EARNINGS TARGET AND THE COMPETING USE OF ABNORMAL R&D AND ABNORMAL ACCRUALS OF R&D INTENSIVE FIRMS

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ABSTRACT

The purpose of this study is to examine the competing use of real earnings management and accruals management in certain specific circumstances of firms where both real earnings management and accruals management are costly and where firms can either use both or any of the two methods of earnings management to meet earnings targets.

A recent study, Zang (2005), examines the competing use of real earnings management and accruals management. She finds that in a broad sample firms tend to use real earnings management before accruals management. This study overlooks the issue that in such a sample firms that are not R&D intensive would find R&D reductions less costly than accruals management. She also overlooks the point that the tendency to use different methods of earnings management depends on how far the earnings are from the earnings targets.

I conduct an examination of the competing use of real earnings management and accruals management in a sample of R&D intensive firms. I use R&D intensive firms because R&D reduction can be costly for them as costs of future earnings generation capacities. I also consider the distance of a firm from meeting its earnings target using the two methods of earnings management.

My results indicate that when real earnings management and accruals management are both costly, firms tend to use both methods. However, as R&D activities are important for R&D intensive firms, they tend to use abnormal accruals more than abnormal R&D to manage their earnings. Based on such findings, I construe that the nature of the firm's activities and the distance of the earnings from the earnings target influence a firm's use of real earnings management and accruals management to meet its earnings target.

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CHAPTER 1: INTRODUCTION

1.1. Introduction

There are two main types of earnings management. These are real earnings management and accruals management. In the literature, most of the studies focus on either real earnings management or accruals management. R&D reduction is a type of real earnings management when managers face a trade-off between meeting earnings targets and maintaining R&D investment (Bushee, 1998). Prior studies provide some evidence that managers reduce R&D expenditure to meet short-term earnings targets of firms (Dechow & Sloan, 1991; Jacobs, 1991; Bushee, 1998). Prior research also indicates that managers use abnormal accruals to meet short-term earnings goals of firms (McNichols, Wilson & Linda, 1988; Dechow, Sloan & Sweeney, 1995; Kasznik, 1999; McNichols & Wilson, 2000; Dechow, Richardson & Tuna, 2003). There are few papers examining the competing use of accruals management and real earnings management (Peasnell, 1998; Graham, Harvey & Rajgopal, 2005; Zang, 2005).

U.S. Financial Accounting Standard Board (FASB) requires that R&D expenditure be immediately and fully expensed in the year it is incurred. This requirement makes R&D vulnerable to reductions by managers attempting to achieve short-term earnings targets. Critics argue that the accounting standard on R&D accounting creates a managerial myopia problem, a short-term focus that leads managers to sacrifice R&D to maintain short-term earnings growth (Drucker, 1986; Jacobs, 1991; Porter, 1992). Managers who are interested in boosting current period income could choose to cut investment in R&D. Under-investment in R&D expense results in a conflict between shareholders and managers because it reduces the long-term competitiveness of firms at the expense of short-term profitability.

A recent paper on the competing use of real earnings management and accruals management, Zang (2005), tests the trade-off between real earnings management and accruals management, and demonstrates that managers prefer to use abnormal R&D instead of abnormal accruals. One problem of Zang (2005) is that she uses a broad sample which includes all the firms whether they are R&D intensive or not R&D intensive. R&D is more costly compared to abnormal accruals for R&D intensive firms because R&D is important for their survival. So such firms may use abnormal accruals more than abnormal R&D to manage their earnings. This scenario cannot be explained by Zang' (2005) results. Another problem of Zang (2005) is that she does not look at how far a firm is from its earnings target. If firms are not too far away from their earnings targets, they may use some of their R&D to meet their earnings targets as it will not be too costly for them to forego R&D.

With regards to the distance from the earnings target, Bushee (1998) looks at specific circumstances of firms. However, he only examines the use of R&D, i.e., real earnings management, and not accruals management. He assumes that firms only rely on real earnings management, and overlooks the issue of accruals management. Another problem with his study is that although he uses R&D intensive firms, he assumes that they may cut the full extant of R&D to meet short-term earnings targets. R&D intensive firms would most likely not do this because R&D is essential for their long-term competitiveness. However, Bushee does point out two important aspects of the use of earnings management by firms. These are that one should appreciate the nature of the firm in terms of how important or costly the type of earnings management is to the firm and how far is the firm from meeting its earnings target.

It seems that the literature does not sufficiently appreciate the circumstances under which firms manage their earnings. I argue that firms may behave differently under different circumstances while adopting real earnings management and accruals management to manage earnings. So Zang's trade-off issue needs to be combined with Bushee's recognition of the nature of the firms and the specific circumstances of how far is the firm from meeting its earnings target.

In this study, I choose R&D intensive firms and choose R&D expense as the real earnings management tool that the firms may use for real earnings management. Then I focus on firms that are likely to manage earnings using abnormal R&D and abnormal accruals. Within this, I examine the competing use of abnormal accruals and abnormal R&D in four different circumstances.

In circumstance 1, R&D intensive firms have pre-managed earnings below prior year's earnings by an amount that could be reversed either by using income-increasing abnormal R&D or using income-increasing abnormal accruals. In circumstance 2, R&D intensive firms have pre-managed earnings below prior year's earnings by an amount that could be reversed by using income-increasing abnormal R&D, but not by using income-increasing abnormal accruals. In circumstance 3, R&D intensive firms have pre-managed earnings below prior year's earnings by an amount that could be reversed by using income-increasing abnormal accruals, but not by using income-increasing abnormal R&D. In circumstance 4, R&D intensive firms have pre-managed earnings below prior year's earnings by an amount that cannot be reversed either by using income-increasing abnormal accruals or by using income-increasing abnormal R&D.

I select four sub-samples meeting the conditions of each circumstance. An assumption that I make is that reducing abnormal R&D is more costly than increasing abnormal accruals for R&D intensive firms.

My results indicate that in all of the above circumstances R&D intensive firms tend to use both abnormal accruals and abnormal R&D to meet their earnings targets. However, in all circumstances except circumstance 3, they use abnormal accruals in larger amounts than abnormal R&D to manage their earnings targets. In terms of sequentiality or simultaneity, the results for Circumstance 1 show that abnormal accruals substitute abnormal R&D and for Circumstances 2 abnormal accruals and abnormal R&D complement each other. For Circumstance 3, the results suggest the relation between accruals and abnormal R&D is sequential and could substitute each other. These findings support my view that firms that rely extensively on certain forms of real earnings activities are likely not to depend too much on real earnings management that relate to these activities, and are likely to use abnormal accruals instead to meet their earnings targets.

This thesis is structured as follows: Chapter 2 reviews the relevant literature. Chapter 3 describes the research question. Chapter 4 develops the hypotheses. Chapter 5 illustrates research design. Chapter 6 explains the sample and sub-samples selection. Chapter 7 presents the descriptive statistics and empirical results. Conclusion, contributions, limitations and suggestions for future research are laid out in Chapter 8.

CHAPTER 2: LITERATURE REVIEW

This chapter briefly reviews the literature on the mechanism of earnings management used by managers to meet short-term earnings targets and the trade-off between real earnings management and accruals management. In doing so, I set up a theoretical background and framework for developing my hypotheses.

2.1. Earnings management

2.1.1. Definition

One of the first definitions of earnings management was given by Schipper (1989, p.92), who defined it as "... purposeful intervention in the external financial reporting process, with the intention of obtaining some private gain". A popular and more extensive definition has been given by Healy and Wahlen (1999, p.368) which is: "Earnings management occurs when managers use judgment in financial reporting and in structuring transactions to alter financial reports to either mislead some stakeholders about the underlying economic performance of the company or to influence contractual outcomes that depend on reported accounting numbers."

2.1.2. Managers' incentives to meet earnings target

Managers allegedly overemphasize short-term effects in their decision-making process. Several recent papers document managers' incentives to meet simple earnings goals, including: (1) avoiding losses (Bushee, 1998; Dechow & Skinner, 2000); (2) reporting increases in seasonally adjusted quarterly earnings (Dechow & Skinner, 2000); (3) meeting analysts' expectations for quarterly earnings (Dechow & Skinner, 2000); (4) influencing expectations of specific types of investors (Bushee, 1998); (5) compensation contracts written in terms of accounting numbers (Healy, 1985; DeAngelo, DeAngelo & Skinner, 1994; Gaver, Gaver & Austin, 1995; Holthausen, Larcker & Sloan, 1995; Guidry, Leone & Rock, 1999; Matsunaga & Park, 2001); (6) short-term need to raise capital (Bhojraj & Libby, 2005); (7) short managerial horizon

(Dechow & Sloan, 1991); (8) job tenure concerns (Fudenberg & Tirole, 1995) and (9) stock market rewards firms (Bartov , Givoly & Hayn, 2002; Skinner & Sloan, 2002).

2.1.3. Types of earnings management

Earnings management can be classified into two categories: accruals management and real earnings management. Accruals management involves within-Generally Accepted Accounting Principles (GAAP) choices that try to "obscure" or "mask" true economic performance (McNichols et al., 1988; Dechow & Skinner, 2000). Real earnings management is defined as management actions that deviate from normal business practices, undertaken with the primary objective of meeting certain earnings target (Roychowdhury, 2006).

2.2. Accruals management

Accruals management, broadly defined, refers to managers' ability to use accrual accounting to temporarily manipulate reported earnings. Based on current accounting standards, managers have many ways to exercise judgment in financial reporting. For example, managers have the flexibility to choose among different accounting methods to report certain transactions, such as to use the straight-line or accelerated depreciation methods; delaying the reorganization of expenses; accelerating the recognition of revenues; and under-provisioning for bad debt expenses and delaying asset write-offs. The most direct way to detect and measure earnings management is to use an accruals-based model. A number of studies use models of "abnormal accruals" to investigate the manipulation of accruals to achieve earnings management goals (Healy & Wahlen, 1999). These studies focus on the opportunistic use of accruals to window-dress and mislead users of financial statements.

While corporate profits depend upon business conditions and firm performance, some latitude is given to managers in reporting earnings to shareholders. This latitude is allowed under GAAP. A major way of "managing" earnings towards some desired level of profit is the use of abnormal accruals, which allows revenues, expenses, gains, and losses to be shifted from one year to another. These abnormal accruals usually 'reverse' in a future period and so the impact of earnings management is often transient. For managers, however, the timing of earnings may be extremely important and so they make use of abnormal accruals in reporting profits and other accounting numbers. Prior studies indicate that managers could manage accruals to meet short-term earnings targets.

One strand of research focuses on accruals that are managed to meet firms' earnings targets. Peasnell, Pope and Young (2000) find evidence of accruals management in Pre-Cadbury and Post-Cadbury periods. Beneish (2001) claims that if earnings are managed, it is most likely to occur in the accruals component of earnings. Accruals are not by themselves *prima facie* evidence of earnings management. GAAP requires firms, even those who seek to present transparent and informative financial statements, to record certain assets and liabilities in such a way that they generate accruals. Additionally, cyclical variation in a firm's industry or changes in its lines of business alter the firm's working-capital needs and generate positive accruals that are not due to earnings management. Chung, Firth and Kim (2002) provide evidence that when managers have incentives to increase (decrease) reported profits; they attempt to accomplish this by using of income-increasing (income-decreasing) abnormal accruals. Bauwhede, Willekens and Gaeremynck (2003) study publicly available financial statements of a matched sample of publicly and privately held Belgian firms. They use abnormal accruals as a measure of earnings management. They find that both private and public Belgian companies engage in income smoothing and manage earnings opportunistically to meet the benchmark of prior-year earnings. Koh (2007) indicates that managers use abnormal accruals to meet firms' short-term earnings targets.

Another strand of research compares abnormal accruals for firms that just beat or just miss earnings benchmarks (McNichols et al., 1988; Dechow et al., 1995; McNichols and Wilson, 2000; Dechow et al., 2003), among others, demonstrate that abnormal accruals increase with earnings.

2.3. Real earnings management

Most of the current studies on earnings management focus on detecting abnormal accruals. However, managers could also manage earnings through real activities, which is real earnings management. Real earnings management occurs when managers undertake actions that deviate from the first best practice to increase reported earnings, such as stock repurchases (Hribar, Jenkins & Johnson, 2006); derivative hedging (Barton, 2001; Pincus & Rajgopal, 2002); debt-equity swaps (Hand, 1989); cutting investments can boost reported earnings (Penman & Zhang, 2002); accelerating the timing of sales or generating additional unsustainable sales through increased price discounts or more lenient credit terms (Bartov, 1993; Black, Sellers & Manly, 1998; Gunny, 2005; Roychowdhury, 2006); decreasing discretionary expenses which include reduce R&D, advertising expenditures or Selling, General and Administrative (SG&A) expenditure to meet benchmarks (Dechow & Sloan, 1991; Bange & DeBondt, 1998; Bushee, 1998; Graham et al., 2005; Gunny, 2005; Roychowdhury, 2006); reporting lower cost of goods sold by increasing production (Thomas & Zhang, 2002; Gunny, 2005) and changing the timing of income recognition from the disposal of long-lived assets and investments to manage earnings (Gunny, 2005). Real activities manipulations can reduce firm value because actions taken in the current period to increase earnings can have a negative effect on cash flows in future periods (Roychowdhury, 2006).

2.3.1. R&D as a tool of real earnings management

Literature highlights the importance of R&D. Reduction in R&D will affect the firm's long-term value and performance and reduce the long-term competitiveness (Jacobs, 1991; Porter, 1992; Sougiannis, 1994; Laverty, 1996; Burgstahler & Dichev, 1997). R&D expenditures are not only related to the contemporary stock price and stock returns, but also significantly associated with future stock returns (Lev & Sougiannis, 1999).

The GAAP requirement of expensing R&D expenditures and the short-term focus of U.S. capital markets have been cited as the major reasons for the problem of potential underinvestment in R&D (Bushee,1998). Under the GAAP, Statement of Financial Accounting Standard (SFAS) No.2 requires firms to expense all R&D expenditure as it is incurred. The only exception to the immediate expensing rule is SFAS No.86, which requires software development costs to be capitalized when a product successfully passes a technological feasibility test. The full expensing requirement of current R&D in the U.S., eliminates the need to assess the uncertain future benefits associated with R&D expenditure. This expensing rule may be inadequate for financial statement analysis because it may seriously affect profitability. Lev and Sougiannis (1999) argues that the absence of R&D capital from financial reports denies investors the ability to assess a firm's return on innovative activities.

Some prior studies in the U.S. focus on R&D reduction, because U.S. GAAP requirement provides a unique environment in which managers have to discretionarily cut R&D if they want to meet earnings targets. Baber, Fairfield & Haggard (1991) and Dechow and Sloan (1991) indicate that managers are likely to cut R&D expenditures to meet short-term earnings targets especially when managers are close to retirement or try to avoid losses. Jacobs (1991) states that managers engage in R&D reduction to meet firms' short-term earnings targets. Perry and Grinaker (1994) find that managers manage R&D expenditures to meet earnings expectation. Bushee (1998) points out that firms cut R&D to meet their short-term earnings targets. Graham et al. (2005) provides evidence that managers take real economic actions to maintain accounting appearance. In particular, 80% of survey participations report that they would decrease discretionary spending on R&D, advertising and maintenance to meet their earnings targets. Roychowdhury (2006) indicates that managers manage R&D expense to meet their earnings targets.

2.4. Earnings management and institutional ownership

Literature indicates that both accruals and R&D could be managed to meet firms' short-term earnings targets. There are some studies indicate that institutional investors could monitor earnings management.

2.4.1. Accruals and institutional ownership

Chung et al. (2002) provide evidence that when managers have incentives to increase (decrease) reported profits; they attempt to accomplish this by the use of income-increasing (income-decreasing) abnormal accruals. They also find that large institutional shareholdings inhibit managers from using accruals management. Koh (2007) points out that long-term institutional ownership is associated with fewer abnormal accruals in firms that manage accruals to meet/beat earnings targets. In other words, long-term institutional investors monitor managers not engage in accruals management.

2.4.2. R&D and institutional ownership

Bushee (1998) finds that high turnover and momentum trading by institutional investors encourages managers to reduce investment in R&D to meet short-term earnings targets. However, a larger proportion of sophisticated investors monitor managers not engage in R&D earnings management.

2.5. Costs and benefits of accruals management and real earnings management

Prior studies indicate that both accruals management and real earnings management have costs and benefits (Roychowdhury, 2003). One benefits of accruals management is that managers can undertake pure accruals manipulation at the end of the year, when they have knowledge of pre-managed earnings. Although the accruals do affect cash flow immediately but that they must reverse sometime in the future (Roychowdhury, 2003). In other words, boosting earnings in one period must reduce subsequent earnings.

One benefit of using real earnings management is that it is less likely to face auditors' or regulators' scrutiny. Another benefit of using real earnings management is that managers could manage real activities to meet earnings targets easily and cover any residual shortfall with pure accruals management. The primary cost of using real operating decisions to manage earnings is that it has cash flow consequences. Therefore, R&D reduction is costly for R&D intensive firms because R&D is important for firms' their value.

Even though accruals management may be less costly, with respect to firm value, there are several reasons managers may still engage in real earnings management. First, aggressive accounting choices with respect to accruals are at higher risk for Securities and Exchange Commission (SEC) scrutiny and class action litigation. Second, the firms may have limited accounting flexibility (i.e. limited ability to report abnormal accruals). For example, accruals management is limited by the business operations and by accruals manipulation in prior year (Barton & Simko, 2002). Third, operating decisions are controlled by managers, whereas accounting treatments must meet the requirements of auditors (Graham et al., 2005). A summary of costs and benefits to manage real activities versus rely solely on accrual is cited in Table 1.

INSERT Table 1 HERE

In summary, both accruals and real activities could be managed to meet short-term earnings targets and both accruals management and real earnings management are costly. R&D is not essential for firms that are not R&D intensive; they may easily give up their R&D expenditures. The costs of R&D reduction are less costly compared to abnormal accruals for firms that are not R&D intensive, since abnormal accruals must be reverse in the future. In this situation, managers determine to use abnormal R&D to substitute abnormal accruals. However, R&D expenditure affects a firm's long-term competitiveness (Jacobs, 1991; Porter, 1992; Sougiannis, 1994; Laverty, 1996; Burgstahler & Dichev, 1997), thus the costs of cutting R&D are high for R&D intensive firms. Abnormal accruals do not affect cash flow directly; therefore, abnormal accruals are less costly compared to R&D reduction in R&D intensive firms. In order to meet short-term earnings targets, R&D intensive firms cannot easily cut R&D expenditures and are likely to use abnormal accruals. Therefore, in different circumstances, firms may use abnormal accruals or abnormal accruals to meet earnings targets.

2.6. Trade-off between accruals management and real earnings management

Based on previous studies, both abnormal R&D and abnormal accruals could be used by managers to meet firms' short-term earnings targets. However, empirical earnings management research predominantly focuses on either accruals management or real earnings management (such as R&D, advertising and other types of real activities). There are few studies that examine the association between real earnings management and accruals management. However, when managers face trade-off between real earnings management and accruals management to meet short-term earnings targets, the results of empirical studies are not conclusive.

Peasnell (1998) conjectures that since the costs of reversals are likely to be less than the costs of resorting to sub-optimal operating decisions to boost reported performance, managers will generally prefer to use pure accruals management to manage earnings. This is particularly likely to apply in those situations where the goal is to temporarily boost reported profit.

In spite of the costs associated with real earnings management, managers are not likely to rely solely on abnormal accruals to manage earnings. Even though real earnings management potentially imposes greater long-term costs on the company, there are reasons to believe that managers expect to bear greater private costs, at least in the short-term, when they engage in managing accruals. In the surveys conducted by Bruns and Merchant (1990) and Graham et al. (2005), indicate a greater willingness by financial executives to manage earnings through real activities rather than accruals. There are at least two possible reasons for this. First, accruals management is more likely to draw auditor or regulatory scrutiny than real decisions about pricing and production. Second, relying on accruals management alone entails a risk of not meeting earnings threshold. The realized year-end shortfall between unmanaged earnings and the desired threshold can exceed the amount by which it is possible to manage accruals. If that happens, and reported income falls below the threshold, real activities cannot be managed at end of year.

Zang (2005) indicates that there is a trade-off between real earnings management and accruals management. Her broad sample test rejects the simultaneity of real earnings management and accruals management, in favour of a sequential decision process, whereby managers determine real earnings management before accruals management. Her conclusion is consistent with Bruns and Merchant (1990) and Graham et al. (2005), that financial executives have greater willingness to manipulate earnings through real activities rather than accruals.

Chapter 3: RESEARCH QUESTION

Zang (2005) tests the trade-off between real earnings management and accruals management, and demonstrates that the managers use abnormal R&D to substitute abnormal accruals. One problem of Zang (2005) is that she uses a broad sample which includes all the firms irrespective of whether they are R&D intensive or not R&D intensive. R&D is less costly compared to abnormal accruals for firms that are not R&D intensive; so firms may cut R&D expenditure to substitute accruals management. Zang's (2005) results support this scenario. However, R&D is more costly compared to abnormal accruals for R&D intensive firms, so firms may use abnormal accruals to substitute abnormal R&D. This scenario cannot be explained by Zang's (2005) research design as she does not separately study the case of R&D firms. So her study needs to be further extended by focusing on R&D intensive firms to see if the behaviours of firms change when R&D reduction is costly for them.

Another problem of Zang (2005) is that she does not take into account how far firms' earnings are from their targets. If firms are not too far away from their earnings targets, they may use some of their R&D to meet their earnings targets as it will not be too costly for them to forego R&D. This will especially be less costly than accruals if they are not R&D intensive firms. Also, if they are too far away from their earnings targets, cutting R&D and other forms of real earnings management may be less costly as the scrutiny of the market and regulators may make it difficult to increase accruals extensively.

The above observations necessitates the need for examining the setting where the R&D and accruals interplay takes place much more carefully before attempting to explain whether R&D (real earnings management) or abnormal accruals take place first or in larger amounts. In this regard, I examine four different circumstances under which R&D earnings management may take place. I also focus on firms that have to rely on

R&D to survive. These firms would find R&D earnings management costly just as they would find accruals management costly.

Bushee (1998) looks at specific circumstances, but only at real earnings management, more specifically R&D. He identifies three types of samples: "Small earnings Decrease" (SD) sample, "Increase" (IN) sample and "Large earnings Decrease" (LD) sample. Bushee mainly focuses on R&D intensive firms in the SD sample. This circumstance includes R&D intensive firms with pre-tax and pre-R&D earnings below prior year's earnings by an amount that could be reversed by cutting R&D. He also looks at R&D intensive firms in the other two samples, IN sample and LD sample. IN sample includes R&D intensive firms with pre-tax and pre-R&D earnings that exceed prior year's earnings. LD sample includes R&D intensive firms with pre-tax and pre-R&D earnings below prior year's earnings by an amount that cannot be reversed by cutting R&D. IN and LD samples are selected for assessing the results of the SD sample. Although he looks at specific circumstances, there are two problems with his study. One problem is that he uses R&D intensive firms and assumes that they may cut the full extant of R&D to meet short-term earnings targets. R&D intensive firms would most likely not do this because R&D is essential for their long-term competitiveness. It is likely that they will cut only the part of R&D which is over and above normal R&D, the abnormal R&D. In this regard, Zang (2005) takes the appropriate steps of comparing abnormal R&D with abnormal accruals. Also as mentioned by Fields, Lys and Vincent (2001), examining only one earnings management technique at a time as Bushee (1998) does, cannot explain the overall effect of earnings management. Bushee assumes that firms only rely on real earnings management; however, he ignores that firms also could use accruals to manage earnings.

In summary, the literature does not sufficiently appreciate the circumstances under which firms manage their earnings. My above assessments suggest that firms behave differently under different circumstances while trading off real earnings management against accruals management. So Zang's trade-off issue needs to be combined with

Bushee's recognition of the nature of the firms and the specific circumstances of the firms' earnings targets. Thus, I raise the following question:

> How do firms use the two competing forms of earnings management, real earnings management and accruals management, under different circumstances?

While considering the trade-off between real earnings management and accruals management. One needs to identify the importance of real activities to the firms that they may attempt to curtail to manage earnings, the distance of earnings from their earnings targets and which of the two methods they can use to meet their earnings targets.

Based on my earlier discussion, I use firms for which real earnings management can have significant adverse effects. So I choose R&D intensive firms and choose R&D expense as the real earnings management tool that the firms may use to manage earnings. Furthermore, firms that are R&D intensive are likely to use income-increasing abnormal R&D against income-increasing abnormal accruals (as espoused by Zang) rather than their total R&D (as espoused by Bushee). Then I focus on firms that are likely to manage earnings using income-increasing abnormal R&D and/or income-increasing abnormal accruals.

Within this, there can be three groups of firms that can (1) manage earnings by using either income-increasing abnormal R&D or income-increasing abnormal accruals; (2) manage earnings by using income-increasing abnormal R&D but not income-increasing abnormal accruals; (3) manage earnings by using income-increasing abnormal accruals but not income-increasing abnormal R&D. (4) For comparison purposes, I add a fourth group of firms that includes firms that cannot manage earnings using either income-increasing abnormal R&D or income-increasing abnormal accruals. I summarize the structure of this study in Figure 1.

INSERT Figure 1 HERE

CHAPTER 4: HYPOTHESES DEVELOPMENT

I draw the following hypotheses for the four circumstances discussed earlier.

Circumstance 1

The literature suggests that both real earnings management and accruals management are costly. However, for R&D intensive firms, R&D is essential for their long-term returns. Therefore, they may find real earnings management using income-increasing abnormal R&D detrimental for their long-term well-being. So in a circumstance where they can meet their earnings targets either by using income-increasing abnormal R&D or income-increasing abnormal accruals, they are likely to use income-increasing abnormal accruals. Accordingly, I hypothesize that

H1a: The number of firms that increase income-increasing abnormal accruals is greater than the number of firms that increase income-increasing abnormal R&D.

H1b: The mean of change in abnormal accruals is greater than the mean of change in abnormal R&D.

In circumstance 1, because the cost of abnormal accruals is lower than the cost of abnormal R&D for R&D intensive firms, managers would attempt to use abnormal accruals as a mean of meeting earnings targets instead of using abnormal R&D. I expect firms use change in abnormal accruals to substitute change in abnormal R&D. Therefore, I hypothesize that:

H1c: There is sequentiality in the association between change in abnormal accruals and change in abnormal R&D with change in abnormal accruals substituting the change in abnormal R&D.

Circumstance 2

In a circumstance where R&D intensive firms can use income-increasing abnormal R&D to meet their earnings targets but not income-increasing abnormal accruals, they are likely to use both methods. R&D intensive firms in such circumstance can use their entire income-increasing abnormal R&D to meet their earnings targets. However, as R&D is important for them, they may use income-increasing abnormal accruals complement income-increasing abnormal R&D to meet their earnings targets. Therefore, I hypothesize that

H2a: The number of firms that increase both income-increasing abnormal accruals and income-increasing abnormal R&D is greater than the number of firms that either increase income-increasing abnormal accruals or increase income-increasing abnormal R&D.

H2b: The mean of change in abnormal accruals is not different from the mean of change in abnormal R&D.

In circumstance 2, firms do not have enough income-increasing abnormal accruals to meet their earnings targets, however, the cost of abnormal accruals is lower than the cost of abnormal R&D. So I expect that change in abnormal accruals and change in abnormal R&D to occur together. Therefore, I hypothesize that:

H2c: There is simultaneity in the association between change in abnormal accruals and change in abnormal R&D with change in abnormal accruals complementing the change in abnormal R&D.

Circumstance 3

In a circumstance where R&D intensive firms can use income-increasing abnormal accruals to meet their earnings targets but not income-increasing abnormal R&D, R&D intensive firms are likely to use income-increasing abnormal accruals as they have enough income-increasing abnormal accruals. It is likely to be the least costly option to manage the earnings. Therefore, I hypothesize that

H3a: The number of firms that increase income-increasing abnormal accruals is greater than the number of firms that increase income-increasing abnormal R&D.

H3b: The mean of change in abnormal accruals is greater than the mean of change in abnormal R&D.

In circumstance 3, because firms do not have enough income-increasing abnormal R&D to meet their earnings targets and the cost of abnormal accruals is lower than the cost of abnormal R&D, I expect firms use change in abnormal accruals instead of changing in abnormal R&D. Therefore, I hypothesize that:

H3c: There is sequentiality in the association between change in abnormal accruals and change in abnormal R&D with change in abnormal accruals substituting change in abnormal R&D.

Circumstance 4

In a circumstance where R&D intensive firms cannot use either income-increasing abnormal accruals or income-increasing abnormal R&D to meet their earnings targets, R&D intensive firms are likely to use income-increasing abnormal accruals as they are less costly compared to income-increasing abnormal R&D. Therefore, I hypothesize that

H4a: The number of firms that increase income-increasing abnormal accruals is greater than the number of firms that increase income-increasing abnormal R&D.

H4b: The mean of change in abnormal accruals is greater than the mean of change in abnormal R&D.

In circumstance 4, firms do not have enough income-increasing abnormal R&D or enough income-increasing abnormal accruals to meet their earnings targets. Also, the cost of abnormal accruals is lower than the cost of abnormal R&D for them. I expect firms use change in abnormal accruals to substitute change in abnormal R&D. Therefore, I hypothesize that:

H4c: There is sequentiality in the association between change in abnormal accruals and change in abnormal R&D with change in abnormal accruals substituting change in abnormal R&D.

In order to give a clear picture of my hypotheses, I summarize these hypotheses in Table 2.

INSERT Table 2 HERE

CHAPTER 5: RESEARCH DESIGN

In this chapter, I will describe the research design to examine these hypotheses developed in Chapter 4. The research designs are laid out in the following manner. I first describe how I will test H1a, H2a, H3a and H4a hypotheses. This is followed by the description of the tests for H1b, H2b, H3b and H4b hypotheses. Finally, I describe the tests for hypotheses H1c, H2c, H3c and H4c.

5.1. Tests for H1a, H2a, H3a and H4a

I run cross-tabs and Chi-square test for each sub-sample for testing hypotheses H1a, H2a, H3a and H4a. For each sub-sample, I use cross-tabs to assign firms into categories A, B, C and D as shown in Figure 2.

INSERT Figure 2 HERE

5.1.1. Cross-tabs and Chi-square test for H1a

The expectation of H1a is that the number of firms that increase income-increasing abnormal accruals is greater than the number of firms that increase income-increasing abnormal R&D. Therefore, I expect that the number of firms in Categories B to be greater than the number of firms in Categories C.

5.1.2. Cross-tabs and Chi-square test for H2a

The expectation of H2a is that the number of firms that increase both income-increasing abnormal accruals and income-increasing abnormal R&D is greater than the number of firms that either increase income-increasing abnormal accruals or increase income-increasing abnormal R&D. Therefore, I expect that the number of firms in Categories D is bigger that the number of firms in Categories C, and the number of firms in Categories D is greater than the number of firms in Categories B.

5.1.3. Cross-tabs and Chi-square test for H3a

The expectation of H3a is that the number of firms that increase income-increasing abnormal accruals is greater than the number of firms that increase income-increasing abnormal R&D. Therefore, I expect that the number of firms in Categories B is greater than the number of firms in Categories C.

5.1.4. Cross-tabs and Chi-square test for H4a

The expectation of H4a is that the number of firms that increase income-increasing abnormal accruals is greater than the number of firms that increase income-increasing abnormal R&D. Therefore, I expect that the number of firms in Categories B is greater than the number of firms in Categories C.

In all of the above cross-tabs, Chi-square tests are conducted to establish whether the four categories have significantly different frequencies.

5.2. Tests for H1b, H2b, H3b and H4b

I run T-test for testing whether the mean of change in abnormal accruals (ΔAA_{it}) and the mean of change in abnormal R&D (ΔARD_{it}) are significantly different in each of the four sub-samples. T-test will indicate whether the mean of ΔAA_{it} is significantly different from the mean of ΔARD_{it} in each of the four sub-samples.

5.3. Tests for the H1c, H2c, H3c and H4c

I use Hausman tests for hypotheses H1c, H2c, H3c and H4c. Hausman test is useful for identifying the association between ΔAA_{it} and ΔARD_{it}, and assess the sequentiality or simultaneity between these variables and to assess which of these variables is substitutes the other. I conduct Hausman tests by using Zang's (2005) methodology. Hausman test is a two-stage least squares test.

The following models are estimated for each of the four sub-samples.

Stage 1:

$$\Delta AA_{it} = \alpha_0 + \beta_1 \sum_{N=1}^{11} \text{Control variables}_{it} + \varepsilon_{it} \quad (1)$$

$$\Delta ARD_{it} = \alpha_0 + \beta_1 \sum_{N=1}^{11} \text{Control variables}_{it} + \varepsilon_{it} \quad (2)$$

Stage 2 :

$$\Delta ARD_{it} = \alpha_0 + \beta_1 \Delta AA_{it} + \beta_2 P\_\Delta AA_{it} + \varepsilon_{it} \quad (3)$$

$$\Delta AA_{it} = \alpha_0 + \beta_1 \Delta ARD_{it} + \beta_2 P\_\Delta ARD_{it} + \varepsilon_{it} \quad (4)$$

Where,

ΔARD_{it}	=	Change in abnormal R&D of firm i in year t;
ΔAA_{it}	=	Change in abnormal accruals of firm i in year t;
$P\_\Delta AA_{it}$	=	Predicted value of ΔAA_{it} from Model 1 of firm i in year t;
$P\_\Delta ARD_{it}$	=	Predicted value of ΔARD_{it} from Model 2 of firm i in year t;
Control $variable_{it}$	=	$PCRD_{it}$, $CIRD_{it}$, $CGDP_{it}$, $TOBQ_{it}$, $CCAP_{it}$, $CSALES_{it}$, $SIZE_{it}$, $DIST\_ARD_{it}$, $DIST\_AA_{it}$, LEV_{it} and FCF_{it}.

All variables are defined in Table 5.

INSERT Table 5 HERE

The first stage of the Hausman test is conducted by regressing ΔAA_{it} and ΔARD_{it} on the control variables (see Model 1 and Model 2). The predicted values of the two regressions are derived from these regressions ($P\_\Delta AA_{it}$ is derived from the ΔAA_{it} regression and $P\_\Delta ARD_{it}$ is derived from from the ΔARD_{it} regression).

The predicted values are then used in the stage two regressions (see Model 3 and Model 4). The coefficients of ΔAA_{it} and ΔARD_{it}, and $P\_\Delta AA_{it}$ and $P\_\Delta ARD_{it}$ are used to interpret whether there is sequentiality or simultaneity between ΔAA_{it} and ΔARD_{it}.

The various scenarios of these coefficients are noted in Table 3, and the interpretation with respect to sequentiality and simultaneity, and which variable precedes the other are identified in the last column of that table. For example, in Scenario 1, the ΔAA_{it} has a negative significant coefficient and P_ΔAA_{it} coefficient is not significant in the ΔARD_{it} model (Model 3). Also, the ΔARD_{it} is either negative and significant or not significant and P_ΔARD_{it} is significant in the ΔAA_{it} model (Model 4). The interpretation is that as ΔAA_{it} increase ΔARD_{it} is reduced and P_ΔAA_{it} is not driving ΔARD_{it} in the ΔARD_{it} model (Model 3) while in the ΔAA_{it} model (Model 4) ΔAA_{it} is driven by either ΔARD_{it} or P_ΔARD_{it}. So while ΔAA_{it} substitute ΔARD_{it} but the reverse is not clear. The relation between ΔAA_{it} and ΔARD_{it} is regarded as sequential and ΔAA_{it} is seen to substitute ΔARD_{it}. The underlying premise of these interpretations that are listed in Table 3 and derived from Zang (2005).

INSERT Table 3 HERE

5.3.1. Hausman test for H1c

The expectation of H1c is that there is sequentiality in the association between ΔARD_{it} and ΔAA_{it}, and ΔAA_{it} substitutes ΔARD_{it}. When I use Hausman test to test H1c, I expect scenario 1 in Table 3 to occur, i.e., I expect sequentiality between ΔAA_{it} and ΔAA_{it}, and that ΔAA_{it} will substitute ΔARD_{it}.

5.3.2. Hausman test for H2c

The expectation of H2c is that there is simultaneity in the association between ΔARD_{it} and ΔAA_{it}, and ΔAA_{it} is complemented by ΔARD_{it}. When I use Hausman test to test H2c, I expect that scenario 6 in Table 3 to occur, i.e., I expect simultaneity between ΔAA_{it} and ΔARD_{it}, and that ΔAA_{it} will occur together with ΔARD_{it}.

5.3.3. Hausman test for H3c

The expectation of H3c is that there is sequentiality in the association between ΔARD_{it} and ΔAA_{it}, and ΔAA_{it} substitutes ΔARD_{it}. When I use Hausman test to test H3c, I expect scenario 1 in Table 3 to occur, i.e., I expect sequentiality between ΔAA_{it} and ΔAA_{it}, and that ΔAA_{it} will substitute ΔARD_{it}.

5.3.4. Hausman test for H4c

The expectation of H4c is that there is sequentiality in the association between ΔARD_{it} and ΔAA_{it}, and ΔAA_{it} substitutes ΔARD_{it}. When I use Hausman test to test H4c, I expect scenario 1 in Table 3 to happen, i.e., I expect sequentiality between ΔAA_{it} and ΔAA_{it}, and that ΔAA_{it} will substitute ΔARD_{it}.

5.4. Measurement of short-term earnings target

The extant literature suggests several possible earnings targets, such as previous years' earnings or seasonally lagged quarterly earnings, loss avoidance or analysts' consensus forecasts (Burgstahler & Dichev, 1997; Degeorge, Patel & Zeckhauser, 1999; Graham et al., 2005). Bushee (1998) argues that the appropriate measure of earnings target is last year's earnings per share. Graham et al. (2005) suggest that for large firms the consensus earnings number is approximately as important as the four quarters lagged number.

I use last year's pre-managed earnings as the *short-term earnings target* as it fulfils the condition that firms try to meet a simple benchmark (Burgstahler & Dichev, 1997; Bushee, 1998; Payne & Robb, 2000). Following these prior studies, I define short-term earnings target as pre-managed earnings in the prior year. If firms with pre-managed earnings have declined relative to the prior year, these firms miss their short-term earnings targets. In this study, I only focus on firms which miss their current earnings targets.

Following prior studies (Peasnell et al., 2000; Koh, 2007); I define *pre-managed earnings before abnormal accruals* as this year's reported earnings minus abnormal accruals. Also, by following prior studies (Baber et al., 1991; Bushee, 1998), I define *pre-managed earnings before abnormal R&D* as this year's reported earnings minus abnormal R&D.

The computations are done as follows:

Pre-managed earnings$_{it-1}$ before abnormal accruals
$EBTAA_{it-1}$ = Pretax income$_{it-1}$ - AA_{it-1}

Pre-managed earnings$_{it-1}$ before abnormal R&D
$EBTARD_{it-1}$ = Pretax income$_{it-1}$ - ARD_{it-1}

Where,

$EBTAA_{it-1}$	=	Pre-managed earnings before abnormal accruals of firm i in year *t-1*;
$EBTARD_{it-1}$	=	Pre-managed earnings before abnormal R&D of firm i in year *t-1*;
AA_{it-1}	=	Abnormal accruals of firm i in year *t-1*;
ARD_{it-1}	=	Abnormal R&D of firm i in year *t-1*.

$EBTAA_{it-1}$, $EBTARD_{it-1}$, AA_{it-1} and ARD_{it-1} are defined in Table 5.

5.5. Measurement of ΔARD_{it}

The change of abnormal R&D shows that the change of R&D for each firm across years represents the amount of R&D that managers could use to manage firms' short-term earnings. The change of abnormal R&D is a better measurement than the measurement used in Bushee (1998). He uses the change of R&D expense in current year and indicates that managers could cut R&D to meet firms' short-term earnings targets. This measurement could be problematic since he assumes that last year' R&D is at the optimal level. However, there are some other factors that could affect the R&D expense. Therefore, Berger (1993), Gunny (2005) and Zang (2005) use a model to capture the abnormal R&D. They use some control variables in their regressions to control for the effects of other variables that affect the level of R&D of a firm.

Following Berger (1993), Gunny (2005) and Zang (2005), I estimated the abnormal level of R&D expenditures as the residuals from model (5). I multiply these residuals by negative one; such that higher values (denoted as ARD_{it}) indicate a higher possibility that firm cut R&D to increase reported earnings. The regression is estimated cross-sectional for each industry with at least 15 observations, where the industry is defined following Fama and French (1997). I did not follow Zang's (2005) study to compute the abnormal R&D by each industry-year. If I compute abnormal R&D by each industry-year with a range of small and large observations, residuals gained for these different industry-years will not be comparable, because the residual amounts will be affected by the variations in the sample sizes of each industry-year sub-sample. Therefore, I use the cross-sectional approach, i.e., using the whole sample and using dummies for year and industry. This results in abnormal R&Ds that are comparable across industry and year.

The model used for this is as follows:

$$RD_{it}/A_{it-1} = \alpha_0 + \alpha_1[RD_{it-1}/A_{it-1}] + \alpha_2[Funds_{it}/A_{it-1}] + \alpha_3[TobinsQ_{it}] + \alpha_4[CapitalExp_{it}/A_{it-1}] + \alpha_5\sum_{I=1}^{48} Industry + \alpha_6\sum_{Y=1}^{7} Year + \varepsilon_{it} \quad (5)$$

Where,

RD_{it}	=	R&D expense of firm i in year t;
RD_{it-1}	=	R&D expense of firm i in year t-1;
A_{it-1}	=	Total assets of firm i in year t-1;
$Funds_{it}$	=	(Income before extraordinary item+ R&D +Depreciation) of firm i in year t;
$TobinsQ_{it}$	=	TobinsQ of firm i in year t;
$CapitalExp_{it}$	=	Capital expenditure of firm i in year t;
Industry	=	Dichotomous industry dummies; the industries were classified by

		following Fama-French (1997);
Year	=	Dichotomous year dummies;
ε_{it}	=	A residual term that captures the level of abnormal R&D of firms i in year t.

All variables are defined in Table 5.

In model (5), the RD_{it-1}/A_{it-1} proxies for the firms' innovation opportunity; the coefficient of this variable is expected to be positive. $Funds_{it}$ (internal fund) is included based on the argument that expanding R&D investment is cheaper for firms with more internal funds since external funds are more expensive for R&D projects than internal funds. Thus, I expect a positive coefficient for this variable. $TobinsQ_{it}$ captures the firms' growth potential. The $CapitalExp_{it}$ (Capital expenditure) represents the firms' investing activities in the current year. I expect the coefficients of both $TobinQ_{it}$ and $CapitalExp_{it}$ to be positive. I report the results of this R&D model for year *t* and year *t-1* in Appendix A and Appendix B.

I find that the coefficients of RD_{it-1}/A_{it-1}, $TobinsQ_{it}$, and $CaptialExp_{it}/A_{it-1}$ are positive and significantly ($p<0.01$) associated with RD_{it}/A_{it-1} in year *t*. The signs of these coefficients in year *t* are the same as found in Zang (2005) except $Funds_{it}/A_{it-1}$. I also find that the coefficients of RD_{it-1}/A_{it-1} and $CaptialExp_{it}/A_{it-1}$ are positive and significantly ($p<0.01$) associated with RD_{it}/A_{it-1} in year *t-1*. The signs of these variables in year *t-1* are same as found in Zang (2005) except for $Funds_{it}/A_{it-1}$ and $TobinsQ_{it}$. The adjusted R^2 for the R&D model is 98.7% in year *t* and is 50.5% in year *t-1*. This indicates that the variables in the R&D model have strong explanatory powers for variations of R&D and the residuals (abnormal R&D) are those components of R&D that are likely to be abnormal in nature.

5.6. Measurement of ΔAA_{it}

Accruals management could be costly if firms have limited accounting flexibility, i.e., they do not have the accruals available to manage earnings if they have managed accruals heavily in the previous year. The change of abnormal accruals shows the real amount of abnormal accruals that could be managed in the current year. The change of abnormal accruals is a better measurement than the measurement used in Zang (2005). Zang (2005) uses abnormal accruals to test the association between abnormal R&D and abnormal accruals. Her measurement does not indicate the amount of abnormal accruals they have used for meeting earnings targets. It only shows an amount they can use.

I follow Dechow et al. (1995) to compute abnormal accruals. Dechow et al. (1995) discuss a weakness of the Jones (1991) model. They indicate that Jones' (1991) model is unable to capture the impact of revenue-based manipulation, since changes in revenues are assumed to give rise to normal accruals. They explain that managers use their discretion to accrue revenues at year-end when the cash has not yet been received and it is highly questionable whether the revenues have been earned. The result of this managerial discretion is an increase in revenues and total accruals (through an increase in receivables). The Jones model estimates total accruals with respect to revenues and therefore extracts this abnormal component of accruals, causing the estimate of earnings management to be biased toward zero.

Following Dechow et al. (1995) [hereafter DSS] modified Jones model, I estimated the abnormal level of accruals as the residuals from model (6). In an attempt to capture revenue-based manipulations, Dechow et al. (1995) proposed a modification to the standard-Jones model, with the exception that the change in debtors (ΔREC_{it}) is subtracted from ΔREV_{it}.

The regression equation can be written as follows:

$$TA_{it}/A_{it-1} = \alpha_0[1/A_{it-1}] + \beta_1[(\Delta S_{it}-\Delta REC_{it})/A_{it-1}] + \beta_2[PPE_{it}/A_{it-1}] + \beta_3\sum_{I=1}^{48} Industry + \beta_4\sum_{Y=1}^{7} Year + \varepsilon_{it} \quad (6)$$

Where,

TA_{it}	=	Total accruals of firm i in year t [Income before extraordinary items less cash flow from operation by following Zang (2005)];
A_{it-1}	=	Total assets of firm i in year t-1;
ΔS_{it}	=	Net Sales of firm i in year t less net sales of firm i in year t-1;
ΔREC_{it}	=	Account receivable of firm i in year t less account receivable of firm i in year t-1;
PPE_{it}	=	Net property, plant and equipment of firm i in year t;
Industry	=	Dichotomous industry dummies; the industries were classified by following Fama-French (1997);
Year	=	Dichotomous year dummies;
ε_{it}	=	A residual term that captures the level of abnormal accruals of firm i in year t.

All variables are defined in Table 5.

In model (6), DSS find that both the coefficient of PPE_{it}/A_{it-1} and the coefficient of $1/A_{it-1}$ is negative, while the coefficient of $[\Delta S_{it}-\Delta REC_{it}]$ is positive. The residuals gain from model (6) is abnormal accruals.

Akin to my computation of abnormal R&D, I use the cross-sectional approach to run DSS (1995) model, i.e., I control year and industry when I run the DSS (1995) model. I report the results of DSS (1995) model for year *t* and year *t-1* in Appendix C and Appendix D.

I find that all of the estimated coefficients are significant and with the same signs as found in DSS (1995) in year *t*. I also find that all of the estimated coefficients are significant with the same signs as found in DSS (1995) except $[\Delta S_{it} - \Delta REC_{it}]/A_{it-1}$ in year *t-1*. The adjusted R^2 for DSS (1995) model is 82.4% in year *t* and is 76 % in year *t-1*. This indicates that the variables in the DSS (1995) model have strong explanatory powers for variations of accruals and the residuals (abnormal accruals) are those components of accruals that are likely to be abnormal in nature.

5.7. Measurement of control variables

Follow Bushee (1998), I use a set of control variables in my Hausman test regressions. I summarize their measurements in Table 5.

If a firm's R&D opportunity set has been declining (increasing) over time, a decline (increase) in R&D in the previous year makes a firm more (less) likely to cut R&D this year. I include a proxy for the prior year's change in R&D ($PCRD_{it}$) for changes in the firm's R&D opportunity set in the current year (Berger, 1993; Bushee, 1998).

Firms in industries with increasing (decreasing) R&D are expected to be less (more) likely to cut R&D. I include the change in industry R&D intensity ($CIRD_{it}$) to control for changes in the R&D opportunity set within the firm's industry and changes in the level of R&D spending needed to stay competitive within the industry (Berger, 1993; Bushee, 1998).

In years when CGDP is high (low), firms are expected to have more (fewer) profitable R&D opportunities and thus be less (more) likely to reduce R&D. I include the changes in the Gross Domestic Product ($CGDP_{it}$) to control for growth in the overall economy and increases in the level of technological progress in the economy (Berger, 1993; Bushee, 1998).

Tobin'q ($TOBQ_{it}$) is used to control for the marginal benefit-to-cost ratio of undertaking new investments. As a proxy for the unobservable marginal TOBQ, Berger (1993) and Bushee (1998) use the average TOBQ, defined as the market value of the firm's equity and debt, divided by the book value of its assets. Because of the accounting treatment of R&D, this measure is similar to the market-to-book ratio in that both are positively associated with the future value of R&D spending. Based on these interpretations, firms with higher (lower) TOBQ have more (fewer) valuable R&D opportunities and face a higher (lower) cost of reducing R&D.

The change in capital expenditures ($CCAP_{it}$) controls for reduced funds available for investment and/or entry into a more mature, lower investment stage of the firm's life cycle (Perry & Grinaker, 1994; Bushee, 1998). Both explanations yield an expected negative relation with ΔARD_{it}.

I include $CSALES_{it}$ to control for firm growth and funds available for R&D investment, as well as to capture the fact that R&D budgets are often based on sales (Berger, 1993; Bushee, 1998). For each of these reasons, a negative relation with the decision to cut R&D is expected.

Size ($SIZE_{it}$) controls for two possible effects, both of which lead to a negative expected relation with ΔARD_{it}. First, SIZE proxies for the amount of information available about the firm (Wiedman, 1996). Larger (smaller) firms have richer (poorer) information environments that should reduce (increase) opportunities for successful earnings management with R&D. Second, SIZE proxies for the likelihood that the firm faces cash constraints (Jalilvand & Harris, 1984). Smaller firms are more likely to suffer cash flow shortages that force them to reduce R&D.

The distance of the expected earnings from the earnings targets ($DIST\_ARD_{it}$, $DIST\_AA_{it}$) measures the portion of abnormal R&D (or abnormal accruals) that would be needed to obtain a positive earnings change. As firm's expected earnings get closer to the earnings goal, the firm can use income-increasing abnormal R&D more easily. Thus, a negative relation between $DIST\_ARD_{it}$ and ΔARD_{it} is expected. As firms'

$DIST\_AA_{it}$ increases, they are likely to use income-increasing abnormal R&D as it is more difficult to use income-increasing abnormal accruals for managing earnings. So a positive relation between $DIST\_AA_{it}$ and ΔARD_{it} is expected.

The firm's leverage ratio (LEV_{it}) captures potential debt covenant incentives to manage earnings (Duke & Hunt, 1990). A positive sign is expected if meeting debt covenants motivates earnings management. Higher LEV could also indicate fewer growth opportunities for the firm (Myers, 1984), in which case a positive sign would also be expected.

Finally, I include a measure of free cash flow (FCF_{it}), defined as cash flow from operations less capital expenditures, and scaled by net tangible assets, to proxy for possible near-term financing requirements. Firms with substantially negative free cash flows have a greater need to raise equity in the near-term, and thus have incentives to boost earnings and reduce the chance of an undervaluation (Dechow, Sloan & Sweeney, 1996). This variable also proxies for reduced funds available for investment, which might trigger reductions in R&D. Either explanation indicates that a negative relation is expected.

CHAPTER 6: SAMPLE COLLECTION

This chapter delineates the sample selection, sub-samples classification and the source of data. The sample and data collection is aimed at facilitating the data analysis and testing the hypotheses of this study.

6.1. Sample selection

The hypotheses put forward in Chapter 4 imply that the contextual environment allowing expensing R&D is a precondition for collecting data for this study. I use U.S. firms because U.S.GAAP requires that R&D expenditures be immediately and fully expensed. The absence of the option to capitalize R&D requires firms to cut R&D to reduce R&D expense for the year if they want to use R&D reduction as a tool to meet their earnings targets.

I start my sampling by including all the firm-year observations of U.S. firms from 1999 to 2005 for which data are available from Compustat. Following Bushee (1998) and Zang (2005), I exclude firm-year observations that (1) are not included in the Fama-French industry classification, (2) are financial institutions (SIC Code 6000-6999) (Financial institutions are subject to fundamentally different regulatory regimes and therefore, their abnormal accruals estimation is problematic (DeFond & Subramanyam, 1998; Peasnell et al., 2000)); (3) are in utility industries (SIC Code 4400-5000), (They have potential differences in their incentives and opportunities to manage earnings (Peasnell et al., 2000)), (4) have missing current or prior year R&D data, (5) the ratio of R&D-by-Sales is less than 1 percent (For these firms, R&D is not a significant portion of earnings to calculate industry R&D intensity), (6) have fewer than 15 other firms in the same industry. Using this sample, I compute abnormal R&D and abnormal accruals in year t and year $t-1$. (7) Since there are missing data for computing control variables for the multivariate tests. The overall sample available for multivariate tests consists of

8083 firm-year observations. Panel A of Table 6 shows the stages of the sample selection process.

INSERT Table 6 HERE

6.2. Sub-samples selection

To test the hypotheses presented in Chapter 4, I extract four sub-samples from the full sample. Based on the four circumstances described earlier, four sub-samples are selected to test the association between ΔARD_{it} and ΔAA_{it} for the four different circumstances. Panel B of Table 6 shows the criteria for selecting the sub-samples. The first circumstance (C1) sub-sample includes firms that have pre-managed earnings below prior year's earnings by an amount that can be reversed either by using income-increasing abnormal R&D (criterion 1, Table 4) or using income-increasing accruals (criterion 2, Table 4). There are 109 firm-year observations that meet these criteria. The second circumstance (C2) sub-sample includes firms that have pre-managed earnings below prior year's earnings by an amount that can be reversed by using income-increasing abnormal R&D (criterion 1, Table 4) and cannot be reversed by using income-increasing accruals (criterion 4, Table 4). There are 175 firm-year observations that meet these criteria. The third circumstance (C3) sub-sample includes firms that have pre-managed earnings below prior year's earnings by an amount that can be reversed by using income-increasing abnormal accruals (criterion 2, Table 4) and cannot be reversed by using income-increasing R&D (criterion 3, Table 4). There are 102 firm-year observations that meet these criteria. The fourth circumstance (C4) sub-sample includes firms that have pre-managed earnings below prior year's earnings by an amount that cannot be reversed either by using income-increasing abnormal R&D (criterion 3, Table 4) or by using income-increasing accruals (criterion 4, Table 4). There are 317 firm-year observations that meet these criteria. Table 4 summarizes the selection criteria of these sub-samples.

INSERT Table 4 HERE

CHAPTER 7: DESCRIPTIVE STATISTICS AND EMPIRICAL RESULTS

In this chapter, I describe the descriptive statistics and report and analyse the results of cross-tabs, the results of T-test and the results of Hausman tests in the four different circumstances of identified earlier.

7.1. Descriptive statistics for C1, C2, C3 and C4

The descriptive statistics are shown in Table 7. Examining $DIST\_ARD_{it}$ and $DIST\_AA_{it}$, I can confirm whether the sub-samples of the four circumstances meet the desired sampling requirements. First, I note that the means of $DIST\_ARD_{it}$ and $DIST\_AA_{it}$ in the C1 sub-sample are larger than the means of the same variables in the C4 sub-sample. This is consistent with the sampling procedure used to determine these two sub-samples. The sub-sample for C1 contains firms that can use either income-increasing abnormal R&D or income-increasing abnormal accruals to meet their earnings targets. Whereas, the sub-sample for C4 contains firms that cannot use either income-increasing abnormal R&D or income-increasing abnormal accruals to meet their earnings targets. Second, I find that mean of the $DIST\_ARD_{it}$ is larger than the mean of $DIST\_AA_{it}$ in the C2 sub-sample. This is consistent with the sampling procedure used to determine this sub-sample. The sub-sample for C2 contains firms that can use income-increasing abnormal R&D but not income-increasing abnormal accruals to meet their earnings targets. Third, I find that the mean of the $DIST\_AA_{it}$ is larger than the mean of $DIST\_ARD_{it}$ in the C3 sub-sample. This is consistent with the sampling procedure used to determine this sub-sample. The sub-sample for C3 contains firms that can use income-increasing abnormal accruals but not income-increasing abnormal R&D to meet their earnings targets. These observations confirm that the sub-samples of the four circumstances meet the desired sampling requirements.

INSERT Table 7 HERE

The means of $CSALES_{it}$, FCF_{it} and $SIZE_{it}$ in the C1 sub-sample are larger than the means of the same variables in the other three sub-samples. Therefore, C1 sub-sample is seen to be the more robust in terms of performance than the other three sub-samples.

7.2. Results for C1

Panel A of Table 8 shows the cross-tabs results of firm-year observations in the C1 sub-sample. It shows that the number of firms that use both Increase in income-increasing abnormal R&D ($IIIARD_{it}$) and Increase income-increasing abnormal accruals ($IIIAA_{it}$) is greater than the number of firms that either use $IIIARD_{it}$ or $IIIAA_{it}$. This result does not support H1a. In other words, in C1, although I conjectured that abnormal accruals are less costly to manage earnings, more firms use both $IIIARD_{it}$ and $IIIAA_{it}$. In this case, although the Chi-Square likelihood ratio is not significant, it is quite obvious that the number of firms that use both $IIIARD_{it}$ and $IIIAA_{it}$ is much larger than the number of firms in the other three categories. The reason for the low Chi-Square statistics is that the other three categories do not have significantly different frequencies.

INSERT Table 8 HERE

In order to get evidence for H1b, I use T-test to examine the differences between the means of ΔARD_{it} and ΔAA_{it}. Panel B of Table 8 provides the evidence that the mean of ΔAA_{it} is significantly greater than the mean of ΔARD_{it} in the C1 sub-sample ($p<0.01$). Thus, the result supports H1b. Therefore, putting together the results of H1a and H1b, I construe that while either income-increasing abnormal R&D or income-increasing abnormal accruals are enough to meet earnings targets, firms use the less costly abnormal accruals in larger amounts more than abnormal R&D to manage earnings in C1.

Using Table 3, I note that the results of the Hausman test for C1 relates to Scenario 4, where the coefficient of ΔAA_{it} is positive and significant in the ΔARD_{it} regression, but ΔARD_{it} is not significant in the ΔAA_{it} regression; and $P\_\Delta AA_{it}$ is not significant but $P\_\Delta ARD_{it}$ is significant. Therefore, I construe that there is simultaneity between ΔAA_{it} and ΔARD_{it} and ΔAA_{it} substitutes ΔARD_{it}.

7.3. Results for C2

Panel A of Table 9 shows cross-tabs results of the observations in the C2 sub-sample. It shows that the number of firms that use both $IIIARD_{it}$ and $IIIAA_{it}$ is greater than the number of firms that either use $IIIARD_{it}$ or $IIIAA_{it}$. This result supports H2a. In other words, for C2, firms do not have enough income-increasing abnormal accruals to manage earnings, however income-increasing abnormal accruals are less costly compared to income-increasing abnormal R&D. Thus, firms attempt to use both $IIIARD_{it}$ and $IIIAA_{it}$. In this case, the Chi-Square statistics not computed because two of the cells had no observations. In spite of that, it is obvious that the number of firms-year observations in the category for $IIIARD_{it}$ and $IIIAA_{it}$ has the highest number of observations.

INSERT Table 9 HERE

In order to get evidence for H2b, I use T-test to examine the differences between the means of ΔARD_{it} and ΔAA_{it}. Panel B of Table 9 provides the evidence that the mean of ΔAA_{it} is significantly greater than the mean of ΔARD_{it} in the C2 sub-sample ($p<0.01$). This result does not support H2b. Therefore, putting together the results of H2a and H2b, I construe that while income-increasing abnormal R&D are enough to manage earnings and income-increasing abnormal accruals are not enough to meet the earnings targets, firms use the less costly abnormal accruals to manage their earnings more than they use abnormal R&D in C2.

Using Table 3, I note that the results of the Hausman test for C2 relates to Scenario 6, where the coefficient of ΔAA_{it} is positive and significant in the ΔARD_{it} regression, ΔARD_{it} is also positive significantly in the ΔAA_{it} regression; and P_ΔAA_{it} is significant and P_ΔARD_{it} is significant. Therefore, I construe that there is simultaneity between ΔAA_{it} and ΔARD_{it} and ΔAA_{it} occurs together with ΔARD_{it}.

7.4. Results for C3

Panel A of Table 10 shows the cross-tabs results of firm-year observations in the C3 sub-sample. It shows that the number of firms that use both $IIIARD_{it}$ and $IIIAA_{it}$ is greater than the number of firms that either use $IIIARD_{it}$ or $IIIAA_{it}$. In this case, the Chi-Square statistics is significant ($p<0.05$), it indicates that the differences between the frequencies of the categories are significant. This result is similar to those of the C1 sub-sample and the C2 sub-sample. However, this result does not support H3a. In other words, in C3, although I conjectured that abnormal accruals are less costly to manage earnings, more firms use both $IIIARD_{it}$ and $IIIAA_{it}$.

INSERT Table 10 HERE

In order to get evidence for H3b, I use T-test to examine the differences between means of ΔARD_{it} of ΔAA_{it}. Panel B of Table 10 shows that the mean of ΔAA_{it} is not significantly greater than the mean of ΔARD_{it} in the C3 sub-sample. This result does not support H3b. Therefore, putting together the results of H3a and H3b, I construe that while income-increasing abnormal accruals are enough to manage earnings and income-increasing abnormal R&D are not enough to meet earnings targets, more firms use both abnormal accruals and abnormal R&D to manage their earnings in C3.

Using Table 3, I note that the results of the Hausman test for C3 relates to Scenario 3, where the coefficient of ΔAA_{it} is negative and significant in the ΔARD_{it} regression, ΔARD_{it} is also negative significantly in the ΔAA_{it} regression; and $P\_\Delta AA_{it}$ is not significant and $P\_\Delta ARD_{it}$ is not significant. Therefore, I construe that there is sequentiality between ΔAA_{it} and ΔARD_{it} and ΔAA_{it} and ΔARD_{it} substitutes each other.

7.5. Results for C4

Panel A of Table 11 shows the cross-tabs results of firm-year observations in the C4 sub-sample. It shows that the number of firms that use both $IIIARD_{it}$ and $IIIAA_{it}$ is greater than the number of firms that either use $IIIARD_{it}$ or $IIIAA_{it.}$ In this case, although the Chi-Square likelihood ratio is not significant, it is quite obvious that the number of firms using both $IIIARD_{it}$ and $IIIAA_{it}$ is much larger than the number in the other three categories. The reason for the low Chi-Square statistics is that the other three categories do not have significantly different number of firms. This result is similar to those of the C1 sub-sample, the C2 sub-sample and the C3 sub-sample. This result does support H4a. In other words, for C4, although I conjecture that abnormal accruals are less costly to manage earnings, more firms use both $IIIARD_{it}$ and $IIIAA_{it}$.

INSERT Table 11 HERE

In order to get an evidence to support H4b, I use T-test to examine the differences between means of ΔARD_{it} and ΔAA_{it}. Panel B of Table 11 shows that the mean of ΔAA_{it} is significantly and positively greater than the mean of ΔARD_{it} in the C4 sub-sample ($p<0.01$). This result supports H4b. Therefore, put together the results of H4a and H4b, I construe that while either income-increasing abnormal accruals or income-increasing abnormal R&D are not enough to be used to meet earnings targets, firms use the less costly abnormal accruals to manage their earnings more than they use abnormal R&D in C4.

Using Table 3, I note that the results of the Hausman test for C4 relates to Scenario 7, where the coefficient of ΔAA_{it} is not significant in the ΔARD_{it} regression, ΔARD_{it} is also not significant in the ΔAA_{it} regression. $P\_\Delta AA_{it}$ is significant and $P\_\Delta ARD_{it}$ is significant. Therefore, I construe that there is no association between ΔAA_{it} and ΔARD_{it}.

7.6. Additional tests

Bushee (1998) provides the evidence that managers could cut the full amount of their R&D expenditures to meet short-term earnings targets. Therefore, I re-estimate previous models with the dependent variable change of R&D (ΔRD_{it}). I find that the results do not support H1 to H4. The reason that can be forwarded for this lack of support is that firms that are in the R&D intensive industries are likely not to attempt to cut the full amount of their R&D. It is likely that they will cut only the abnormal portion of their R&D because that is manageable without hindering their normal activities too much. However, I also feel that R&D intensive firms may not at times cut their abnormal R&D too much and perhaps use abnormal accruals because they may be using additional R&D for growth and competitiveness purposes.

7.7. Discussion

The results of the tests are summarized hypothesis by hypothesis in Table 12. The results show some support for my contentions that R&D intensive firms prefer to use abnormal accruals rather than abnormal R&D when they can use either method to meet their earnings targets. For H1a, I find that firms tend to use both $IIIARD_{it}$ and $IIIAA_{it}$ rather than just use $IIIAA_{it}$. For H1c, I find that the relation between ΔARD_{it} and ΔAA_{it} is simultaneous rather than sequential. However, for H1b, I find that firms use ΔAA_{it} in larger amounts than ΔARD_{it}; and for H1c, I find that ΔAA_{it} substitutes ΔARD_{it}. So, there is some support for my contention that in a circumstance where a firm can use both an increase in income-increasing abnormal accruals and income-increasing abnormal R&D, it will tend to use abnormal accruals more than abnormal R&D and ΔAA_{it} substitutes ΔARD_{it}.

INSERT Table 12 HERE

The results show strong support for H2a and H2c. Therefore, in a circumstance where income-increasing abnormal R&D are enough to manage earnings and income-increasing abnormal accruals are not enough to meet earnings targets, but income-increasing abnormal accruals are less costly, firms are likely to use both $IIIARD_{it}$ and $IIIAA_{it}$ (result for H2a). Also, firms use ΔAA_{it} more than ΔARD_{it} (result for H2b) and ΔAA_{it} substitutes ΔARD_{it} (result for H2c). This result of H2b along with the results of H2c (i.e., ΔAA_{it} complements ΔARD_{it}) suggest that ΔAA_{it} is more prominently used than ΔARD_{it}.

For H3a, the results are identical to those of H1a and H2a. However, the result for H3b is not significant. Similarly, the result for H3c is also not strong. Although, there is a sequentialilty but either of the two variables substitutes each other.

For H4a, the results are identical to H1a, H2a and H3a. Once again, both $IIIARD_{it}$ and $IIIAA_{it}$ are used together. Furthermore, H4b is identical to the results of H1b and H2b, showing that abnormal accruals is used in greater amount than abnormal R&D to manage earnings.

Put the results of the four circumstances together, I construe that R&D intensive firms tend to use both abnormal accruals and abnormal R&D to meet their earnings targets, but they seem to use abnormal accruals in larger amount than abnormal R&D. In terms of sequentiality or simultaneity, there is some support for abnormal accruals substituting abnormal R&D or both abnormal accruals and abnormal R&D occur simultaneously. However, there is little support for Zang (2005)'s contention that abnormal R&D substitutes abnormal accruals. This supports my view that firms that rely on certain forms of real earnings activities, they are likely not to affect them activities and use abnormal accruals instead to meet their earnings targets.

CHAPTER 8: CONCLUSION, CONTRIBUTIONS, LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

8.1. Conclusion

This study extends both Bushee (1998) and Zang (2005). Bushee ignores accruals management in his study and assumes that R&D reduction is the only mechanism that can be used by managers for managing earnings. This study also extends Zang's (2005) study, She uses a broad sample which includes both R&D intensive firms and firms that are not R&D intensive. She examines the trade off between abnormal accrual and abnormal R&D. However, she does not take note of the circumstances in which earnings management take place. My research design overcomes the drawbacks of Bushee (1998) and Zang (2005). I argue that the nature of trade off that occurs between abnormal accruals and abnormal R&D is dependent on the nature of the real activity that is affected real earnings management and the circumstances of the firms in terms of whether or not it can meet its earnings target, use the two methods of earnings management. I assume that managers can use either abnormal accruals or abnormal R&D to manage earnings. I use change in abnormal R&D and change in abnormal accruals as proxies of abnormal R&D and abnormal accruals. I focus on R&D intensive firms and I design four sub-samples to test the association between abnormal accruals and abnormal R&D in four different circumstances.

My four circumstances are: Circumstance 1: R&D intensive firms have pre-managed earnings below prior year's earnings by an amount that could be reversed either by using income-increasing abnormal R&D or using income-increasing abnormal accruals. Circumstance 2: R&D intensive firms have pre-managed earnings below prior year's earnings by an amount that could be reversed by using income-increasing abnormal R&D, but not by using income-increasing abnormal accruals. Circumstance 3: R&D

intensive firms have pre-managed earnings below prior year's earnings by an amount that could be reversed by using income-increasing abnormal accruals, but not by using income-increasing abnormal R&D. Circumstance 4: R&D intensive firms have pre-managed earnings below prior year's earnings by an amount that cannot be reversed either by using income-increasing abnormal accruals or by using income-increasing abnormal R&D.

For Circumstance 1, I argue that while firms could use either abnormal accruals or abnormal R&D, since the firms in the sample are R&D intensive firms, they are likely not to cut abnormal R&D but use abnormal accruals. However, my results show that they use both abnormal accruals and abnormal R&D. Likewise, I find similar results in all the other three circumstances. However, I also find that while the firms tend to use both abnormal accruals and abnormal R&D to manage earnings, in three of the four circumstances they use abnormal accruals more than abnormal R&D. There is also some support for abnormal accruals substituting abnormal R&D and simultaneity of the use of both methods of earnings management. There is only some support for abnormal R&D substituting abnormal accruals, as demonstrated by Zang (2005).

From my results, I have ascertained that the use of real earnings management and accruals management to meet earnings targets depends a great deal on the importance of the real earnings activity that is affected and the circumstances of the firm. Therefore, it is not possible to generalize the prominence of either method of earnings management for all circumstances as Zang (2005) did.

8.2. Contributions

This study contributes to the ongoing debate on the competing use of earnings management mechanisms, accruals management and real earnings management to meet short-term earnings targets. This study extends this line of inquiry by examining the use of abnormal R&D and abnormal accruals in meeting short-term earnings targets in different circumstances.

This study makes two important contributions. The first contribution relates to the design aspect of the study on the competing use of real earnings management and accruals management. The second contribution is a policy contribution. For the first contribution, I show that for studying the use of the two methods of earnings management, real earnings management and accruals management, researchers should identify the nature and circumstances of the firm before setting their research design. My results show that the nature and circumstances of the firms can influence the managerial decision on which method of earnings management to use. More specifically, in my research design, I use change in abnormal accruals and change in abnormal R&D. These changes tell how much change was made for firms to meet their earnings targets. While Zang (2005) only uses the total abnormal accruals and abnormal R&D which does not tell how much change in these variables were made for meeting the earnings targets.

For the second contribution, it is important for policymakers to note that firms in different industries and under different circumstances are likely to behave differently when it comes to managing earnings. Regulating firms under different circumstance may mean ascertaining a firm's circumstances before imposing a rule or before monitoring a rule. Also, some types of firms under certain circumstances may need greater scrutiny than others.

Arising from the results of this study, an implication is that, in spite of the costs of abnormal accruals, R&D intensive firms are likely to use abnormal accruals more than abnormal R&D to meet their short-term earnings targets in certain circumstances. R&D intensive firms are likely to use both abnormal accruals and abnormal R&D to meet their short-term earnings targets and use abnormal accruals instead of abnormal R&D in some circumstances. Therefore, they do not have to reduce their capacity to generate future earnings since R&D reductions reduce firms' future earnings. If this type of short-term adaptive behaviour by management has a disruptive effect on the efficiency and effectiveness of U.S. industry R&D programs, these findings have important implications for accounting standard setters and public policy makers.

Another point to note is that the restriction on accruals may encourage managers to engage in real earnings management and real earnings management is harder detect by auditors or regulators. These findings suggest that both real earnings management and accruals management exist together. Accounting standard setters should consider how to reduce other forms of earnings management. Only restricting accruals may not be enough.

8.3. Limitations

A possible limitation of this study is that I only include the firms which avoid earnings declines to the extent of not meeting short-term earnings targets. I do not focus on firms that avoid losses. Loss firms have stronger incentives to manage earnings. They may use income-increasing abnormal R&D to meet earnings targets if they do not have enough income-increasing abnormal accruals. However, I did not use firms that avoid losses because my sample size would reduce drastically. Also, the measures of how much abnormal accruals the firm has was computed based in the abnormal accruals firms had actually used. The firms may have additional capacity to use abnormal accruals if it has not used abnormal accruals too much in previous years. This aspect is difficult to establish from the available data. However, I have controlled the ability to use abnormal accruals to a certain extent by controlling for prior year abnormal accruals.

Another possible limitation is lack of some of control variables such as institutional ownership. The literature indicates that institutional investors could monitor managers to restrict them from managing earnings (e.g., see Bushee,1998; Koh, 2007).

8.4. Suggestions for the future research

Future research should attempt to use of firms in industries that are not R&D intensive and compare their result with those of R&D intensive firms and identify the nature of earnings management that may exist in those circumstances. Future research could also include other control variables such as the percentage of institutional ownership. Furthermore, future research could include more years to increase the sample size for getting a larger sample of firms that avoid losses.

Figure 1: Structure of this study

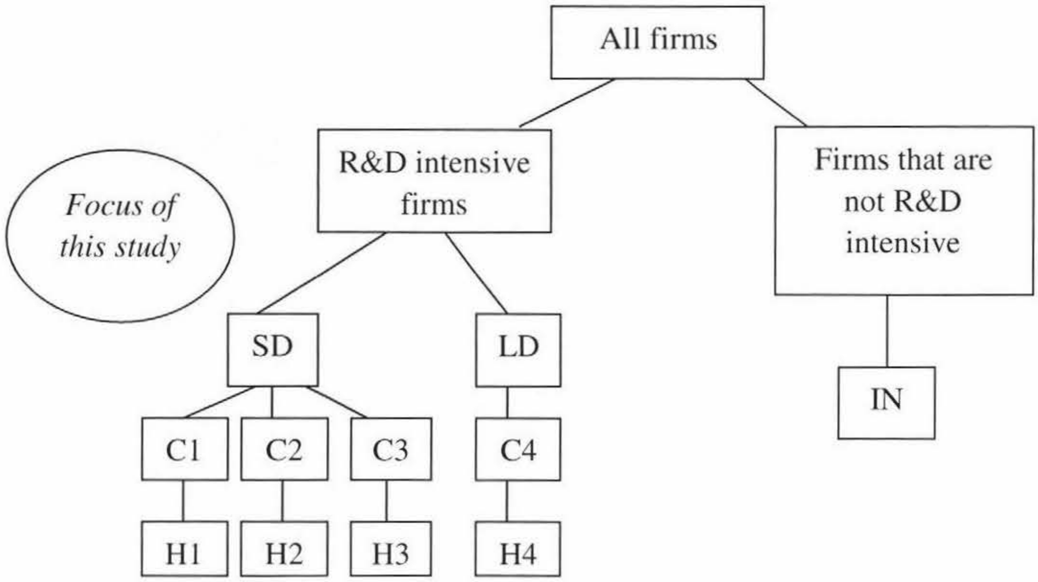

Figure 2: Group firms into four categories in each sub-sample

	Non-IIIAA firms[1]	**IIIAA firms**[1]
Non-IIIARD firms[1]	**Categories A**	**Categories B**
IIIARD firms[1]	**Categories C**	**Categories D**

[1]IIIAA firms = Firms that increase income-increasing abnormal accruals;
Non-IIIAA firms = Firms that do not increase income-increasing abnormal accruals;
IIIARD firms = Firms that increase income-increasing abnormal R&D;
Non-IIIARD firms = Firms that do not increase income-increasing abnormal R&D.

Table 1: Costs and benefits of earnings management (P37, Roychowdhury 2003)

	Manipulate real activities during the year to increase earnings	**Do not manipulate real activities - rely solely on pure accrual manipulation to cover shortfall between pre-managed earnings and the target**
Costs		
	Cash flow consequences of costly real activities are likely to extend well beyond the current period.	Pure accrual manipulation is limited by GAAP and any accrual management in prior years. If at the end of the year, the shortfall is bigger than the discretionary accruals the managers can report via pure accrual manipulation, managers have to just miss the target. They lose the opportunity to increase reported earnings by manipulating real activities.
	The shortfall between pre-managed earnings and the earnings target, that is, the extent of manipulation required is not known with certainty.	Pure accrual manipulation may be detected by auditors, or investors/regulators. This may lead to adverse stock price consequences, sometimes severe, and even bankruptcies. This may affect both the dollar wealth and the human capital of the managers.
Benefits		
	Makes meeting targets more likely. Managers still retain the opportunity to cover any residual shortfall with pure accrual manipulation.	Managers can undertake pure accrual manipulation at the end of the year, when they have knowledge of pre-managed earnings.
	Company is less likely to	Does not affect cash flows - at least

face auditor or regulator (SEC) scrutiny for real decisions. Harder to detect.	not directly (see costs).

Table 2: Summary of hypotheses in four different circumstances

Circumstance	Hypotheses[1]		
1	**H1a:** Number of firms with $IIIAA_{it}$ > Number of firms with $IIIARD_{it}$	**H1b:** Mean of ΔAA_{it} > Mean of ΔARD_{it}	**H1c:** Sequentiality, and ΔAA_{it} substitutes ΔARD_{it}.
2	**H2a:** Number of firms with $IIIAA_{it}$ and $IIIARD_{it}$ > Number of firms with $IIIARD_{it}$ & Number of firms with $IIIAA_{it}$ and $IIIARD_{it}$ > Number of firms with $IIIAA_{it}$	**H2b:** Mean of ΔAA_{it} is not different from mean of ΔARD_{it}	**H2c:** Simultaneity, and ΔAA_{it} complements ΔARD_{it}.
3	**H3a:** Number of firms with $IIIAA_{it}$ > Number of firms with $IIIARD_{it}$	**H3b:** Mean of ΔAA_{it} > Mean of ΔARD_{it}	**H3c:** Sequentiality, and ΔAA_{it} substitutes ΔARD_{it}.
4	**H4a:** Number of firms with $IIIAA_{it}$ > Number of firms with $IIIARD_{it}$	**H4b:** Mean of ΔAA_{it} > Mean of ΔARD_{it}	**H4c:** Sequentiality, and ΔAA_{it} substitutes ΔARD_{it}.

[1]$IIIAA_{it}$ = Increase income-increasing abnormal accruals;
$IIIARD_{it}$ = Increase income-increasing abnormal R&D;
ΔAA_{it} = Change in abnormal accruals;
ΔARD_{it} = Change in abnormal R&D.

Table 3: Expectation of Hausman test

Scenario	Coefficient of ΔAA_{it} on ΔARD_{it} equation *(Coefficient of Predicted value of ΔAA_{it} on ΔARD_{it} equation)*	Coefficient of ΔARD_{it} on ΔAA_{it} equation *(Coefficient of predicted value of ΔARD_{it} on ΔAA_{it} equation)*	Assessment simultaneity versus sequentiality of ΔAA_{it} and ΔARD_{it}, according to Zang (2005)
1	Negative significant *(Not significant)*	Negative not significant/ Negative significant *(Significant)*	Sequentiality, and ΔAA_{it} substitutes ΔARD_{it}.
2	Negative not significant/ Negative significant *(Significant)*	Negative significant *(Not significant)*	Sequentiality, and ΔARD_{it} substitutes ΔAA_{it}.
3	Negative significant *(Not significant)*	Negative significant *(Not significant)*	Sequentiality, and ΔAA_{it} substitutes ΔARD_{it}, or ΔARD_{it} substitutes ΔAA_{it}.
4	Positive significant *(Not significant)*	Positive not significant/ Positive significant *(Significant)*	Simultaneity, and ΔAA_{it} substitutes ΔARD_{it}.
5	Positive not significant/ Positive significant *(Significant)*	Positive significant *(Not significant)*	Simultaneity, and ΔARD_{it} substitutes ΔAA_{it}.

6	Positive significant (*Significant*)	Positive significant (*Significant*)	Simultaneity, and ΔAA_{it} complements ΔARD_{it}.
7	Positive not significant (*Significant*)	Positive not significant (*Significant*)	No conclusion.
8	Positive not significant (*Not significant*)	Positive not significant (*Not significant*)	Same as above.
9	Positive not significant (*Not significant*)	Positive not significant (*Significant*)	Same as above.
10	Positive not-significant (*Significant*)	Positive not significant (*Not significant*)	Same as above.
11	Positive significant (*Not significant*)	Positive significant (*Not significant*)	Same as above.
12	Negative not significant (*Significant*)	Negative not significant (*Significant*)	Same as above.
13	Negative not significant (*Not significant*)	Negative not significant (*Not significant*)	Same as above.
14	Negative not significant (*Not significant*)	Negative not significant (*Significant*)	Same as above.
15	Negative not significant (*Significant*)	Negative not significant (*Not significant*)	Same as above.
16	Negative significant (*Significant*)	Negative significant (*Significant*)	Same as above.

Table 4: Sub-samples selection criteria

***Criterion* 1**: $ARD_{it} > 0$ & $(EBTARD_{it} - EBTARD_{it-1}) < 0$ & $(EBTARD_{it} - EBTARD_{it-1} + ARD_{it}) > 0$	***Criterion* 2**: $AA_{it} > 0$& $(EBTAA_{it} - EBTAA_{it-1}) < 0$ & $(EBTAA_{it} - EBTAA_{it-1} + AA_{it}) > 0$
***Criterion* 3**: $ARD_{it} > 0$ & $(EBTARD_{it} - EBTARD_{it-1}) < 0$ & $(EBTARD_{it} - EBTARD_{it-1} + ARD_{it}) < 0$	***Criterion* 4**: $AA_{it} > 0$& $(EBTAA_{it} - EBTAA_{it-1}) < 0$ & $(EBTAA_{it} - EBTAA_{it-1} + AA_{it}) < 0$
Sub-Sample design	***To meet the criteria***
C1 Sub-Sample	*Criterion* 1 & *Criterion* 2
C2 Sub-Sample	*Criterion* 1 & *Criterion* 4
C3 Sub-Sample	*Criterion* 2 & *Criterion* 3
C4 Sub-Sample	*Criterion* 3 & *Criterion* 4

Note: See definitions of ARD_{it}, AA_{it}, $EBTARD_{it}$ and $EBTAA_{it}$ in Table 5.

Table 5: Variable Definitions

Variable	Measurement
Variable used in the estimation models for normal level of R&D and accrual (Source: adapted from Zang (2005)).	
RD_{it}	R&D expense
$Funds_{it}$	Income before extraordinary item+ R&D + Depreciation
$TobinsQ_{it}$	(Market value of equity + Book value of preferred stock + Long-term debt + Short-term debt)/Total Assets
$CapitalExp_{it}$	Capital expenditure
TA_{it}	Income before extraordinary item - Net cash flow from operation activities
A_{it}	Total Assets
S_{it}	Net sale
ΔS_{it}	$S_{it} - S_{it-1}$
REC_{it}	Account receivable
ΔREC_{it}	$REC_{it} - REC_{it-1}$
PPE_{it}	Net property, plant and equipment
Proxies for Abnormal R&D Abnormal Accruals	
ARD_{it}	$ARD_{it} = \varepsilon_{it} * (-1) * A_{it-1}$, ε_{it} was estimated cross-sectionally for each Fama-French industry with at least 15 observations: $RD_{it}/A_{it-1} = \alpha_0 + \alpha_1[RD_{it-1}/A_{it-1}] + \alpha_2[Funds_{it}/A_{it-1}] + \alpha_3[TobinsQ_{it}] + \alpha_4[CapitalExp_{it}/A_{it-1}] + \alpha_5\sum_{I=1}^{48} Industry + \alpha_6\sum_{Y=1}^{7} Year + \varepsilon_{it}$ (5)
AA_{it}	$AA_{it} = \varepsilon_{it} * A_{it-1}$, ε_{it} was estimated cross-sectionally for each Fama-French industry with at least 15 observations: $TA_{it}/A_{it-1} = \alpha_0[1/A_{it-1}] + \beta_1[(\Delta S_{it} - \Delta REC_{it})/A_{it-1}] + \beta_2[PPE_{it}/A_{it-1}] + \beta_3\sum_{I=1}^{48} Industry + \beta_4\sum_{Y=1}^{7} Year + \varepsilon_{it}$ (6)
Variables used in regressions to test the association between Abnormal R&D (or R&D) and Abnormal Accruals.	
ΔARD_{it}	$(ARD_{it} - ARD_{it-1})$, ΔARD_{it} is based on the measurement unit of million U.S. dollar.
ΔAA_{it}	$(AA_{it} - AA_{it-1})$, ΔAA_{it} is based on the measurement unit of million U.S. dollar.
$EBTAA_{it}$	Pretax $income_{it} - AA_{it}$

Variables used in regressions to test the association between Abnormal R&D (or R&D) and Abnormal Accruals (Source: adopted from Bushee (1998)).

$EBTARD_{it}$	Pretax $income_{it}$ - ARD_{it}
$PCRD_{it}$	$\ln(RD_{it-1}) - \ln(RD_{it-2})$, where RD_{it-1} is R&D per share in year *t-1;* RD_{it-2} is R&D per share in year *t-2*
$CIRD_{it}$	$\ln(IRD_{it}/ISALES_{it}) - \ln(IRD_{it-1}/ISALES_{it-1})$
$CCAP_{it}$	$\ln(CAP_{it}) - \ln(CAP_{it-1})$
$CSALES_{it}$	$\ln(SALES_{it}) - \ln(SALES_{it-1})$, where $SALES_{it}$ is sales per share in year *t*
$TOBQ_{it}$	(market value of common equity + book value of preferred equity + long-term debt + short-term debt)/Total assets
$CGDP_{it}$	$\ln(GDP_{it}) - \ln(GDP_{it-1})$
$SIZE_{it}$	$Ln(MVE_{it})$
$DIST\_ARD_{it}$	$(EBTARD_{it} - EBTARD_{it-1})/ARD_{it}$
$DIST\_AA_{it}$	$(EBTAA_{it} - EBTAA_{it-1})/AA_{it}$
LEV_{it}	$(LTD_{it} + STD_{it})/ASSETS_{it}$
FCF_{it}	$(CFO_{it}$ - Average CAP_{it-1} to $_{it-3})/CA_{it-1}$
LTD_{it}	Long-term debt
STD_{it}	Short-term debt
IRD_{it}	Total R&D per share for all firms in the same industry which classified by following Fama-French (1997).
$ISALES_{it}$	Total sales per share for all firms in the same industry which classified by following Fama-French (1997).
CAP_{it}	Capital expenditure per share
GDP_{it}	Gross domestic product
CFO_{it}	Cash flow from operating activities
CA_{it}	Current assets
MVEit	Market value of equity

Table 6: Sample and sub-sample selection

Panel A: selection of the full sample

Sample Size	
Total firm-year observations from Compustat, 1999-2005	**166838**
Sample Selection Criteria	*Firm-year observations*
Excluding firm-year observations are not included in Fama-French industry classifications	(7393)
Excluding financial institution (SIC6000-6999)	(38219)
Excluding regulated industries (SIC4400-5000)	(11557)
Excluding firm-year observations which missing $R\&D_{it}$	(79833)
Compustat firm-year observations with non-missing $R\&D_{it}$	**29836**
Less: firm-year observations which missing $R\&D_{it-1}$	(1756)
Less: $R\&D_{it}/Sales_{it}$ less than 1%	(7243)
Less: fewer than fifteen other firms in industry	(227)
The sample size at this stage	**20610**
Less: missing data to calculate variables	(12527)
Full sample	**8083**

Panel B: Sub-samples for testing hypotheses in different circumstances

Circumstance	Hypothesis	Sub-Samples	Firm-year observations
1	1	C1 Sub-Sample[a]	109
2	2	C2 Sub-Sample[a]	175
3	3	C3 Sub-Sample[a]	102
4	4	C4 Sub-Sample[a]	317
		Total	703

[a] C1 Sub-Sample, C2 Sub-Sample, C3 Sub-Sample and C4 Sub-Sample are defined in Table 4.

Table 7: ***Descriptive Statistics***

Variables		C1 Sub-Sample[a]	C2 Sub-Sample[a]	C3 Sub-Sample[a]	C4 Sub-Sample[a]
$PCRD_{it}$	**Mean**	0.168	0.067	0.044	0.146
	Std. Dev	*0.629*	*0.685*	*0.734*	*0.675*
$CIRD_{it}$	**Mean**	-0.251	-0.381	-0.325	-0.305
	Std. Dev	*0.492*	*0.449*	*0.494*	*0.514*
$CGDP_{it}$	**Mean**	0.028	0.031	0.031	0.033
	Std. Dev	*0.010*	*0.011*	*0.012*	*0.013*
$TOBQ_{at}$	**Mean**	1.370	1.370	1.285	1.292
	Std. Dev	*0.593*	*0.749*	*0.626*	*0.540*
$CCAP_{it}$	**Mean**	0.000	-0.169	0.038	-0.102
	Std. Dev	*0.771*	*0.784*	*0.825*	*0.841*
$CSALES_{it}$	**Mean**	0.217	0.122	-0.212	-0.136
	Std. Dev	*0.525*	*0.596*	*0.645*	*0.677*
$SIZE_{it}$	**Mean**	6.040	5.569	4.282	4.817
	Std. Dev	*2.629*	*2.402*	*2.167*	*2.570*
$DIST\_ARD_{it}$	**Mean**	-0.479	-0.456	-1.577	-1.741
	Std. Dev	*0.285*	*0.274*	*0.655*	*0.852*
$DIST\_AA_{it}$	**Mean**	-0.507	-1.406	-0.542	-1.569
	Std. Dev	*0.293*	*0.438*	*0.286*	*0.872*
LEV_{it}	**Mean**	0.490	0.469	0.351	0.459
	Std. Dev	*0.269*	*0.299*	*0.350*	*0.319*
FCF_{it}	**Mean**	0.187	0.044	-0.295	-0.254
	Std. Dev	*0.619*	*0.673*	*0.600*	*0.738*
ΔARD_{it}	**Mean**	2.598	2.259	1.040	1.426
	Std. Dev	*3.620*	*2.947*	*1.999*	*3.290*
ΔAA_{it}	**Mean**	4.146	5.536	0.494	4.635
	Std. Dev	*3.478*	*4.792*	*2.957*	*6.601*
N		**109**	**175**	**102**	**317**

[a] C1 Sub-Sample , C2 Sub-Sample, C3 Sub-Sample and C4 Sub-Sample are defined in Table 4.

$PCRD_{it}$	=	$\ln(RD_{it-1}) - \ln(RD_{it-2})$
$CIRD_{it}$	=	$\ln(IRD_{it}/ISALES_{it}) - \ln(IRD_{it-1}/ISALES_{it-1})$
$CCAP_{it}$	=	$\ln(CAP_{it}) - \ln(CAP_{it-1})$
$CSALES_{it}$	=	$\ln(SALES_{it}) - \ln(SALES_{it-1})$
$TOBQ_{it}$	=	(market value of common equity + book value of preferred equity + long-term debt + short-term debt)/Total assets
$CGDP_{it}$	=	$\ln(GDP_{it}) - \ln(GDP_{it-1})$
$SIZE_{it}$	=	$Ln(MVE_{it})$
$DIST\_ARD_{it}$	=	$(EBTARD_{it} - EBTARD_{it-1})/ARD_{it}$
$DIST\_AA_{it}$	=	$(EBTAA_{it} - EBTAA_{it-1})/AA_{it}$
LEV_{it}	=	$(LTD_{it} + STD_{it})/ASSETS_{it}$
FCF_{it}	=	$(CFO_{it}$ - Average $CAP_{it-1}$to $_{it-3})/CA_{it-1}$
ΔARD_{it}	=	$(ARD_{it} - ARD_{it-1})$
ΔAA_{it}	=	$(AA_{it} - AA_{it-1})$

Table 8: Results for C1 Sub-Sample[a]

Panel A: Crosstabs result for the C1 Sub-Sample[a]

C1Sub-Sample[a]	Non-IIIAA firms[b]	IIIAA firms[b]	Total
Non-IIIARD firms[b]	3	17	20
IIIARD firms[b]	4	**85**	89
N	7	102	109
Chi-Square statistics Likelihood Ratio	*2.432*		

[a] C1 Sub-Sample is defined in Table 4.
[b] Non-IIIAA firms = Firms that do not increase income-increasing abnormal accruals;
Non-IIIARD firms = Firms that do not increase income-increasing abnormal R&D;
IIIAA firms = Firms that increase income-increasing abnormal accruals;
IIIARD firms = Firms that increase income-increasing abnormal R&D.
** and* represents significance at 1% and 5% respectively.

Panel B: T-test for the differences in means between ΔARD_{it} and ΔAA_{it}

Differences in means	C1 Sub-Sample[a]
Mean of ΔARD_{it}	2.598
Mean of ΔAA_{it}	4.146
T-value (Mean of ΔAA_{it} > Mean of ΔARD_{it})	-5.184**

[a] C1 Sub-Sample is defined in Table 4.
**and* represents significance at 1% and 5% respectively.

Panel C: Hausman test for simultaneity versus sequentiality of ΔARD_{it} and ΔAA_{it} in the C1 Sub-Sample[a]

$$\Delta ARD_{it} = \alpha_0 + \beta_1 \Delta AA_{it} + \beta_2 P\_\Delta AA_{it} + \varepsilon_{it} \quad (3)$$
$$\Delta AA_{it} = \alpha_0 + \beta_1 \Delta ARD_{it} + \beta_2 P\_\Delta ARD_{it} + \varepsilon_{it} \quad (4)$$

C1 Sub-Sample[a]	ΔARD_{it} equation (N=109)		ΔAA_{it} equation (N=109)	
Variables	Coefficient	P-value	Coefficient	P-value
ΔAA_{it}	0.397	0.020		
ΔARD_{it}			0.208	0.065
$P\_\Delta AA_{it}$	0.245	0.147		
$P\_\Delta ARD_{it}$			0.521	0.000
Hausman Test				
1st stage adj. R^2(%)		77.2		56.6
2nd stage adj. R^2(%)		37.9		47.4
P-value for Hausman test		0.147		0.000

[a] C1 Sub-Sample is defined in Table 4.

Table 9: Results for C2 Sub-Sample[a]

Panel A: Crosstabs result for C2 Sub-Sample[a]

C2 Sample[a]	Non-IIIAA$_{it}$ firms[b]	IIIAA$_{it}$ firms[b]	Total
Non-IIIARD firms[b]	0	27	27
IIIARD firms[b]	0	**148**	148
N	0	175	175
Chi-Square statistics Likelihood Ratio	*No results*		

[a] C2 Sub-Sample is defined in Table 4.
[b] Non-IIIAA firms = Firms that do not increase income-increasing abnormal accruals;
Non-IIIARD firms = Firms that do not increase income-increasing abnormal R&D;
IIIAA firms = Firms that increase income-increasing abnormal accruals;
IIIARD firms = Firms that increase income-increasing abnormal R&D.
**and* represents significance at 1% and 5% respectively.

Panel B: T-test for the differences in means between ΔARD_{it} and ΔAA_{it}

Differences in means	C2 Sub-Sample[a]
Mean of ΔARD_{it}	2.259
Mean of ΔAA_{it}	5.536
T-value (Mean of ΔAA_{it} > Mean of ΔARD_{it})	-11.815**

[a] C2 Sub-Sample is defined in Table 4.
**and* represents significance at 1% and 5% respectively.

Panel C: Hausman test for simultaneity versus sequentiality of ΔARD_{it} and ΔAA_{it} in the C2 Sub-Sample[a]

$$\Delta ARD_{it} = \alpha_0 + \beta_1 \Delta AA_{it} + \beta_2 P\_\Delta AA_{it} + \varepsilon_{it} \quad (3)$$
$$\Delta AA_{it} = \alpha_0 + \beta_1 \Delta ARD_{it} + \beta_2 P\_\Delta ARD_{it} + \varepsilon_{it} \quad (4)$$

C2 Sub-Sample[a]	ΔARD_{it} equation (N=175)		ΔAA_{it} equation (N=175)	
Variables	Coefficient	P-value	Coefficient	P-value
ΔAA_{it}	0.435	0.000		
ΔARD_{it}			0.301	0.000
$P\_\Delta AA_{it}$	0.265	0.005		
$P\_\Delta ARD_{it}$			0.509	0.000
Hausman Test				
1st stage adj. R^2(%)		59.7		41.8
2nd stage adj. R^2(%)		43.5		55.1
P-value for Hausman test		0.005		0.000

[a] C2 Sub-Sample is defined in Table 4.

Table 10: Results for C3 Sub-Sample[a]

Panel A: Crosstabs result for the C3 Sub-Sample[a]

C3 Sub-Sample[a]	Non-IIIAA firms[b]	IIIAA firms [b]	Total
Non-IIIARD firms[b]	5	17	22
IIIARD firms[b]	39	**41**	80
N	44	58	102
Chi-Square statistics			
Likelihood Ratio	*5.039**		

[a] C3 Sub-Sample is defined in Table 4.

[b] Non-IIIAA firms = Firms that do not increase income-increasing abnormal accruals;
Non-IIIARD firms = Firms that do not increase income-increasing abnormal R&D;
IIIAA firms = Firms that increase income-increasing abnormal accruals;
IIIARD firms = Firms that increase income-increasing abnormal R&D.

**and* represents significance at 1% and 5% respectively.

Panel B: T-test for the differences in means between ΔARD_{it} and ΔAA_{it}

Differences in means	C3 Sub-Sample[a]
Mean of ΔARD_{it}	1.040
Mean of ΔAA_{it}	0.494
T-value (Mean of ΔAA_{it} >Mean of ΔARD_{it})	1.291

[a] C3 Sub-Sample is defined in Table 4.

** and* represents significance at 1% and 5% respectively.

Panel C: Hausman test for simultaneity versus sequentiality of ΔARD_{it} and ΔAA_{it} in the C3 Sub-Sample[a]

$$\Delta ARD_{it} = \alpha_0 + \beta_1 \Delta AA_{it} + \beta_2 P\_\Delta AA_{it} + \varepsilon_{it} \quad (3)$$
$$\Delta AA_{it} = \alpha_0 + \beta_1 \Delta ARD_{it} + \beta_2 P\_\Delta ARD_{it} + \varepsilon_{it} \quad (4)$$

C3 Sub-Sample[a]	ΔARD_{it} equation (N=102)		ΔAA_{it} equation (N=102)	
Variables	Coefficient	P-value	Coefficient	P-value
ΔAA_{it}	-0.554	0.000		
ΔARD_{it}			-0.527	0.000
$P\_\Delta AA_{it}$	0.156	0.142		
$P\_\Delta ARD_{it}$			0.115	0.269
Hausman Test				
1st stage adj. R^2(%)		22.3		18.4
2nd stage adj. R^2(%)		22.0		21.2
P-value for Hausman test		0.142		0.269

[a] C3 Sub-Sample is defined in Table 4.

Table 11: Results for C4 Sub-Sample[a]

Panel A: Crosstabs result for the C4 Sub-Sample[a]

C4 Sub-Sample[a]	Non-IIIAA firms [b]	IIIAA firms[b]	Total
Non-IIIARD firms[b]	4	74	78
IIIARD firms[b]	20	**219**	239
N	24	293	317
Chi-Square statistics Likelihood Ratio	*0.955*		

[a] C4 Sub-Sample is defined in Table 4.

[b] Non-IIIAA firms = Firms that do not increase income-increasing abnormal accruals;
Non-IIIARD firms = Firms that do not increase income-increasing abnormal R&D;
IIIAA firms = Firms that increase income-increasing abnormal accruals;
IIIARD firms = Firms that increase income-increasing abnormal R&D.

**and* represents significance at 1% and 5% respectively.

Panel B: T-test for the differences in means between ΔARD_{it} and ΔAA_{it}

Differences in means	C4 Sub-Sample[a]
Mean of ΔARD_{it}	1.426
Mean of ΔAA_{it}	4.635
T-value (Mean of ΔAA_{it} >Mean of ΔARD_{it})	-9.857**

[a] C4 Sub-Sample is defined in Table 4.

**and* represents significance at 1% and 5% respectively.

Panel C: Hausman test for simultaneity versus sequentiality of ΔARD_{it} and ΔAA_{it} in the C4 Sub-Sample[a]

$$\Delta ARD_{it} = \alpha_0 + \beta_1 \Delta AA_{it} + \beta_2 P\_\Delta AA_{it} + \varepsilon_{it} \quad (3)$$
$$\Delta AA_{it} = \alpha_0 + \beta_1 \Delta ARD_{it} + \beta_2 P\_\Delta ARD_{it} + \varepsilon_{it} \quad (4)$$

C4 Sub-Sample[a]	ΔARD_{it} equation (N=317)		ΔAA_{it} equation (N=317)	
Variables	Coefficient	P-value	Coefficient	P-value
ΔAA_{it}	0.138	0.086		
ΔARD_{it}			0.072	0.125
$P\_\Delta AA_{it}$	0.278	0.001		
$P\_\Delta ARD_{it}$			0.635	0.000
Hausman Test				
1st stage adj. R^2(%)		56.6		16.3
2nd stage adj. R^2(%)		15.0		44.4
P-value for Hausman stat		0.001		0.000

[a] C4 Sub-Sample is defined in Table 4.

Table12: Summary of the results

Hypotheses[1]	Expectations	Hypotheses supported	Actual findings
H1a	Number of firms with $IIIAA_{it}$ > Number of firms with $IIIARD_{it}$	No	The number of firms with $IIIARD_{it}$ and $IIIAA_{it}$ in largest amounts.
H1b	Mean of ΔAA_{it} > Mean of ΔARD_{it}	Yes	Mean of ΔAA_{it} > Mean of ΔARD_{it}
H1c	Sequentiality, and ΔAA_{it} substitutes ΔARD_{it}.	No	Simultaneity, but ΔAA_{it} substitutes ΔARD_{it}.
H2a	Number of firms with $IIIAA_{it}$ and $IIIARD_{it}$ > Number of firms with $IIIARD_{it}$ & Number of firms with $IIIAA_{it}$ and $IIIARD_{it}$ > Number of firms with $IIIAA_{it}$	Yes	Number of firms with $IIIAA_{it}$ and $IIIARD_{it}$ > Number of firms with $IIIARD_{it}$ & Number of firms with $IIIAA_{it}$ and $IIIARD_{it}$ > Number of firms with $IIIAA_{it}$
H2b	Mean of ΔAA_{it} is not different from Mean of ΔARD_{it}.	No	The mean of ΔAA_{it} is larger than the mean of ΔARD_{it}.
H2c	Simultaneity and ΔAA_{it} complements ΔARD_{it}.	Yes	Simultaneity and ΔAA_{it} complements ΔARD_{it}.
H3a	Number of firms with $IIIAA_{it}$ > Number of firms with $IIIARD_{it}$	No	The number of firms with $IIIARD_{it}$ and $IIIAA_{it}$ in largest amounts.
H3b	Mean of ΔAA_{it} >Mean of ΔARD_{it}	No	Mean of ΔAA_{it} is not different from Mean of ΔARD_{it}.
H3c	Sequentiality, and ΔAA_{it} substitutes ΔARD_{it}.	Partially support	Sequentiality, but either ΔAA_{it} substitutes ΔARD_{it} or ΔARD_{it} substitutes ΔAA_{it}.
H4a	Number of firms with $IIIAA_{it}$ > Number of firms with $IIIARD_{it}$.	No	The number of firms with $IIIARD_{it}$ and $IIIAA_{it}$ in largest amounts.
H4b	Mean of ΔAA_{it} > Mean of ΔARD_{it}	Yes	Mean of ΔAA_{it} > Mean of ΔARD_{it}
H4c	Sequentiality, and ΔAA_{it} substitutes ΔARD_{it}.	No	No conclusion.

[1] $IIIAA_{it}$ = Increase income-increasing abnormal accruals;
$IIIARD_{it}$ = Increase income-increasing abnormal R&D;
ΔAA_{it} = Change in abnormal accruals;
ΔARD_{it} = Change in abnormal R&D.

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Appendix A: Results of R&D model for year *t*

$$RD_{it}/A_{it-1} = \alpha_0 + \alpha_1[RD_{it-1}/A_{it-1}] + \alpha_2[Funds_{it}/A_{it-1}] + \alpha_3[TobinsQ_{it}] + \alpha_4[CapitalExp_{it}/A_{it-1}] + \alpha_5\sum_{I=1}^{48} Industry + \alpha_6\sum_{Y=1}^{7} Year + \varepsilon_{it} \quad (5)$$

Where t = 1999 to 2005

R&D Model	Standardized Coefficient	T-Value	P-Value
Intercept		1.859	*0.063*
RD_{it-1}/A_{it-1}	0.329	246.980	*0.000*
$Funds_{it}/A_{at-1}$	-0.442	-68.183	*0.000*
$TobinsQ_{it}$	0.025	25.942	*0.000*
$CapitalExp_{it}/A_{it-1}$	0.476	74.214	*0.000*
Y99	0.001	0.527	*0.598*
Y00	0.004	2.936	*0.003*
Y01	0.001	0.535	*0.593*
Y02	0.001	0.533	*0.594*
Y03	0.001	0.720	*0.471*
Y04	0.001	0.755	*0.450*
Food	-0.001	-1.002	*0.317*
Agri	0.000	-0.272	*0.786*
Beer	0.002	2.369	*0.018*
Smoke	0.000	-0.399	*0.690*
Toys	-0.001	-0.603	*0.546*
Fun	-0.001	-0.570	*0.569*
Books	0.000	-0.396	*0.692*
Hshld	-0.001	-1.147	*0.252*
Clths	-0.001	-0.574	*0.566*
Hlth	0.000	-0.390	*0.696*
MedEq	-0.002	-1.500	*0.134*
Chems	-0.001	-1.208	*0.227*
Drugs	0.001	0.743	*0.458*
Rubber	-0.001	-0.688	*0.491*
Txtls	0.000	-0.497	*0.619*
BldMt	-0.001	-1.001	*0.317*
Cnstr	0.000	-0.115	*0.909*
Steel	-0.001	-0.868	*0.385*
FabPr	-0.001	-0.568	*0.570*
Mach	-0.002	-1.912	*0.056*
ElcEq	0.000	-0.431	*0.666*
Misc	-0.001	-0.763	*0.446*
Aero	-0.001	-0.692	*0.489*
Ships	0.000	-0.496	*0.620*

G	-0.001	-0.593	*0.553*
Mines	0.000	-0.390	*0.696*
Enrgy	-0.001	-1.144	*0.253*
PerSv	0.000	-0.329	*0.742*
Comps	-0.001	-1.218	*0.223*
Chips	0.000	0.156	*0.876*
LabEq	0.000	0.252	*0.801*
Paper	-0.001	-1.074	*0.283*
Boxes	-0.001	-1.215	*0.225*
Whlsl	-0.001	-0.612	*0.541*
Retail	0.000	-0.425	*0.671*
Autos	-0.002	-1.720	*0.085*
Meals	0.000	-0.267	*0.789*
adj R^2(%)	**98.7**		
F-Value	**22888.130**		
(P-Value)	***(0.000)***		
N	**14056**		

Appendix B: Results of R&D model for year *t-1*

$$RD_{it}/A_{it-1} = \alpha_0 + \alpha_1[RD_{it-1}/A_{it-1}] + \alpha_2[Funds_{it}/A_{it-1}] + \alpha_3[TobinsQ_{it}] + \alpha_4[CapitalExp_{it}/A_{it-1}] + \alpha_5\sum_{I=1}^{48} Industry + \alpha_6\sum_{Y=1}^{7} Year + \varepsilon_{it} \quad (5)$$

Where t = 1998 to 2004

R&D Model	Standardized Coefficient	T-Value	P-Value
Intercept		0.691	*0.490*
RD_{it-1}/A_{it-1}	0.709	24.006	*0.000*
$Funds_{it}/A_{it-1}$	-0.006	-0.995	*0.320*
$TobinsQ_{it}$	-0.002	-0.060	*0.952*
$CapitalExp_{it}/A_{it-1}$	0.061	9.648	*0.000*
Y99	0.000	-0.054	*0.957*
Y00	0.002	0.284	*0.777*
Y01	0.001	0.139	*0.889*
Y02	-0.002	-0.201	*0.841*
Y03	-0.003	-0.417	*0.677*
Y04	0.012	1.437	*0.151*
Food	-0.002	-0.335	*0.737*
Agri	-0.001	-0.085	*0.933*
Beer	0.000	-0.059	*0.953*
Smoke	0.000	-0.072	*0.942*
Toys	-0.001	-0.174	*0.861*
Fun	-0.001	-0.123	*0.902*
Books	-0.001	-0.214	*0.830*
Hshld	-0.003	-0.379	*0.704*
Clths	-0.002	-0.235	*0.814*
Hlth	-0.001	-0.096	*0.923*
MedEq	-0.004	-0.495	*0.621*
Chems	0.029	4.229	*0.000*
Drugs	0.004	0.506	*0.613*
Rubber	-0.002	-0.332	*0.740*
Txtls	-0.001	-0.176	*0.860*
BldMt	-0.003	-0.389	*0.697*
Cnstr	-0.001	-0.104	*0.917*
Steel	-0.002	-0.347	*0.729*
FabPr	-0.001	-0.189	*0.850*
Mach	-0.005	-0.648	*0.517*
ElcEq	-0.003	-0.389	*0.697*
Misc	-0.002	-0.271	*0.787*
Aero	-0.003	-0.464	*0.643*
Ships	-0.001	-0.189	*0.850*

G	-0.001	-0.196	*0.844*
Mines	-0.001	-0.139	*0.889*
Enrgy	-0.003	-0.409	*0.683*
PerSv	-0.001	-0.102	*0.919*
Comps	-0.003	-0.342	*0.732*
Chips	-0.005	-0.580	*0.562*
LabEq	-0.005	-0.666	*0.506*
Paper	-0.003	-0.406	*0.684*
Boxes	-0.002	-0.273	*0.785*
Whlsl	-0.001	-0.194	*0.846*
Retail	0.001	0.119	*0.905*
Autos	-0.003	-0.489	*0.625*
Meals	-0.001	-0.139	*0.890*
adj R^2(%)	**50. 5**		
F-Value	**270.038**		
(P-Value)	***(0.000)***		
N	**12374**		

Appendix C: Results for DSS (1995) model for year *t*

$$TA_{it}/A_{it-1} = \alpha_0[1/A_{it-1}] + \beta_1[(\Delta S_{it}-\Delta REC_{it})/A_{it-1}] + \beta_2[PPE_{it}/A_{it-1}] + \beta_3\sum_{I=1}^{48} Industry + \beta_4\sum_{Y=1}^{7} Year + \varepsilon_{it} \quad (6)$$

Where t = 1999 to 2005

DSS Model	Standardized Coefficient	T-value	P-value
$1/A_{it-1}$	-0.161	-35.670	*0.000*
$(\Delta S_{it}-\Delta REC_{it})/A_{it-1}$	0.109	22.448	*0.000*
PPE_{it}/A_{it-1}	-0.882	-231.013	*0.000*
Y00	0.001	0.363	*0.717*
Y01	0.003	0.753	*0.451*
Y02	0.003	0.646	*0.518*
Y03	0.004	1.063	*0.288*
Y04	-0.005	-1.336	*0.181*
Y05	0.004	0.902	*0.367*
Food	-0.001	-0.309	*0.757*
Agri	0.000	-0.030	*0.976*
Beer	0.003	1.074	*0.283*
Smoke	0.000	-0.084	*0.933*
Toys	0.000	-0.098	*0.922*
Fun	-0.001	-0.206	*0.837*
Books	0.000	-0.061	*0.951*
Hshld	-0.001	-0.189	*0.850*
Clths	0.000	-0.073	*0.942*
Hlth	-0.001	-0.226	*0.821*
MedEq	-0.002	-0.493	*0.622*
Chems	-0.013	-4.096	*0.000*
Drugs	-0.003	-0.880	*0.379*
Rubber	0.000	-0.099	*0.921*
Txtls	0.000	-0.063	*0.950*
BldMt	-0.001	-0.220	*0.826*
Cnstr	0.000	-0.031	*0.975*
Steel	0.000	-0.045	*0.964*
FabPr	0.000	-0.072	*0.942*
Mach	-0.001	-0.255	*0.798*
ElcEq	0.000	-0.153	*0.878*
Misc	-0.001	-0.281	*0.779*
Aero	0.000	-0.159	*0.873*
Ships	0.000	-0.048	*0.962*
G	0.000	-0.046	*0.963*
Mines	0.000	-0.020	*0.984*
Enrgy	0.000	-0.022	*0.983*
PerSv	0.000	-0.136	*0.892*
BusSv	-0.007	-1.729	*0.084*

Comps	-0.002	-0.569	*0.570*
Chips	-0.002	-0.552	*0.581*
LabEq	-0.002	-0.478	*0.633*
Paper	0.000	-0.087	*0.931*
Boxes	0.000	-0.108	*0.914*
Whlsl	0.000	-0.124	*0.901*
Retail	-0.001	-0.262	*0.794*
Autos	-0.001	-0.293	*0.769*
Meals	0.000	-0.001	*0.999*
adj R^2(%)	**82.4**		
F-Value	**2036.823**		
(P-Value)	***(0.000)***		
N	**20477**		

Appendix D: Results for DSS (1995) model for year *t-1*

$$TA_{it}/A_{it-1} = \alpha_0[1/A_{it-1}] + \beta_1[(\Delta S_{it}-\Delta REC_{it})/A_{it-1}] + \beta_2[PPE_{it}/A_{it-1}] + \beta_3\sum_{I=1}^{48} Industry + \beta_4\sum_{Y=1}^{7} Year + \varepsilon_{it} \quad (6)$$

Where t = 1998 to 2004

DSS Model	Standardized Coefficient	T-value	P-value
$1/A_{it-1}$	-0.150	-36.265	*0.000*
$(\Delta S_{it}-\Delta REC_{it})/A_{it-1}$	-0.300	-39.271	*0.000*
PPE_{it}/A_{it-1}	-0.518	-72.183	*0.000*
Y00	0.004	0.756	*0.450*
Y01	-0.001	-0.272	*0.785*
Y02	0.005	1.032	*0.302*
Y03	0.005	1.083	*0.279*
Y04	0.007	1.434	*0.151*
Y99	0.007	1.328	*0.184*
Food	-0.001	-0.215	*0.830*
Agri	0.000	-0.093	*0.926*
Beer	0.000	0.099	*0.921*
Smoke	0.000	0.012	*0.990*
Toys	-0.001	-0.307	*0.759*
Fun	-0.001	-0.233	*0.816*
Books	0.000	-0.116	*0.908*
Hshld	-0.001	-0.374	*0.708*
Clths	0.000	0.135	*0.893*
Hlth	-0.001	-0.254	*0.800*
MedEq	0.000	-0.111	*0.911*
Chems	-0.019	-4.851	*0.000*
Drugs	-0.002	-0.445	*0.656*
Rubber	-0.001	-0.282	*0.778*
Txtls	-0.001	-0.170	*0.865*
BldMt	-0.001	-0.394	*0.694*
Cnstr	0.000	-0.098	*0.922*
Steel	-0.001	-0.246	*0.806*
FabPr	0.000	-0.117	*0.907*
Mach	-0.003	-0.637	*0.524*
ElcEq	-0.001	-0.356	*0.722*
Misc	-0.002	-0.516	*0.606*
Aero	0.000	0.037	*0.970*
Ships	0.000	-0.114	*0.909*
G	0.000	-0.096	*0.923*
Mines	0.000	-0.116	*0.908*
Enrgy	-0.001	-0.314	*0.754*
PerSv	0.000	-0.099	*0.921*
BusSv	-0.013	-2.294	*0.022*

Comps	-0.003	-0.722	*0.471*
Chips	-0.004	-0.836	*0.403*
LabEq	-0.006	-1.521	*0.128*
Paper	-0.001	-0.289	*0.772*
Boxes	0.000	-0.114	*0.910*
Whlsl	-0.001	-0.373	*0.709*
Retail	0.002	0.540	*0.589*
Autos	-0.002	-0.435	*0.664*
Meals	0.000	-0.123	*0.902*
adj R^2(%)	**76.0**		
F-Value	**1297.518**		
(P-Value)	***(0.000)***		
N	**19248**		

Appendix E: Industry classification

I use four-digit SIC codes to assign firms-year observations into 48 industries by following Fama and French (1997). The industries short name, long name, and SIC codes are:

Agric	Agriculture	0100-0799, 2048-2048
Food	Food Products	2000-2046, 2050-2063, 2070-2079 2090-2095, 2098-2099
Soda	Candy and Soda	2064-2068, 2086-2087, 2096-2097
Beer	Alcoholic Beverages	2080-2085
Smoke	Tobacco Products	2100-2199
Toys	Recreational Products	0900-0999, 3650-3652, 3732-3732, 3930-3949
Fun	Entertainment	7800-7841, 7900-7999
Books	Printing and Publishing	2700-2749, 2770-2799
Hshld	Consumer Goods	2047-2047, 2391-2392, 2510-2519 2590-2599, 2840-2844, 3160-3199 3229-3231, 3260-3260, 3262-3263 3269-3269, 3630-3639, 3750-3751 3800-3800, 3860-3879, 3910-3919 3960-3961, 3991-3991, 3995-3995
Clths	Apparel	2300-2390, 3020-3021, 3100-3111. 3130-3159, 3965-3965
Hlth	Healthcare	8000-8099
MedEq	Medical Equipment	3693-3693, 3840-3851
Drugs	Pharmaceutical Products	2830-2836
Chems	Chemicals	2800-2829, 2850-2899
Rubbr	Rubber and Plastic Products	3000-3000, 3050-3099
Txtls	Textiles	2200-2295, 2297-2299, 2393-2395 2397-2399
BldMt	Construction Materials	0800-0899, 2400-2439, 2450-2459 2490-2499, 2950-2952, 3200-3219 3240-3259, 3261-3261, 3264-3264, 3270-3299, 3420-3442, 3446-3452 3490-3499, 3996-3996
Cnstr	Construction	1500-1549, 1600-1699, 1700-1799
Steel	Steel Works, Etc.	3300-3369, 3390-3399

FabPr	Fabricated Products	3400-3400, 3443-3444, 3460-3479
Mach	Machinery	3510-3536, 3540-3569, 3580-3599
ElcEq	Electrical Equipment	3600-3621, 3623-3629, 3640-3646, 3648-3649, 3660-3660, 3691-3692, 3699-3699
Misc	Miscellaneous	3900-3900, 3990-3990, 3999-3999, 9900-9999
Autos	Automobiles and Trucks	2296-2296, 2396-2396, 3010-3011, 3537-3537, 3647-3647, 3694-3694, 3700-3716, 3790-3792, 3799-3799
Aero	Aircraft	3720-3729
Ships	Shipbuilding, Railroad Eq	3730-3731, 3740-3743
G	Defence	3480-3489, 3760-3769, 3795-3795
Gold	Precious Metals	1040-1049
Mines	Non-metallic Mining	1000-1039, 1060-1099, 1400-1499
Coal	Coal	1200-1299
Enrgy	Petroleum and Natural Gas	1310-1389, 2900-2911, 2990-2999
Util	Utilities	4900-4999
Telcm	Telecommunications	4800-4899
PerSv	Personal Services	7020-7021, 7030-7039, 7200-7212 7215-7299, 7395-7395, 7500-7500 7520-7549, 7600-7699, 8100-8199, 8200-8299, 8300-8399, 8400-8499 8600-8699, 8800-8899
BusSv	Business Services	2750-2769, 3993-3993, 7300-7372 7374-7394, 7397-7397, 7399-7399 7510-7519, 8700-8748, 8900-8999
Comps	Computers	3570-3579, 3680-3689, 3695-3695, 7373-7373
Chips	Electronic Equipment	3622-3622, 3661-3679, 3810-3810 3812-3812
LabEq	Measuring and Control Equip	3811-3811, 3820-3830
Paper	Business Supplies	2520-2549, 2600-2639, 2670-2699 2760-2761, 3950-3955
Boxes	Shipping Containers	2440-2449, 2640-2659, 3210-3221, 3410-3412
Trans	Transportation	4000-4099, 4100-4199, 4200-4299, 4400-4499, 4500-4599, 4600-4699 4700-4799
Whlsl	Wholesale	5000-5099, 5100-5199

Rtail	Retail	5200-5299, 5300-5399, 5400-5499, 5500-5599, 5600-5699, 5700-5736 5900-5999
Meals	Restaurants, Hotel, Motel	5800-5813, 5890-5890, 7000-7019 7040-7049, 7213-7213
Banks	Banking	6000-6099, 6100-6199
Insur	Insurance	6300-6399, 6400-6411
RlEst	Real Estate	6500-6553
Fin	Trading	6200-6299, 6700-6799