and d_{IS^-} are dummy variables representing income smoothing and variance increasing earnings management, respectively. For example, d_{IS^+} takes on 1 if $SRE_i - SPE_i \geq 0$. Similarly, d_{IS^-} takes on 1 if $SRE_i - SPE_i < 0$. The result (not reported) shows that both β_2^+ and β_2^- are negative, but only β_2^- is significant. It seems that the impact of earnings management on the number of analysts following is more pronounced for variance increasing earnings management firms than for income smoothing firms.

[18]In an attempt to consider fixed effects by year, dummy variables representing fiscal years are additionally included. The results (not reported) are similar to those reported here.

than for firms that do not manage earnings.[19] In order to investigate the differential impact of income smoothing and variance increasing earnings management, the following regression is considered.

$$\mathrm{SD}_{it} = \beta_0 + \beta_1 SRE_i + \beta_2^+ d_{IS^+}|SRE_i - SPE_i| + \beta_2^- d_{IS^-}|SRE_i - SPE_i| + \beta_3 SIZE_{it}$$
$$+\beta_4 STROE_{it} + \beta_5 CORR_{it}^{RE} + \beta_6 GROWTH_i + \beta_7|ES_{it}| + \beta_8 PNEW_{it} + \varepsilon_{it},$$

where d_{IS^+} is a dummy variable representing income smoothing firms. That is, if $SRE_i - SPE_i \geq 0$ then d_{IS^+} equals 1, and otherwise 0. Similarly, d_{IS^-} represents variance increasing earnings management firms. That is, if $SRE_i - SPE_i < 0$ then d_{IS^-} equals 1, and otherwise 0. Regression (5.3) used in table 5.5 can be viewed as a restricted regression since β_2^+ and β_2^- are assumed to be equal. Table 5.6 reports the results of unrestricted regressions for the standard deviation, the forecast errors, and revision volatility. The standard deviation of analysts' forecasts regression shows that the coefficient on $d_{IS^-}|SRE_i - SPE_i|$ is significantly negative, but that on $d_{IS^+}|SRE_i - SPE_i|$ is insignificant.[20] It seems that the significant negative coefficient on the restricted regression is driven by variance increasing earnings management firms. It is surprising that variance increasing earnings management leads to greater consensus among analysts once the smoothness of reported earnings are controlled for.

The significant negative coefficient on size suggests that analysts have higher consensus for large firms than for small firms. This is consistent with analysts having more common information for large firms. The dispersion of analysts' forecasts is positively associated with earnings surprise, but is not associated with the standard deviation of ROE, the correlation between annual returns and earnings, growth, and the percentage of new forecasts.

Panel C of table 5.5 reports the result of regressing the forecast errors on the smoothness

[19] Section 5.5.6, however, shows that the magnitude of earnings management has no impact on the standard deviation of analysts' forecasts if a simultaneous equations approach is used.

[20] The t-test (not reported) confirms that d_{IS^+} and d_{IS^-} are not equal.

of reported earnings and control variables. The adjusted R^2 is 2.3%. With respect to hypothesis 5.4, the significant negative coefficient on the smoothness of reported earnings implies that forecast errors are less for firms with smooth earnings than for firms with volatile earnings. That is, smooth earnings reduces forecast errors. Once the smoothness of reported earnings is controlled for, it is found that the magnitude of earnings management has no impact on the forecast error. The unrestricted regression for the forecast errors reported in table 5.6 shows that the coefficients on $d_{IS+}|SRE_i - SPE_i|$ and $d_{IS-}|SRE_i - SPE_i|$ are both insignificant. Unlike the unrestricted regression for the standard deviation of analysts' forecasts, earnings management has no impact on the forecast errors regardless of the type of earnings management. The other results of panel C of table 5.5 are very similar to those reported in panel B.

Panel D of table 5.5 reports the result of regressing the revision volatility on the smoothness of reported earnings and control variables. The adjusted R^2s are around 17.0%. The coefficient on the smoothness of reported earnings is significantly negative. Consistent with hypothesis 5.5, smooth earnings decrease the revision volatility, that is, forecasts are less intensely revised for firms with smooth earnings than for firms with volatile earnings. As in the standard deviation regression, the magnitude of earnings management is significantly negatively associated with the revision volatility. It is consistent with earnings management reducing the revision activity. As in the standard deviation of analysts' forecasts, the unrestricted regression for the forecast errors reported in table 5.6 shows that the negative relation is driven by variance increasing earnings management firms, not by income smoothing firms. It seems that variance increasing earnings management leads to less intense revision of analysts forecasts. Except for the coefficient on the percentage of new forecasts being significant, other results in panel D of table 5.5 are similar to those in panel B and C.

In summary, the dispersion, the forecast error, and the revision volatility of analysts' forecasts are negatively associated with the smoothness of reported earnings.[21]

5.5.4 Robustness Check

Inconsistent with Lang and Lundholm (1996), the previous analysis provides evidence that the number of analysts following is less for firms with smooth reported earnings than for firms with volatile reported earnings. However, Lang and Lundholm (1996) examine the similar issues using rank regression rather than ordinary least squares regression. Rank regression does not assume the linearity between independent variables and dependent variables. In particular, if the relation is monotonic, but non-linear, then the rank regression works better than OLS (Iman and Conover (1979)). Rank regression is also less vulnerable to extreme observations and violations of the distributional assumptions regarding error term (Chaudhury and Ng (1992)).

For comparability with Lang and Lundholm (1996), the same analyses are repeated using rank regression. Table 5.5 and 5.7 show that there is no improvement in the adjusted R^2 for the number of analysts following, but there is a big improvement in the adjusted R^2 for other properties of analysts' forecasts. For other properties of analysts' forecasts, rank regression may be more appropriate than OLS. The results reported in table 5.7 are very similar to those in table 5.5. Panel A shows that the coefficients on the smoothness of reported earnings and the difference in the smoothness of reported versus pre-managed earnings are significantly negative. The rest of the table shows that the smoothness of reported earnings is negatively associated with the standard deviation, forecast error, and revision volatility of analysts' forecasts.

Next, in order to check the robustness of the measure of the smoothness of reported earnings, the smoothness of reported earnings is also measured over the previous ten-year period

[21] In an attempt to consider fixed effects by year, dummy variables representing fiscal years are additionally included. The results (not reported) are insensitive whether dummy variables are included or not.

rather than the whole examination period. The ten-year period is rolled forward each year. The results (not reported) for the number of analysts following is qualitatively similar to those reported here. In other properties of analysts' forecasts regressions, the coefficient on the smoothness of reported earnings is insignificant. If rank regressions are used, the coefficient on the smoothness of reported earnings is significantly negative for both the number of analysts following and other properties of analysts.

Finally, panel B of table 5.3 reports a high correlation between the smoothness of reported earnings and the standard deviation of ROE (-0.68). In order to assess the multicollinearity problem between the two variables, the same analysis is repeated excluding the standard deviation of ROE. The results (not reported) are insensitive to the exclusion of the standard deviation of ROE.

5.5.5 Further Investigation of the Number of Analysts Following

The empirical results for the other properties of analysts' forecasts are consistent with Lang and Lundholm (1996), but the result for the number of analysts following is different. The inconsistency may result from the differences in examination period. The examination period in Lang and Lundholm (1996) is from 1985 to 1989. Further analysis is performed in order to confirm whether the difference in examination period affects the empirical results. Firm-year observations are divided by year: 1987 - 1989 and 1990 - 1995 periods. 1987 - 1989 period contains 2,061 firm-year observations and 1990 - 1995 period contains 4,386 firm-year observations. In addition, a possible effect of firm size is considered. Firms are further partitioned by size.[22] A firm year is classified as big if the market value of the firm is equal to or greater than the median of the sample firms in that year. Otherwise, the firm year is classified as small.

[22] The size of the sample firms are relatively similar. The mean and median market values of the firm in Lang and Lundholm (1996) are $2,438 million and $1,072 million, respectively.

The big firm group has 3,223 firm-years and the small firm group has 3,224 firm-years.

Table 5.8 presents the result of the regression of the number of analysts following by period and size. Panel A presents the result of the regression by period. The coefficients on the smoothness of reported earnings is significant for the period of 1987 - 1989, but insignificant for the period of 1990 - 1995. However, the difference in the smoothness of reported versus pre-managed earnings is significant in both periods. Overall, the result for the period of 1987 - 1989 is similar to that in panel A of table 5.5, but the result for the period of 1990 - 1990 is a little weak. In addition, the coefficient on growth is insignificant for the period of 1987 - 1989 and the coefficient on the correlation between annual returns and earnings is insignificant for the period of 1990-1995.

Panel B of table 5.8 reports the result of the regression by size. The results for large firms are very similar to those in panel A of table 5.5. But, for small firms, the coefficient on the smoothness of reported earnings is insignificant.

To summarize, the negative relation between the number of analysts following and the smoothness of reported earnings is more obvious in the period prior to 1990 and for large firms. However, the negative relation between the number of analysts following and the measure of income smoothing is robust to the examination period and size of the sample firms.

5.5.6 A Simultaneous Equations Approach

In their study of the effect of extreme accounting events on analysts following and forecast accuracy, Alford and Berger (1997) report that the number of analysts following and forecast accuracy is simultaneously determined, and that forecast accuracy increases as the number of analysts following increases. This subsection considers the possibility that the number of analysts following and other properties of analysts' forecasts are simultaneously determined.

The correlation analysis in panel A of table 5.3 shows that the standard deviation, forecast error, and revision volatility are highly correlated with each other. Therefore, rather than considering the standard deviation, forecast error, and revision volatility at the same time, only one of them will be considered. That is, it is assumed that the standard deviation, forecast error, and revision volatility represent very similar characteristics of analysts' forecasts.

A system of simultaneous equations is formed between the number of analysts following and one of other properties of analysts' forecasts.

$$NA_{it} = \beta_0 + \beta 1 OP_{it} + \beta_2 SRE_i + \beta_3 (SRE_i - SPE_i) + \beta_4 SIZE_{it} + \beta_5 STROE_{it} + \beta_6 CORR^{RE}_{it} + \beta_7 GROWTH_i + \varepsilon_{it},$$

and

$$OP_{it} = \beta_0 + \beta 1 NA_{it} + \beta_2 SRE_i + \beta_3 |SRE_i - SPE_i| + \beta_4 SIZE_{it} + \beta_5 STROE_{it} + \beta_6 CORR^{RE}_{it} + \beta_7 GROWTH_i + \beta_8 |ES_{it}| + \beta_9 PNEW_{it} + \varepsilon_{it}, \qquad (5.4)$$

where OP_{it} denotes either the standard deviation, forecast error, or revision volatility for firm i for year t. Alford and Berger (1997) report that the number of analysts following is higher for firms with greater forecast accuracy, and interpret this as indicating that analysts complement other sources of information. They consider only forecast accuracy, not the standard deviation and revision volatility of analysts' forecasts. Since the three variables are highly correlated, Alford and Berger's (1997) result suggests that the number of analysts following will be negatively associated with the standard deviation and revision volatility. Unlike Alford and Berger (1997), this chapter does not interpret the negative coefficient on the other properties of analysts' forecasts as indicating that analysts complement other sources of information, in particular, the earnings report.[23] It is unlikely that if there is more consensus

[23] Lang and Lundholm (1996, p.483) take the similar position by stating that "firm-provided disclosures complement rather than substitute for analyst activities". If Alford and Berger (1997)'s interpretation is adopted, then a positive coefficient on other properties of analysts' forecasts is consistent with analysts' services substituting earnings reports.

among analysts, there will be more analysts following the firm. The other property of analysts' forecasts is included in the number of analysts following regression for the comparability with Alford and Berger (1997). Consistent with hypotheses 5.1 and 5.2, the coefficients on SRE_i and $SRE_i - SPE_i$ are expected to be negative. With respect to other properties of analysts' forecasts, the coefficient on the number of analysts following is expected to be positive since more analysts following implies more information about the firm. Alford and Berger (1997) find that there is a negative association between the forecast error and the number of analysts following, but there is no association between the forecast error and size.

Table 5.9 reports the results of 2SLS regressions for various combinations of endogenous variables.[24] The Hausman test (1978) indicates that the number of analysts following and other properties are simultaneously determined. In the presence of simultaneity, the OLS regressions produce inconsistent estimates. For example, the OLS regression for the standard deviation of analysts' forecasts with the number of analysts following is quite different from the corresponding 2SLS regression. The coefficient on the number of analysts following is positive under the OLS regression while it is negative under the 2SLS (see below).

Panel A reports the 2SLS regressions for the number of analysts following and the standard deviation of analysts' forecasts. The result for the number of analysts following is similar to the OLS result without the standard deviation of analysts' forecasts except that the coefficient on the smoothness of reported earnings is no longer significant. Inconsistent with Alford and Berger (1997), the coefficient on the standard deviation of analysts' forecasts is significantly positive. With respect to the standard deviation regression, the coefficient on the number of analysts following is significantly negative, implying that more analysts' following decreases the standard deviation of analysts' forecasts. However, the coefficient on size is significantly

[24]It can be verified that the number of analysts following equation is exactly identified and the other property of analysts' forecasts equation is over-identified. Therefore, 2SLS method can be used.

positive. Once the number of analysts following is considered, there is less consensus among analysts for larger firms. The significant positive relation between size and the standard deviation of analysts' forecasts is consistent with size capturing the complexity of the firm. Unlike the OLS result, the coefficient on the magnitude of earnings management is insignificant. The other results are very similar to the OLS result without the number of analysts following.

Panel B reports the 2SLS regression results for the number of analysts following and forecast error. The result for the number of analysts following regression is similar to that reported in Panel A. With respect to forecast error regression, the coefficient on the number of analysts following is negative, but insignificant. In addition, the coefficient on size is not significant as well. It is surprising that both the number of analysts following and size are not significant. It is different from Alford and Berger (1997) who report a significant negative association between forecast errors and the number of analysts following.

Panel C of table 5.9 reports the 2SLS regression results for the number of analysts following and revision volatility. The results are similar to those of panel A except that the coefficient on size in the revision volatility regression is not significant. But, unlike the forecast error regression, the coefficient on the number of analysts following is significantly negative.

5.6 Conclusions

This chapter examines the impact of the smoothness of reported earnings and earnings management on the number of analysts following, the dispersion, the forecast error, and the revision volatility. Inconsistent with Lang and Lundholm (1996), the empirical results provide evidence that the number of analysts' following is less for firms with smooth reported earnings than for firms with volatile reported earnings. Note that this study is based on a bigger sample, and the examination period ranges from 1987 to 1995 rather than 1985 to 1989. A further analysis shows that the negative relation between the number of analysts following and the smoothness of reported earnings is less obvious in the post 1990 period and for small firms. On the other hand, consistent with Lang and Lundholm (1996), the smoothness of reported earnings is negatively associated with the dispersion, the forecast error, and the revision volatility. This chapter also provides evidence that growth is positively associated with the number of analysts following. A simultaneous equations approach provides evidence that the standard deviation and revision volatility of analysts' forecasts are negatively associated with the number of analysts following. More importantly, once the number of analysts following is controlled for, it is found that the standard deviation of analysts' forecasts is positively associated with size. It seems that if the number of analysts following is not controlled for, size proxies for the amount of information available to the market whereas once the number of analysts following is controlled for, size proxies for the complexity of the firm's operations. Therefore, the negative relation between the standard deviation of analysts' forecasts and size reported in the OLS regression is due to the omission of the number of analysts following.

This study has some potential for improvement. In particular, the demand function for analysts' services is assumed to be linear to the smoothness of earnings reports, but it may be non linear. Moreover, this chapter considers only a few factors affecting the demand and supply for analysts forecasts. They are far from complete. Other important factors can change the conclusion of this chapter. More sophisticated research will shed light on the issue of the nature of analysts' forecasts. However, this chapter contributes to analysts' forecasts and earnings management literature by providing evidence that analysts have more incentives to collect information for firms with volatile reported earnings than for firms with smooth reported earnings, and that the smoothness of reported earnings has an impact on properties of analysts' forecasts. In addition, the simultaneous equations approach provides a new interpretation for size.

Table 5.1: Distribution of the Sample

YEAR	Frequency	Percent	Cumulative Frequency	Cumulative Percent
87	682	10.6	682	10.6
88	665	10.3	1,347	20.9
89	714	11.1	2,061	32.0
90	724	11.2	2,785	43.2
91	715	11.1	3,500	54.3
92	705	10.9	4,205	65.2
93	724	11.2	4,929	76.5
94	734	11.4	5,663	87.8
95	784	12.2	6,447	100.0

Table 5.2: Descriptive Statistics

Variable	N	Mean	Std. Dev.	Median	Minimum	Maximum
NA	6,447	13.376	8.988	11.091	3.000	48.917
SD	6,447	0.008	0.036	0.004	0.000	2.202
FE	6,438	0.018	0.187	0.006	0.000	14.724
RV	6,308	0.004	0.013	0.002	0.000	0.701
SRE	6,447	-0.062	0.082	-0.040	-2.381	-0.002
IS	6,447	0.072	0.119	0.049	-0.284	2.427
MKVALF	6,443	2,900.1	6,973.8	905.4	9.0	103,341.0
STROE	6,447	0.303	3.698	0.054	0.003	102.737
CORR^{RE}	6,447	0.099	0.357	0.096	-0.979	0.959
GROWTH	6,447	0.004	0.009	0.004	-0.057	0.163
$\lvert ES \rvert$	6,447	0.047	0.165	0.015	0.000	8.999
PNEW	6,447	0.270	0.097	0.267	0.000	1.000

NA: the number of analysts providing an annual earnings forecast.
SD: the standard deviation of analysts forecasts deflated by the beginning stock price.
FE: the absolute value of the analyst forecast error deflated by the beginning stock price.
RV: the standard deviation of changes in median analysts forecast from the previous month deflated by the beginning stock price.
SRE: negative of the standard deviation of the changes in earnings per share divided by the average of the beginning stock prices.
IS: the difference between SRE and SPE, where SPE represents the smoothness of pre-managed earnings.
MKVALF: market value of the firm at the beginning of the period.
STROE: the standard deviation of return on equity over the previous ten years.
CORR^{RE}: the correlation coefficient between annual returns and earnings.
GROWTH: mean of changes in earnings per share.
$\lvert ES \rvert$: absolute change in earnings per share deflated by the beginning stock price.
PNEW: mean of percentage of new forecasts deflated by the total number of analysts forecasts.

Table 5.3: Spearman Correlations

Panel A: Correlations among the Independent and Dependent Variables

Variable	NA	SD	FE	RV
SRE	0.1610	-0.5790	-0.4793	-0.5628
	0.0001	0.0001	0.0001	0.0001
IS	-0.1756	0.1929	0.1494	0.1825
	0.0001	0.0001	0.0001	0.0001
MKVALF	0.7457	-0.3361	-0.3152	-0.4169
	0.0001	0.0001	0.0001	0.0001
STROE	-0.1822	0.3891	0.3127	0.4215
	0.0001	0.0001	0.0001	0.0001
$CORR^{RE}$	-0.1017	0.0931	0.0772	0.0664
	0.0001	0.0001	0.0001	0.0001
GROWTH	0.0988	-0.2376	-0.2288	-0.1979
	0.0001	0.0001	0.0001	0.0001
$\|ES\|$	-0.0401	0.5562	0.4687	0.5201
	0.0013	0.0001	0.0001	0.0001
PNEW	-0.0131	0.3430	0.4334	0.5593
	0.2944	0.0001	0.0001	0.0001
SD	-0.0943			
	0.0001			
FE	-0.1934	0.6493		
	0.0001	0.0001		
RV	-0.2640	0.7925	0.7095	
	0.0001	0.0001	0.0001	

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Table 5.3: continued from previous page

Panel B: Correlations among the Independent Variables

Variable	SRE	IS	MKVALF	STROE	$CORR^{RE}$	GROWTH	$\|ES\|$
IS	-0.1450						
	0.0001						
MKVALF	0.2171	-0.1584					
	0.0001	0.0001					
STROE	-0.6797	0.0675	-0.1871				
	0.0001	0.0001	0.0001				
$CORR^{RE}$	-0.1368	0.0458	-0.1083	0.0741			
	0.0001	0.0002	0.0001	0.0001			
GROWTH	0.3754	0.0113	0.0954	-0.1955	-0.0361		
	0.0001	0.3659	0.0001	0.0001	0.0038		
$\|ES\|$	-0.4989	0.0996	-0.1817	0.3584	0.0758	-0.0961	
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	
PNEW	-0.3314	0.0460	-0.0201	0.2879	-0.0337	-0.0208	0.2708
	0.0001	0.0002	0.1068	0.0001	0.0068	0.0946	0.0001

Numbers listed below each Spearman Correlation is the p value.

NA: the number of analysts providing an annual earnings forecast.
SD: the standard deviation of analysts forecasts deflated by the beginning stock price.
FE: the absolute value of the analyst forecast error deflated by the beginning stock price.
RV: the standard deviation of changes in median analysts forecast from the previous month deflated by the beginning stock price.
SRE: negative of the standard deviation of the changes in earnings per share divided by the average of the beginning stock prices.
IS: the difference between SRE and SPE, where SPE represents the smoothness of pre-managed earnings.
MKVALF: market value of equity at the beginning of the period.
STROE: the standard deviation of return on equity over the previous ten years.
$CORR^{RE}$: the correlation coefficient between annual returns and earnings.
GROWTH: mean of changes in earnings per share.
$|ES|$: absolute change in earnings per share deflated by the beginning stock price.
PNEW: mean of percentage of new forecasts deflated by the total number of analysts forecasts.

Table 5.4: Univariate Tests of the Number of Analysts Following and other Properties

Panel A: Whole Sample (N=6,447)

Variable	Volatile Reported Earnings (N=3,064)		Smooth Reported Earnings (N=3,383)			
	Mean	Median	Mean	Median	T-test	Wilcoxon
NA	12.48	9.90	14.19	12.33	-7.73***	-8.62***
SD	0.0125	0.0064	0.0034	0.0026	9.75***	38.09***
FE	0.0307	0.0093	0.0064	0.0032	4.95***	31.62***
RV	0.0064	0.0029	0.0017	0.0011	13.36***	36.68***
MKVALF	1,862.14	707.40	3,305.57	969.36	-9.51***	-12.51***
Assets	3.055.68	787.46	3,284.19	912.88	-1.23	-1.31

Panel B: Small Firm-Years (N=3,223)

Variable	Volatile Reported Earnings (N=1,656)		Smooth Reported Earnings (N=1,567)			
	Mean	Median	Mean	Median	T-test	Wilcoxon
NA	8.21	6.83	7.80	6.69	2.56**	1.03
SD	0.0169	0.0082	0.0043	0.0032	7.37***	28.14***
FE	0.0433	0.0140	0.0086	0.0045	3.85***	21.26***
RV	0.0088	0.0045	0.0024	0.0016	10.21***	25.39***
MKVALF	295.31	222.65	368.31	334.00	-9.28***	-10.52***
Assets	625.34	326.44	416.31	283.32	8.87***	4.94***

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Table 5.4: continued from previous page

Panel C: Large Firm-Years (N=3,224)

Variable	Volatile Reported Earnings (N=1,408)		Smooth Reported Earnings (N=1,816)		T-test	Wilcoxon
	Mean	Median	Mean	Median		
NA	17.49	18.00	19.72	18.75	-6.82***	-6.01***
SD	0.0074	0.0047	0.0027	0.0021	20.34***	25.77***
FE	0.0158	0.0083	0.0045	0.0023	14.39***	23.35***
RV	0.0036	0.0019	0.0012	0.0008	14.22***	27.36***
MKVALF	3,704.95	1,754.58	5,840.10	2,446.79	-7.68***	-9.75***
Assets	5.914.10	3,010.77	5,758.84	2,446.88	0.445***	1.30***

***(**) significant at the 0.01 (0.05) level (two-tailed test).

A firm is classified as having smooth earnings if the measure of the smoothness of reported earnings is above the median of the sample firms. Otherwise, the firm is classified as having volatile earnings. A firm-year is classified as large if the market value of the firm at the beginning of the fiscal period is equal to or greater than the median of the sample firms.

NA: the number of analysts providing an annual earnings forecast.
SD: the standard deviation of analysts forecasts deflated by the beginning stock price.
FE: the absolute value of the analyst forecast error deflated by the beginning stock price.
RV: the standard deviation of changes in median analysts forecast from the previous month deflated by the beginning stock price.
SRE: negative of the standard deviation of the changes in earnings per share divided by the average of the beginning stock prices.
MKVALF: market value of equity at the beginning of the period.
Assets: total assets at the beginning of the period.

Table 5.5: Regression of the Number of Analysts Following and Other Properties of Analysts Forecasts

Panel A: Regression of the Number of Analysts Following

$$\text{Number of Analysts}_{it} = \beta_0 + \beta_1 SRE_i + \beta_2(SRE_i - SPE_i) + \beta_3 SIZE_{it} + \beta_4 STROE_{it} + \beta_5 CORR_{it}^{RE} + \beta_6 GROWTH_i + \varepsilon_{it}.$$

Variable	Predicted Sign	Estimate	T-value	Estimate	T-value
Intercept	?	-16.6964	-49.434***	-16.7526	-49.668***
SRE_i	−	-1.2628	-4.718***	-0.6744	-2.314**
$SRE_i - SPE_i$	−			-1.8984	-5.050***
$SIZE_{it}$	+	4.5855	93.744***	4.5436	91.743***
$STROE_{it}$	+	0.0193	0.979	0.0210	1.069
$CORR_{it}^{RE}$	−	-0.4917	-2.414***	-0.4720	-2.322**
$GROWTH_i$	?	23.5325	2.697***	26.0659	2.988***
N		6,447		6,447	
Adj. R^2		0.590		0.591	

Panel B: Regression of the Standard Deviation of Analysts Forecasts

$$\text{Standard Deviation}_{it} = \beta_0 + \beta_1 SRE_i + \beta_2 |SRE_i - SPE_i| + \beta_3 SIZE_{it} + \beta_4 STROE_{it} + \beta_5 CORR_{it}^{RE} + \beta_6 GROWTH_i + \beta_7 |ES_{it}| + \beta_8 PNEW_{it} + \varepsilon_{it}.$$

Variable	Predicted Sign	Estimate	T-value	Estimate	T-value
Intercept	?	0.0167	6.973***	0.0187	7.476***
SRE_i	−	-0.0071	-4.248***	-0.0071	-4.241***
$\|SRE_i - SPE_i\|$	?			-0.0086	-2.800***
$SIZE_{it}$	?	-0.0013	-4.661***	-0.0014	-4.885***
$STROE_{it}$	+	-0.12E-4	-0.109	-0.31E-4	-0.273
$CORR_{it}^{RE}$	−	0.0010	0.816	0.0009	0.796
$GROWTH_i$	?	-0.0415	-0.827	-0.0409	-0.816
$\|ES_{it}\|$	+	0.0821	31.936***	0.0818	31.844***
$PNEW_{it}$	+	-0.0011	-0.240	-0.0013	-0.283
N		6,447		6,447	
Adj. R^2		0.165		0.166	

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Table 5.5 continued from previous page

Panel C: Regression of Forecast Error

$$\text{Forecast Error}_{it} = \beta_0 + \beta_1 SRE_i + \beta_2 |SRE_i - SPE_i| + \beta_3 SIZE_{it} + \beta_4 STROE_{it} + \beta_5 CORR_{it}^{RE} + \beta_6 GROWTH_i + \beta_7 |ES_{it}| + \beta_8 PNEW_{it} + \varepsilon_{it}.$$

Variable	Predicted Sign	Estimate	T-value	Estimate	T-value
Intercept	?	0.0500	3.720***	0.0549	3.927***
SRE_i	$-$	-0.0250	-2.680***	-0.0250	-2.675***
$\|SRE_i - SPE_i\|$	?			-0.0219	-1.277
$SIZE_{it}$	?	-0.0035	-2.236**	-0.0037	-2.337***
$STROE_{it}$	+	0.95E-4	0.151	0.48E-4	0.075
$CORR_{it}^{RE}$	$-$	0.0063	0.958	0.0062	0.949
$GROWTH_i$	?	-0.4043	-1.439	-0.4027	-1.433
$\|ES_{it}\|$	+	0.1454	10.098***	0.1448	10.052***
$PNEW_{it}$	+	-0.0054	-0.215	-0.0059	-0.234
N		6,438		6,438	
Adj. R^2		0.023		0.023	

Panel D: Regression of Revision Volatility

$$\text{Revision Volatility}_{it} = \beta_0 + \beta_1 SRE_i + \beta_2 |SRE_i - SPE_i| + \beta_3 SIZE_{it} + \beta_4 STROE_{it} + \beta_5 CORR_{it}^{RE} + \beta_6 GROWTH_i + \beta_7 |ES_{it}| + \beta_8 PNEW_{it} + \varepsilon_{it}.$$

Variable	Predicted Sign	Estimate	T-value	Estimate	T-value
Intercept	?	0.0074	8.073***	0.0081	8.500***
SRE_i	$-$	-0.0035	-5.573***	-0.0035	-5.562***
$\|SRE_i - SPE_i\|$	?			-0.0031	-2.686***
$SIZE_{it}$	?	-0.0010	-9.150***	-0.3317	-9.352***
$STROE_{it}$	+	0.45E-4	1.067	-0.53E-3	0.907
$CORR_{it}^{RE}$	$-$	0.0005	1.219	-0.0005	1.201
$GROWTH_i$	?	-0.0262	-1.393	-0.0262	-1.393
$\|ES_{it}\|$	+	0.0263	27.532***	0.0263	27.446***
$PNEW_{it}$	+	0.0134	7.751***	0.0134	7.573***
N		6,308		6,308	
Adj. R^2		0.169		0.170	

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Table 5.5: continued from previous page

*** significant at the 0.01 level.
** significant at the 0.05 level.

If signs are predicted, one-tailed tests are performed. Otherwise, two-tailed tests are performed. SRE_i and SPE_i are ranked and converted into percentiles by (rank - 1)/(the number of firms - 1).

SRE_i:	smoothness of reported earnings.
SPE_i:	smoothness of pre-managed earnings.
SIZE_{it}:	log (market value of equity at the beginning of the period).
STROE_{it}:	the standard deviation of return on equity over the previous ten years.
CORR_{it}^{RE}:	the correlation coefficient between annual returns and earnings.
GROWTH_i:	mean of change of earnings per share.
$\lvert ES_{it}\rvert$:	absolute value of the change in earnings per share deflated by the beginning stock price.
PNEW_{it}:	mean of percentage of new forecasts deflated by the total number of analysts forecasts.

Table 5.6: Unrestricted Regression of Other Properties of Analysts Forecasts

$$\text{Dep. Var.}_{it} = \beta_0 + \beta_1 SRE_i + \beta_2^+ d_{IS^+}|SRE_i - SPE_i| + \beta_2^- d_{IS^-}|SRE_i - SPE_i| + \beta_3 SIZE_{it} + \beta_4 STROE_{it} + \beta_5 CORR_{it}^{RE} + \beta_6 GROWTH_i + \beta_7|ES_{it}| + \beta_8 PNEW_{it} + \varepsilon_{it},$$

where Dep. Var. $= SD, FE, orRV$. d_{IS^+} takes on 1 if $SRE_i - SPE_i \geq 0$ and otherwise 0 and d_{IS^-} takes on 1 if $SRE_i - SPE_i < 0$ and otherwise 0.

Variable	Predicted Sign	SD	FE	RV
Intercept	?	0.0190	0.0558	0.0082
		(7.611)***	(3.984)***	(8.627)***
SRE_i	–	-0.0087	-0.0291	-0.0041
		(-4.866)***	(-2.887)***	(-6.019)***
$d_{IS^+}\|SRE_i - SPE_i\|$	?	-0.0040	-0.0107	-0.0015
		(-1.119)	(-0.534)	(-1.107)
$d_{IS^-}\|SRE_i - SPE_i\|$	?	-0.0148	-0.0371	-0.0052
		(-3.742)***	(-1.676)	(-3.532)***
$SIZE_{it}$	?	-0.0012	-0.0034	-0.0010
		(-4.432)***	(-2.135)**	(-8.874)***
$STROE_{it}$	+	-0.38E-4	0.32E-4	0.36E-4
		(-0.332)	(0.050)	(0.853)
$CORR_{it}^{RE}$	–	0.0009	0.0061	0.0005
		(0.746)	(0.926)	(1.157)
$GROWTH_i$	?	-0.0480	-0.4201	-0.0288
		(-0.957)	(-1.493)	(-1.528)
$\|ES_{it}\|$	+	0.0818	0.1447	0.0262
		(31.829)***	(10.040)***	(27.431)***
$PNEW_{it}$	+	-0.0013	-0.0061	0.0133
		(-0.296)	(-0.240)	(7.548)***
N		6,447	6,438	6,308
Adj. R^2		0.166	0.023	0.171

The numbers in parentheses are t-statistics.

*** significant at the 0.01 level.
** significant at the 0.05 level.

If signs are predicted, one-tailed tests are performed. Otherwise, two-tailed tests are performed. SRE_i and SPE_i are ranked and converted into percentiles by (rank - 1)/(the number of firms - 1).

Table 5.7: Rank Regression of the Number of Analysts Following and Other Properties of Analysts Forecasts

Panel A: Rank Regression of the Number of Analysts Following

$$\text{Number of Analysts}_{it} = \beta_0 + \beta_1 SRE_i + \beta_2 (SRE_i - SPE_i) + \beta_3 SIZE_{it} + \beta_4 STROE_{it} + \beta_5 CORR_{it}^{RE} + \beta_6 GROWTH_i + \varepsilon_{it}.$$

Variable	Predicted Sign	Estimate	T-value	Estimate	T-value
Intercept	?	0.1603	12.772***	0.1521	12.098***
SRE_i	–	-0.0678	-5.737***	-0.0473	-3.880***
$SRE_i - SPE_i$	–			-0.0797	-6.564***
$SIZE_{it}$	+	0.7585	91.508***	0.7498	89.611***
$STROE_{it}$	+	-0.0582	-5.266***	-0.0621	-5.633***
$CORR_{it}^{RE}$	–	-0.0120	-1.473	-0.0109	-1.344
$GROWTH_i$	?	0.0614	7.060***	0.0664	7.630***
N		6,447		6,447	
Adj. R^2		0.585		0.587	

Panel B: Rank Regression of the Standard Deviation of Analysts Forecasts

$$\text{Standard Deviation}_{it} = \beta_0 + \beta_1 SRE_i + \beta_2 |SRE_i - SPE_i| + \beta_3 SIZE_{it} + \beta_4 STROE_{it} + \beta_5 CORR_{it}^{RE} + \beta_6 GROWTH_i + \beta_7 |ES_{it}| + \beta_8 PNEW_{it} + \varepsilon_{it}.$$

Variable	Predicted Sign	Estimate	T-value	Estimate	T-value
Intercept	?	0.5953	35.945***	0.5989	34.915***
SRE_i	–	-0.3303	-23.001***	-0.3306	-23.014***
$\|SRE_i - SPE_i\|$	?			-0.0152	-0.791
$SIZE_{it}$	?	-0.2051	-22.104***	-0.2058	-22.077***
$STROE_{it}$	+	-0.0533	-4.335***	-0.0540	-4.382***
$CORR_{it}^{RE}$	–	0.0058	0.640	0.0057	0.633
$GROWTH_i$	?	-0.0763	-7.822***	-0.0764	-7.826***
$\|ES_{it}\|$	+	0.3196	30.490***	0.3195	30.477***
$PNEW_{it}$	+	0.1610	16.639***	0.1609	16.630***
N		6,447		6,447	
Adj. R^2		0.489		0.489	

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Table 5.7 continued from previous page

Panel C: Rank Regression of Forecast Error

$$\text{Forecast Error}_{it} = \beta_0 + \beta_1 SRE_i + \beta_2 |SRE_i - SPE_i| + \beta_3 SIZE_{it} + \beta_4 STROE_{it} + \beta_5 CORR^{RE}_{it} + \beta_6 GROWTH_i + \beta_7 |ES_{it}| + \beta_8 PNEW_{it} + \varepsilon_{it}.$$

Variable	Predicted Sign	Estimate	T-value	Estimate	T-value
Intercept	?	0.5204	29.509***	0.5276	28.893***
SRE_i	–	-0.2117	-13.853***	-0.2125	-13.898***
$\lvert SRE_i - SPE_i \rvert$	?			-0.0311	-1.526
$SIZE_{it}$	?	-0.2075	-20.992***	-0.2088	-21.044***
$STROE_{it}$	+	-0.0791	-6.044***	-0.0807	-6.143***
$CORR^{RE}_{it}$	–	0.0159	1.642	0.0157	1.629
$GROWTH_i$	?	-0.1199	-11.537***	-0.1199	-11.546***
$\lvert ES_{it} \rvert$	+	0.2531	22.688***	0.2529	22.668***
$PNEW_{it}$	+	0.3155	30.629***	0.3153	30.616***
N		6,438		6,438	
Adj. R^2		0.421		0.421	

Panel D: Rank Regression of Revision Volatility

$$\text{Revision Volatility}_{it} = \beta_0 + \beta_1 SRE_i + \beta_2 |SRE_i - SPE_i| + \beta_3 SIZE_{it} + \beta_4 STROE_{it} + \beta_5 CORR^{RE}_{it} + \beta_6 GROWTH_i + \beta_7 |ES_{it}| + \beta_8 PNEW_{it} + \varepsilon_{it}.$$

Variable	Predicted Sign	Estimate	T-value	Estimate	T-value
Intercept	?	0.4857	33.106***	0.4923	32.406***
SRE_i	–	-0.2236	-17.603***	-0.2243	-17.652***
$\lvert SRE_i - SPE_i \rvert$	?			-0.0284	-1.673**
$SIZE_{it}$	?	-0.3072	-37.453***	-0.3086	-37.443***
$STROE_{it}$	+	-0.0132	-1.218	-0.0146	-1.345
$CORR^{RE}_{it}$	–	-0.0071	-0.889	-0.0072	-0.903
$GROWTH_i$	?	-0.0673	-7.803***	-0.0675	-7.821***
$\lvert ES_{it} \rvert$	+	0.2289	24.687***	0.2287	24.665***
$PNEW_{it}$	+	0.4237	48.829***	0.4237	48.831***
N		6,308		6,308	
Adj. R^2		0.610		0.610	

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Table 5.7: continued from previous page

*** significant at the 0.01 level.
** significant at the 0.05 level.

If signs are predicted, one-tailed tests are performed. Otherwise, two-tailed tests are performed. All variables are ranked and converted into percentiles by (rank - 1)/(the number of firms - 1).

SRE_i:	smoothness of reported earnings.
SPE_i:	smoothness of pre-managed earnings.
SIZE_{it}:	log (market value of equity at the beginning of the period).
STROE_{it}:	the standard deviation of return on equity over the previous ten years.
CORR_{it}^{RE}:	the correlation coefficient between annual returns and earnings.
GROWTH_i:	mean of change of earnings per share.
$\lvert ES_{it}\rvert$:	absolute value of the change in earnings per share deflated by the beginning stock price.
PNEW_{it}:	mean of percentage of new forecasts deflated by the total number of analysts forecasts.

Table 5.8: Regression of the Number of Analysts Following by Period and Size

$$\text{Number of Analysts}_{it} = \beta_0 + \beta_1 SRE_i + \beta_2(SRE_i - SPE_i) + \beta_3 SIZE_{it} + \beta_4 STROE_{it} + \beta_5 CORR_{it}^{RE} + \beta_6 GROWTH_i + \varepsilon_{it}.$$

Panel A: Period 1987 - 1989 vs. Period 1990 - 1995

Variable	Predicted Sign	1987 - 1989 Estimate	1987 - 1989 T-value	1990 - 1995 Estimate	1990 - 1995 T-value
Intercept	?	-16.4326	-29.335***	-17.8375	-43.273***
SRE_i	−	-1.8095	-3.577***	-0.0890	-0.253
$SRE_i - SPE_i$	−	-2.7768	-4.430***	-1.5130	-3.347***
$SIZE_{it}$	+	4,8910	57.130***	4.5331	76.601***
$STROE_{it}$	+	0.0498	0.924	0.0290	1.407
$CORR_{it}^{RE}$	−	-2.0941	-6.151***	0.0802	0.316
$GROWTH_i$	?	12.1555	0.679	33.1947	3.426***
N		2,061		4,386	
Adj. R^2		0.631		0.600	

Panel B: Small vs. Large

Variable	Predicted Sign	Small Estimate	Small T-value	Large Estimate	Large T-value
Intercept	?	-1.1160	-2.617***	-21.4817	-22.904***
SRE_i	−	0.2416	0.855	-1.9541	-4.195***
$SRE_i - SPE_i$	−	-1.9884	-5.853***	-2.0042	-3.099***
$SIZE_{it}$	+	1.5255	20.669***	5.3683	45.340***
$STROE_{it}$	+	0.0140	0.974	-0.1158	-1.787**
$CORR_{it}^{RE}$	−	-0.6054	-2.996***	-0.6416	-2.028**
$GROWTH_i$	?	5.9078	0.827	-4.0412	-0.224
N		3,223		3,224	
Adj. R^2		0.388		0.449	

***(**) significant at the 0.01 (0.05)level.

If the sign is predicted, one-tailed test is performed. Otherwise, two-tailed test is performed.

Table 5.9: 2SLS Regressions for the Number of Analysts Following and other Properties of Analysts Forecasts

Systems of simultaneous equations are formed between the number of analysts following (NA) and one of the other properties of analysts forecasts (OP) such as the standard deviation, forecast error , and revision volatility of analysts forecasts. As an estimation technique, two stage least squares method (2SLS) is used.

$$\begin{aligned} NA_{it} = \beta_0 + \beta 1 OP_{it} + \beta_2 SRE_i + \beta_3 (SRE_i - SPE_i) + \beta_4 SIZE_{it} \\ + \beta_5 STROE_{it} + \beta_6 CORR_{it}^{RE} + \beta_7 GROWTH_i + \varepsilon_{it} \end{aligned}$$

and

$$\begin{aligned} OP_{it} = \beta_0 + \beta 1 NA_{it} + \beta_2 SRE_i + \beta_3 |SRE_i - SPE_i| + \beta_4 SIZE_{it} + \beta_5 STROE_{it} \\ + \beta_6 CORR_{it}^{RE} + \beta_7 GROWTH_i + \beta_8 |ES_{it}| + \beta_9 PNEW_{it} + \varepsilon_{it}. \end{aligned}$$

Panel A: Number of Analysts Following and Standard Deviation of Analysts Forecasts

	Predicted	No. of Analysts (NA)		Std. Dev. (SD)	
Variable	Sign	Estimate	T-value	Estimate	T-value
NA_{it}	$-$			-0.0026	-2.215**
SD_{it}	$+$	32.6690	5.993***		
Intercept	?	-17.7237	-47.246***	-0.0275	-1.309
SRE_i	$-$	-0.0410	-0.132	-0.0093	-4.378***
$SRE_i - SPE_i$	$-$	-2.0672	-5.467***		
$\|SRE_i - SPE_i\|$	?			-0.0045	-1.169
$SIZE_{it}$	$+$	4.6008	90.945***	0.0107	1.959**
$STROE_{it}$	$+$	0.0184	0.930	0.19E-4	0.148
$CORR_{it}^{RE}$	$-$	-0.4952	-2.428***	-0.0003	-0.216
$GROWTH_i$	?	28.0555	3.204***	0.0206	0.329
$\|ES_{it}\|$	$+$			0.0894	20.021***
$PNEW_{it}$	$+$			-0.0001	-0.023
N		6,447		6,447	
Adj. R^2		0.567		0.136	
Hausman Test ($\chi^2(1)$)			14.483***		6.231**

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Table 5.9 continued from previous page

Panel B: Number of Analysts Following and Forecast Error

Variable	Predicted Sign	No. of Analysts (NA) Estimate	No. of Analysts (NA) T-value	Forecast Error (FE) Estimate	Forecast Error (FE) T-value
NA_{it}	$-$			-0.0064	-1.061
FE_{it}	$+$	17.7981	5.117***		
Intercept	?	-18.0400	-39.296***	-0.0578	-0.539
SRE_i	$-$	0.1851	0.499	-0.0303	-2.810***
$SRE_i - SPE_i$	$-$	-2.1253	-4.933***		
$\lvert SRE_i - SPE_i \rvert$	?			-0.0122	-0.618
$SIZE_{it}$	$+$	4.6195	79.151***	0.0258	0.927
$STROE_{it}$	$+$	0.0164	0.731	0.0002	0.257
$CORR_{it}^{RE}$	$-$	-0.5735	-2.463***	0.0032	0.440
$GROWTH_i$	?	34.0427	3.382***	-0.2521	-0.787
$\lvert ES_{it} \rvert$	$+$			0.1633	7.171***
$PNEW_{it}$	$+$			-0.0034	-0.130
N		6,438		6,438	
Adj. R^2		0.528		0.022	
Hausman Test ($\chi^2(1)$)			23.996***		1.347

Panel C: Number of Analysts Following and Revision Volatility

Variable	Predicted Sign	No. of Analysts (NA) Estimate	No. of Analysts (NA) T-value	Revision Volatility (RV) Estimate	Revision Volatility (RV) T-value
NA_{it}	$-$			-0.0009	-2.075**
RV_{it}	$+$	97.5641	5.897***		
Intercept	?	-18.4177	-42.599***	-0.0079	-1.014
SRE_i	$-$	0.2644	0.792	-0.0042	-5.427***
$SRE_i - SPE_i$	$-$	-2.1140	-5.478***		
$\lvert SRE_i - SPE_i \rvert$	?			-0.0017	-1.195
$SIZE_{it}$	$+$	4.6584	87.223***	0.0032	1.577
$STROE_{it}$	$+$	0.0142	0.715	0.54E-4	1.184
$CORR_{it}^{RE}$	$-$	-0.4951	-2.391***	0.0001	0.190
$GROWTH_i$	?	28.2563	3.175***	-0.0050	-0.215
$\lvert ES_{it} \rvert$	$+$			0.0289	17.565***
$PNEW_{it}$	$+$			0.0138	7.020***
N		6,308		6,308	
Adj. R^2		0.589		0.144	
Hausman Test ($\chi^2(1)$)			16.251***		5.512**

***(**) significant at the 0.01 (0.05)level. If the sign is predicted, one-tailed test is performed. Otherwise, two-tailed test is performed.

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Appendix

Long-Window ERC

The long window unexpected earnings (2.10) and unexpected share return (2.13) can be restated as follows.

$$uox_t = \Lambda^T \varepsilon_t + \rho \check{\upsilon}_{t-1} + \varepsilon_{dt},$$
$$ur_t = (\pi + D)\varepsilon_t - \frac{\rho}{(R-\gamma)R}\check{\upsilon}_t + \frac{\rho}{R-\gamma}\check{\upsilon}_{t-1},$$

where $\Lambda = [\rho, 1, 0, 0, \xi]^T$, $\varepsilon_t = [\varepsilon_{st}, \varepsilon_{rt}, \varepsilon_{it}, \varepsilon_{ot}, \upsilon_t]^T$, and $\check{\upsilon}_t = \upsilon_t - E[\upsilon_t | \varepsilon_{st}, da_t]$. The long window ERC is calculated in the same way the short window ERC is calculated.

$$\begin{aligned} ERC &= \frac{COV(ur_t, uox_t)}{VAR(uox_t)} \\ &= \frac{(\pi + D)\Sigma\Lambda + \frac{\rho(R\rho - \xi)}{R(R-\gamma)}\sigma^2_{\check{\upsilon}}}{\Lambda^T \Sigma \Lambda + \sigma^2_d + \rho^2 \sigma^2_{\check{\upsilon}}}, \end{aligned}$$

where $\sigma^2_{\check{\upsilon}} = \sigma^2_{\upsilon} - \sigma^2_{\hat{\upsilon}}$ and Σ denotes the variance-covariance matrix for ε_t. Compared to the short window ERC (2.17), the long window ERC additionally contains $\sigma^2_{\check{\upsilon}}$ terms. In the short window ERC, these terms do not appear since the information about the transient sales shock is known to investors before the earnings announcement date.