Earnings Management and IT Investments: An Examination of IT Infrastructure Development

Completed Research Paper

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Abstract

In the context of IT infrastructure development, this paper empirically examines the relationship between IT investments and corporate earnings management. Our results suggest that earnings management undermines the firm’s capability of accomplishing its planned IT investments in infrastructure development. Strategic managers are also likely to manipulate IT infrastructure investments to achieve the goal of earnings management. We further examine how the relationship between IT infrastructure investments and earnings management is influenced by a key aspect of IT governance—decentralization of decision making. Our findings suggest that for firms with more decentralized IT infrastructure decisions, the negative impact of earnings management on the accomplishment of IT infrastructure investments is weaker and IT infrastructure investments are also less likely to be manipulated for the purpose of earnings management. In this regard, our study illustrates an important benefit of decentralized IT governance that has not been documented in the extant literature.

Keywords: IT investment, earnings management, IS governance, IT infrastructure, decentralization

Introduction

Information technology (IT) investments have become a crucial part of capital investments of businesses. Statistics from Bureau of Economic Analysis (BEA) show that in 2012, investment in information processing equipment and software accounted for about 31% of the overall non-residential investment on fixed assets in the United States, totaling $281.8 billion. Given the importance of IT, substantial research attention has been paid to determinants and consequences of IT investments.
Much of the existing research on IT investments utilizes the value-creation perspective or the institutional perspective. Value-creation perspective explains IT investments primarily based on how IT may enhance firm operations, strategies, and performance (e.g., Hitt 1999; Dewan et al. 1998; Kobelsky et al. 2008; Ravichandran and Liu 2011). In contrast, the institutional perspective explains focal firms’ IT investment decisions mainly based on how such decisions are influenced by IT investments of competitors and partners (Ravichandran et al. 2009; Mithas et al. 2013). However, prior research has rarely considered how IT investments may be affected by strategic management behavior, such as earnings management. Agency theories (e.g., Jensen and Meckling 1976) suggest that corporate managers may engage in strategic actions to pursue their own benefits at the expense of firm. For example, in order to meet short-term earnings expectations, managers are often willing to strategically manipulate various business activities and spending at the cost of the firm’s long-term benefits. IT investments are likely to be subject to such strategic management behavior. As a consequence, IT investments are likely to be determined not only by rational value-creation goals and institutional considerations, but also by strategic management behavior, such as earnings management.

This study aims to develop a better understanding of the relationship between firms’ IT investments and earnings management. Earning management (EM) has been defined as managers’ intentional uses of accounting discretion and real business activities to alter financial reports to either mislead stakeholders about the company’s underlying business or to influence outcomes that depend on reported accounting numbers (e.g., Schipper 1989; Healy and Wahlen 1999). Extant literature has documented various motives for managers to engage in EM, such as to improve earnings-based compensation and to enhance investors’ assessment of firm performance (e.g., Healy 1985, Dye 1988; Guidry et al. 1999; Bergstresser and Philippon 2006).

The existing literature distinguishes between two EM strategies: accrual-based earnings management (AEM) and real earnings management (REM), or, manipulation of real business activities. Accrual-based earnings management refers to the purposeful altering of reported earnings by changing the accounting methods or estimates used to present given transactions in the financial statements without altering the underlying real business transactions (Zang 2012). Real earnings management, in contrast, refers to the purposeful altering of reported earnings by manipulating the timing or structuring of real business operations, investment, or transactions, which may have suboptimal business consequences (Graham et al. 2005; Roychowdhury 2006). Examples of real earnings management include the boosting of short-term unsustainable sales through heavy promotions, overproduction to reduce costs of goods sold, and reductions of discretionary expenditure (Roychowdhury 2006; Xu et al. 2007).

Although the early research on EM focused more on AEM, more recent work has illustrated the prevalent use and the important impact of REM (Cohen et al. 2008). IT investments decisions are likely to be affected by REM as the manipulation of real business activities should also interfere with the trajectory of IT development of the firm. The potential negative impact of REM on firm performance may constrain the resources available for IT investments. Moreover, managers may strategically manipulate IT investments itself as part of their REM strategies. For example, managers may cut IT investments as part of discretionary expenditure to boost short-term earnings, as they do with many other types of discretionary spending (e.g., R&D). Because the value of IT is often difficult to be justified in the short-run (Hitt and Brynjolfsson 1996; Tallon et al. 2000) and IT investment is often associated with higher firm risk than other types of capital investment (Dewan et al. 2007), myopic managers who are driven more by short-term earnings performance are likely to sacrifice IT investments for the purpose of meeting earnings targets. Recent media reports imply that Mike Hurd, one of the previous CEOs of H-P, cut H-P’s IT budget from about 4% of revenue to 2% of revenue during the 2003-2010 period (Murphy 2012). Meg Whitman, H-P’s CEO in 2012, noted inadequate investments in "internal software systems that could provide her and other executives with necessary intelligence about how the business is performing” as a reason for poor performance of the company (Worthen and Sherr 2012)

To formally study the relationship between IT investments and REM, we use a special dataset to examine IT infrastructure development by a large sample of US firms over the period 1999-2009. A unique feature of this dataset is that it allows us to observe not only the actual IT infrastructure development in each year, but also the original planned development. Therefore, rather than focusing only on the actual IT investments as in the existing literature (e.g., Kobelsky et al. 2008; Ravichandran et al. 2009), we assess the extent to which firms’ actual IT investments on infrastructure development might fall short of their ex
We develop a measure of accomplished IT investments on infrastructure (AITI), which captures the discrepancy between the firm’s actual IT infrastructure development and their planned level of IT infrastructure development. Our objective is to examine how short-term REM may lower the accomplishment of IT infrastructure investments and make firms forgo their development plans. We first examine whether the engagement in REM in the prior period negatively affects the firm's capability to accomplish more IT infrastructure investments and meet their development plans. We also examine whether managers may forgo their development plans and reduce IT infrastructure investments as part of their REM strategies to boost short-term earnings. In addition, we also examine how the relation between REM and the accomplishment of IT infrastructure investments may be influenced by a key aspect of IT governance, i.e., the decentralization of IT infrastructure decisions.

Our study generates the following important findings. First, the study shows that engaging in REM affects the firm’s capability to realize their planned IT infrastructure development in subsequent periods. The implication is that REM, by interfering with the firm’s normal business processes, may constrain the resources available for IT development in the future. Second, our results provide evidence that investments in IT infrastructure development can be manipulated by managers for the purpose of earnings management. Specifically, the results suggest that the reduction of investments in IT infrastructure development is used by managers as a mechanism to cut current-period discretionary expenditure to achieve goals of REM. Third, our study indicates that the decentralization of IT infrastructure decisions weakens the relation between IT investments in infrastructure development and REM. We find that in firms with more decentralized decision making for IT infrastructure (i.e., more decision rights for IT infrastructure are delegated to business-unit managers), the reduction of IT investments in infrastructure development is associated less with the firm’s REM strategy, and REM also has less impact on the firm’s subsequent IT investments in infrastructure development. These findings suggest decentralized IT governance pattern may shield IT investments from the negative impact of REM.

This study contributes to the existing literature in several ways. First, the study illustrates that IT investments decisions are likely to be affected not just by the value-creation or institutional consideration that have been identified in the IS literature. Reduction in IT investments can be used by myopic or strategic managers as a vehicle to manipulate short-term earnings. Second, the study suggests a potential benefit of decentralized IT governance that has not been documented in the IS governance literature. Decentralized IT governance mitigates the controls of individual managers (especially senior executives) over the entire IT budgeting and makes IT investments subject less to managers’ short-term strategic actions such as earnings management. Third, this study also complements the existing literature on earnings management by showing that IT investments can be as much manipulated for real earnings management, as other types of discretionary expenditure such as advertising and R&D.

Theory and Hypotheses

Background and Theoretical Framework

Although a large body of literature in IS studies the link between IT investments and firm performance (e.g., Hitt and Brynjolfsson 1996; Rai et al. 1997; Bharadwaj et al. 1999; Mithas et al. 2011), relatively fewer studies focus on the determinants of IT investments. In the existing research, the consideration of determinants of IT investments was primarily based on two theoretical perspectives. First, several prior studies adopt value-creation perspective and explain IT investments as a strategy to enhance firm performance (e.g., Kobelsky et al. 2008) and support various aspects, such as operational scale (Harris and Katz 1991), vertical integration and diversification (Hitt 1999; Dewan et al. 1998; Ray et al. 2013). An implicit assumption in these studies is that IT investments decisions are mainly driven by the rational value-creation goals in the interest of the firm. Second, some other studies adopt the institutional perspective and explain IT investments as a consequence of organizational response to environmental and peer pressure (e.g., Ravichandran et al. 2009; Mithas et al. 2013). In these studies, the interest of the firm (e.g., its competitive advantage or social legitimacy), rather than managers’ self-interest, is considered as the key driver of IT investments. In addition to treating IT investments as firm behavior, the IS literature has also recognized the importance of managerial support in IT investments decisions (e.g., Jarvenpaa and Ives 1991; Armstrong and Sambamurthy 1999; Liang et al. 2007). The key perspective is still based on the assumption that managers have aligned incentives with the firm and their support to IT investments.
However, few studies focus on the adverse effects of managers’ self-interest and how IT investments may be manipulated by managers as part of their strategic actions.

This omission is particularly salient because prior studies document criticisms of US managers for being obsessed with short-term earnings performance and related myopic investment behavior under the pressure of the capital markets (Fuller and Jensen 2002; Rappaport 2005), although managers in other country settings may also exhibit similar behaviors. A variety of factors, such as equity compensation (Rappaport 2005), need to raise capital (Bhojraj and Libby 2005), and employment concerns (Graham et al. 2005), drive managers to overweight current earnings performance of their firms, rather than adopt a long-term perspective to improve the future firm value. Such myopic focus results in strategic managerial actions, such as earnings management, to meet short-term earnings targets and induce the capital markets to misprice current earnings without fully considering the underlying economics. Existing research has provided evidence that managers reap private benefits from earnings management. For example, earnings management enables managers to improve their compensation from earning-based bonus (e.g., Healy 1985, Dye 1988; Guidry et al. 1999). Earnings can also be managed to influence stock performance and signal to investors, and eventually benefit managers through their stock and stock option values (e.g., Bergstresser and Philippon 2006).

Managers can manage earnings using two distinct mechanisms: accrual-based earnings management (AEM) and real earnings management (REM), which is also referred to as real activities manipulation (Cohen et al. 2008; Zang 2012). In AEM, managers manipulate reported earnings by exploiting the accounting accruals (e.g., accounts receivables, accounts payables, deferred revenue, prepaid expenses, fixed asset depreciation) to change the presentation of given business activities (Healy and Wahlen 1999; Zang 2012). AEM, however, does not alter the underlying business activities themselves.

In contrast, REM allows managers to manipulate reported earnings by changing the timing or structuring of actual operating, investing, and financing activities (Roychowdhury 2006; Xu et al. 2007). For example, Graham et al. (2005) report in a survey study that 80% of surveyed CFOs would like to cut discretionary expenditure on R&D, advertising, and maintenance to deliver expected earnings, while 55% would postpone new projects to meet earnings targets, even if such delay may cause small loss. Referring back to the H-P example cited earlier, H-P cut its R&D budget from about 5% to 2.4% during the 2003-2010 period, while IBM spent close to 6% during the same period (Worthen 2012).

Existing research suggests that managers make choices between the two earnings management approaches (Cohen et al. 2008; Zang 2012). Compared to AEM, REM is more difficult for stakeholders to detect. As a result, managers have significantly increased the use of REM and decreased the use of AEM after the passage of the Sarbanes-Oxley Act (Cohen et al. 2008). Since REM encompasses various strategies related to different types of real activities (Xu et al. 2007), past studies have examined how REM affects different types of discretionary expenditure, such as research and development (R&D) and advertising, and how the aggregated effect of REM is attributed to these types of discretionary expenditure (Barber and Fairfield 1991; Cohen et al. 2010). However, there has been no clear evidence on how REM may affect IT investments and how managers may also manipulate IT investments for the purpose of earnings management. Our study intends to bridge this gap by specifically considering how IT investments are related to REM.

The relationship between REM and IT investments is likely to be influenced by the governance arrangement of IT. IT governance refers to “specifying the decision rights and accountability framework to encourage desirable behavior in using IT” (Weill and Ross 2004: p. 8). The allocation of IT decision rights, therefore, has been considered as a key aspect of IT governance (e.g., Sambamurthy and Zmud 1999; Weill and Ross 2005; Tiwana 2009; Xue et al. 2011; McElheran 2012), among other aspects of IT governance such as configuration and role of the IT department, how much money firms spend on IT and how IT services are delivered (in-house versus outsourced) (Banker et al. 2011; Han and Mithas 2013; Mithas and Lucas 2010). Large firms can choose between decentralizing more IT decisions to the business unit level and centralizing more IT decisions at the corporate level. Empowerment and control, or autonomy and discipline, are often the factors to be weighed (Gibson and Birkinshaw 2004). The existing literature recognizes that decentralization empowers local business unit managers to better leverage their local information and specialized knowledge in IT decision making (Sambamurthy and Zmud 1999; Tiwana 2009; Xue et al. 2011). However, control is often considered as the advantage of centralization and the existing research has focused less attention to the potential advantage of lack of
control in decentralized settings. Compared to centralization, decentralization results in less control of individual managers (especially top managers) over all processes of decision making. Such less control may also become a constraint that limits the scope of top managers’ strategic behavior. Therefore, it is worthwhile to examine whether decentralized IT decision making weakens the effect of REM on IT investments.

**Hypotheses**

The extant literature on REM (e.g., Roychowdhury 2006) has identified several ways that managers manipulate real business activities, including: (1) generating temporary and unsustainable sales through heavy price discounts or promotions; (2) overproducing products to allocate less overhead to cost of goods sold; (3) aggressively reducing discretionary expenditure, such as that on R&D, advertising, and selling, general and administrative (SG&A) expenses. Since REM involves changing the firm’s underlying operating activities from their normal patterns, it is likely to result in a long-term value-destroying effect (Bhojraj et al. 2009; Zhao et al. 2012) as the short-term abnormal activities may interfere with firms’ sustainable routines and processes. For example, using heavy discounts to boost sales may make consumers expect similar discounts in the future and constrain future profits. Overproduction to reduce short-term costs of goods sold may affect regular management processes and cause additional costs of inventory, maintenance, and distribution in subsequent periods.

The influence of REM on the underlying operations of the firm is likely to undermine the firm’s capability to accomplish its planned investments on IT infrastructure development. When REM interrupts the firm’s sustainable operations and performance, it also constrains the resources available to support IT infrastructure investments that the firm originally planned. For example, costs incurred on the overproduced items that are not recovered in the current period through sales will lead to abnormally low cash flow in the future. Short-term sales boost through heavy promotions may also lower future cash flow by affecting future sales performance. The lower future cash flow should create more resource constraints that prevent firms from accomplishing their planned spending on IT infrastructure. The current-period reduction of discretionary expenses may increase cash flow. However, the abnormal delay and disruption of planned IT investment projects are also likely to incur the cost of discontinuity and affect the firm capability of accomplishing the future plans of IT investments. Considering such potential negative impact, we develop the following hypothesis regarding how REM may lower the firm’s accomplishment of IT infrastructure investments.

**H1:** Engagement in REM makes the firm less able to accomplish its planned IT investments on infrastructure development in the subsequent period.

The reduction of IT investments on infrastructure development may be not only the consequence of REM, but also a strategy used as part of REM. Since IT investments are often considered as discretionary spending (Ravichandran et al. 2009), e.g., as part of SG&A expenses, it is likely to be subject to manipulation in REM. However, in earnings management, managers need to weigh different options which are associated with different costs (Zang 2012). In REM, managers also have options to cut other expenditure, e.g., R&D, advertising and other administrative spending. As the existing literature has documented the significant uses of R&D and advertising reduction (Barber and Fairfield 1991; Cohen et al. 2010), it is not clear if firms also need to significantly cut IT spending as part of their REM, especially when they have predetermined plans to develop their IT infrastructure. Unlike cutting R&D and advertising spending that may only affect certain areas of business, forging IT infrastructure development plans may have a more profound impact on various aspects of business activities. Therefore, it is worthwhile to examine if managers would like to also rely on the cutting of IT infrastructure development to achieve their REM goals.

On the other hand, some features of IT investment also rationalize the reduction of IT expenditure in REM. In REM, managers are more likely to cut discretionary expenses to meet earnings targets when such expenses do not generate immediate revenues or returns (Roychowdhury 2006). The strategic long-term benefits of IT investments are often not fully recognized by corporate executives. For example, a recent study indicates that finance executives show no clear preference towards viewing IT as primarily a tool for adding value against a cost to be managed or (AlixPartners 2014). IT investments are often weighted heavily towards initiatives that simply keep the current businesses running. When managers are under the pressure to meet short-term earnings targets, they are likely to forgo the planned IT initiatives that
may not pay off in the short-run, such as IT infrastructure development. The IS literature also suggests that the real value of IT investments is often difficult to be appropriately assessed and justified using traditional accounting approaches (Tallon et al. 2000). IT investments are also associated with higher uncertainty of firm return compared to other types of capital investments (Dewan et al. 2007). These features may make managers perceive that cutting IT investments is likely to contribute to short-term earnings performance. Forgoing planned IT infrastructure development can be an attractive way to reduce discretionary expenditure as it does not necessarily cause the disposal of existing assets. By cutting discretionary expenditure on IT infrastructure development, managers may reduce the overall discretionary expenditure so as to increase the current-period earnings. When managers cut discretionary expenditure on IT infrastructure to meet their short-term earnings targets, they are more likely to forgo their planned projects on IT infrastructure development and miss their planned levels of IT infrastructure investments. In this regard, the forgoing of planned IT infrastructure investments, which can be captured by the shortfall of IT infrastructure investment relative to the planned level, is likely to be part of the REM strategy of discretionary expenditure reduction. Therefore, we develop the following hypothesis regarding how the accomplishment of IT infrastructure investments is related to the use of REM strategy:

**H2: The less accomplishment of IT infrastructure investments is positively associated with the REM strategy of discretionary expenditure reduction.**

The existing research on REM has considered how organizational choices, such as diversification, may influence the extent of REM (Dhaoui 2008; Rodríguez-Pérez and van Hemmen 2010). The main focus of these studies was on the information asymmetry between managers and external investors. As more complex organizational arrangements (e.g., more diversified and decentralized structures) make the internal business activities less transparent to external investors, managers find it easier to manipulate real activities to realize earnings management (Dhaoui 2008). However, an implicit assumption in prior studies was that decentralization does not affect managers’ capabilities of controlling and manipulating real activities. In addition, prior studies did not directly observe the decentralized decision making processes. In our study, we consider whether IT decision rights are located at the headquarters of the firm (i.e., centralization) or at local business units of the firm (i.e., decentralization). In the decentralized case, top managers often have less control over IT investments decisions than in the centralized case. The less control of top managers on IT budgeting may also have an impact of the extent to which IT investments is used for the purpose of earnings management.

BU managers usually differ from corporate top managers in terms of motives for earning management. Compared to senior corporate executives, business-unit managers receive significantly less stock and options (Guidry et al. 1999). Although they may also benefit from earnings management through bonus compensation, BU managers often concern less about the benefits from stock markets through earnings management (e.g., better stock performance, signals of their management capabilities, reputations, and investor confidence). In this regard, BU managers are less likely to cut their own discretionary spending on IT to meet the overall goals of REM at the corporate level, especially when forgoing or delaying IT infrastructure development projects affects BUs’ own operations.

Decentralized IT decision making pattern also leads to organizational complexity that makes it difficult for top managers to control IT investments across different business units (Sambamurthy and Zmud 1999; McElheran 2012). Different BUs may have heterogeneous IT needs which BU managers are more familiar with (compared to top executives). With decentralized decision making for IT investments, BU managers are therefore likely to prioritize their local IT projects. When REM affects firms’ overall performance, top managers are more likely to first adjust the budgets that are under their controls. If IT decision making is decentralized, top managers may prioritize the adjustments of other types of expenditure that are managed in more centralized ways. BU managers that face local IT needs but are less concerned about the overall firm performance may still prioritize their spending to realize the planned IT infrastructure development. In this regard, REM may have weaker impact on subsequent accomplished IT infrastructure investments in firms with decentralized IT infrastructure decisions.

Top managers without corresponding IT decision rights are also less likely to manipulate IT investments across diverse BUs as a way to realize their firm-level REM. With heterogeneous IT needs, BU managers with decentralized decision rights are also likely to use diverse IT vendors and build various contractual relationships. Therefore, it is harder to reduce IT investments because that may affect vendor relationships and generate complicate impact on the firm’s IT development. Finally, compared to the firm
as a whole, BUs may have relatively smaller scales of IT implementation and deployment. They have less flexibility to reallocate resources and postpone IT projects, and absorb the negative effects of IT investments reduction. Therefore, we expect that in firms with more decentralized decision making on IT infrastructure, the reduction of IT infrastructure spending is used less as a way for REM. Specifically, the positive relationship between accomplished IT investments on infrastructure development and abnormal discretionary expenditure is weaker in firms with more decentralized decision making on IT infrastructure.

H3a: The negative association between REM and subsequent accomplished IT infrastructure investments is weaker in firms with more decentralized IT infrastructure decisions;

H3b: The positive association between abnormal discretionary expenditure and accomplished IT infrastructure investments is weaker in firms with more decentralized IT infrastructure decisions.

Method

We obtain firm-level data on planned and realized IT infrastructure development from the Computer Intelligence (CI) database maintained by the company Harte-Hanks. CI database has been recognized as an authoritative source of firm-level and establishment-level IT data, and has been used extensively in prior studies (e.g., Zhu and Kraemer 2002; Forman 2005). We obtain from CI database a sample consisting of 3961 unique firms over the period 1999-2009. After matching with the Compustat and CRSP databases, our final sample includes 24,122 firm-year observations. The measurement of key variables is as follows.

Accomplished IT investments on Infrastructure Development (AITI). In this study, we follow the recent studies in IT business value literature (e.g., Chwelos et al. 2010; Kleis et al. 2012) by considering the development of three types of IT infrastructure components: namely decentralized computing equipment (measured by the total number of PCs and workstations), centralized computing equipment (measured by the total number of servers), and network communication equipment (measured by the total number of network hubs and routers). In every year, CI database records the numbers of these three types of IT infrastructure components that firms plan to increase in the next year. CI database also records the actual numbers of these components in every year. For each of these three types of IT infrastructure components, we construct a measure of accomplished IT investment as \[
\frac{\text{(realized } \Delta IT_t) - \text{(planned } \Delta IT_t)}{IT_{t-1}},
\] where \(IT\) represents the number of each of the three types of components. A high level of this measure means that the firm accomplishes more IT infrastructure investments relative to its development plans. A positive (negative) value means that the firm exceeds (fall short of) the original plan in making IT infrastructure investments. The three individual measures exhibit good internal consistency reliability, with a Cronbach's Alpha of 0.720. We then use factor analysis to construct a composite measure (using factor analysis) that combines the accomplished development in all of these three IT infrastructure areas.

Real Earnings Management (REM). REM is defined as management actions that deviate from normal business practices undertaken to strategically meet or beat certain earnings thresholds (Roychowdhury 2006). The existing accounting literature (e.g., Roychowdhury 2006; Cohen et al. 2008; Kim et al. 2012) has extensively used three measures of REM: (1) abnormal cash flows from operations (ABCF), (2) abnormal production costs (ABPC), and (3) abnormal discretionary expenses (ABDX). These measures are captured by the residuals from the corresponding regression models estimated by year and the 2-digit NAICS industry (more details in Table 1). The underlying idea is that when firms engage in REM to meet earnings targets, they are likely to incur abnormally lower levels of cash flows (e.g., due to heavy promotions to boost revenue), higher levels of production costs (e.g., due to overproduction), and lower levels of discretionary expenditure (e.g., due to aggressive cut of discretionary spending). Considering the expected directions of these three individual measures, the existing studies have also used a combined measure of REM (denoted as REM) by aggregating the three individual measures in a linear way, i.e., \(REM = ABCF + ABPC - ABDX\) (Cohen et al. 2008; Kim et al. 2012). This stream of literature has also validated these measures by constantly comparing between so-called “suspect firm-years” and other firm-years. Suspect firm-years are observations in which firms just met the critical benchmarks of zero earnings or prior years’ earnings numbers. Firms are likely to engage in REM in these observations as they have strong incentives to meet these critical benchmarks. The literature has verified that the measure of REM has higher values in suspect firm-years than in other firm-years (Cohen et al. 2008; Kim et al.
2012). Therefore, in this study, we follow this stream of literature to use this aggregate measure of REM, with higher levels of this measure representing more REM. We have also used the same approach in this stream of literature to confirm that this REM measure has significantly higher values in suspect firm-year than in other firm-years in our sample.

**IT Decentralization (ITDEC).** In this study, we consider IT decentralization as the extent to which firms delegate the decision rights of IT investments to local establishments (i.e., business units), rather than keep these rights at the corporate IT units. Following prior studies (Xue et al. 2011; McElheran 2012), we use establishment-level data from the CI database to assess the decentralization of IT infrastructure decisions. The CI database records three types of IT infrastructure decisions for each establishment: PC/workstation decisions, server decisions, and network decisions. For each decision, the CI database indicates whether it is made by the headquarters or by the establishment itself. We therefore first develop three establishment-level measures for these three decisions, each with a value of 1 (0) if the corresponding decision is made by the establishment itself (made by the headquarters). We aggregate the establishment-level measures, weighted by the establishment sizes (measured by employee counts), to develop firm-level measures for each decision. The three firm-level measures of IT infrastructure decentralization exhibit reasonably good internal consistency reliability, with a Cronbach’s Alpha of 0.762. We then use factor analysis to develop a composite measure of overall IT decentralization. A high level of the measure means that the firm adopts a more decentralized pattern in its IT infrastructure governance.

We also follow prior studies on IT investments (e.g., Kobelsky et al. 2008) and earnings management (e.g., Kim et al. 2012) to include a set of control variables that may provide rival explanations for realized IT investments and REM. In examining realized IT increase, we first include a measure of *IT intensity (ITINT)* to capture potentially heterogeneous IT needs across organizations. We measure each firm’s number of PCs/workstations per employee, number of servers per employee, and number of network equipment per employee. Based on these three measures (with a Cronbach’s Alpha of 0.706), we also use factor analysis to develop a composite measure of overall IT intensity. Second, we include *advertising expenditure (ADV)*, *R&D expenditure (RND)*, and *capital expenditure (CAPX)*, as these control variables capture how firms may allocate discretionary expenditure resources to other firm strategies and therefore potentially influence IT investments. We also include lagged values of several firm characteristics that are likely to be the determinants of planned and actual IT investments (Kobelsky et al. 2008). These firm characteristics include: (1) *industry-adjusted return-on-asset (AROA)*, as defined as the difference between firm ROA and the corresponding 4-digit NAICS industry-average ROA, to control for firm performance; (2) *firm leverage (LEVR)*, as measured by total debts to total assets, to control for potential constraints on investment budget; (3) *market-to-book (MTB)* ratio, as measured by total market value to book value of equity, to control for potential long-term growth opportunities; (4) *diversification (DIVR)*, as measured by the entropy measure as in Palepu (1985), as a control for IT needs for internal coordination; (5) *firm size (SIZE)*, as measured by nature log value of total employees, to control for operational scale; (6) *sales growth (SGRW)*, as measured by the natural log value of one-year sales growth rate, to control for potential IT needs or competing cash flow needs to sustain operational expansion; (7) *size growth (SZGW)*, as measured by the natural logarithm of one-year growth rate of employees, to control for organizational growth that may need more IT; and (8) *surplus cash (SPLS)*, as measured by cash flow from asset-in-place to total assets (Richardson 2006), to control for higher availability of investment resources.

In studying how manipulation of IT infrastructure investments may contribute to real earnings management, we include the abovementioned control variables of firm characteristics. We also include *Abnormal Accruals (ABA)* as a control for the potential accrual-based earning management used by firms. Both discretionary accruals and real activities manipulation are important approaches of earnings management, and firms may choose between these two approaches (Cohen et al. 2008; Zang 2012). Therefore, we include ABA as a control variable in the model on real activities manipulation (as specified below). Following the existing literature (Roychowdhury 2006; Cohen et al. 2008; Kim et al. 2012), ABA is also measured by the residuals from the corresponding industry-year regression model as specified in the prior literature on earnings management (more details in Table 1).

Table 1 presents that definition and descriptive statistics of all variables. The variable correlation is not presented here to conserve space, but is available upon request. Table 1 shows that the mean values of
ABCF and ABPC are 0.065 and -0.081, suggesting that on average, our sample of firms do not significantly engage in earnings management using sales manipulation (which results in abnormally low levels of cash flow) and overproduction (which results in abnormally high levels of production costs). However, the negative mean value of ABDX (-0.056) indicates that firms on average engage in earnings management by cutting discretionary expenses. The negative mean value of the composite measure REM suggests that on average, firms do not engage in significant earning management. These results are consistent with other studies on REM using large samples over the similar time periods (e.g., Kim et al. 2012). Table 1 also shows that the mean value of AITI is 0.018, which means that our sample of firms, on average, exceed their original plans by about 1.8% in increasing their IT infrastructure implementation. This indicates that in general, these firms are able to realize their planned IT infrastructure development. The mean value 0.587 of ITDEC suggests that on average, the decision making on IT infrastructure is moderately decentralized in these firms.

Empirical Models

To examine how REM may negatively affect firms’ capabilities to accomplish their planned IT investments on infrastructure development, we specify the following model:

\[
\begin{align*}
\text{AITI}_t &= \alpha_0 + \alpha_1 \text{REM}_{t-1} + \alpha_2 \text{ITDEC}_t + \alpha_3 \text{ITDEC}_t \times \text{REM}_{t-1} + \alpha_4 \text{ITINT}_t + \alpha_5 \text{ADV}_t + \alpha_6 \text{RND}_t + \alpha_7 \text{CAPX}_t \\
&\quad + \alpha_8 \text{AROA}_{t-1} + \alpha_9 \text{LEVR}_{t-1} + \alpha_{10} \text{MTB}_{t-1} + \alpha_{11} \text{DIVR}_{t-1} + \alpha_{12} \text{SIZE}_{t-1} + \alpha_{13} \text{SGRW}_{t-1} + \alpha_{14} \text{SZGW}_t \\
&\quad + \alpha_{15} \text{SPS}_{t-1} + \text{[Industry Dummies and Year Dummies]} + \epsilon_t
\end{align*}
\]

In testing H1, we expect a negative sign of coefficient \(\alpha_0\), which means that when firms engage in abnormal real activities to manipulate earnings, they are likely to realize less IT investments in infrastructure development relative to their plans.

To examine whether managers may cut their IT infrastructure investments as part of REM strategies, we specify the following model:

\[
\begin{align*}
\text{ABDX}_t &= \beta_0 + \beta_1 \text{AITI}_t + \beta_2 \text{ITDEC}_t + \beta_3 \text{ITDEC}_t \times \text{AITI}_t + \beta_4 \text{ABA}_t + \beta_5 \text{ADV}_t + \beta_6 \text{RND}_t + \beta_7 \text{CAPX}_t \\
&\quad + \beta_8 \text{AROA}_{t-1} + \beta_9 \text{LEVR}_{t-1} + \beta_{10} \text{MTB}_{t-1} + \beta_{11} \text{DIVR}_{t-1} + \beta_{12} \text{SIZE}_{t-1} + \beta_{13} \text{SGRW}_{t-1} + \beta_{14} \text{SZGW}_t \\
&\quad + \beta_{15} \text{SPS}_{t-1} + \text{[Industry Dummies and Year Dummies]} + \zeta_t
\end{align*}
\]

In Model (2), we only use the individual measure of ABDX (abnormal discretionary expenditure), as the dependent variable for REM, because the manipulation of IT investments is more relevant to discretionary expenditure reduction, rather than other activities of production and revenue generation. In testing H2, we expect a positive sign of coefficient \(\beta_0\), which means that the firm’s forgoing of its planned IT increase contributes to its strategic cutting of discretionary expenditure. In other words, managers essentially forgo planned IT infrastructure investments for the purpose of real earnings management.

We test H3a through model (1) and we expect a positive sign of coefficient \(\alpha_3\), which means IT decentralization mitigates the negative impact of REM on accomplished IT investments on infrastructure development. We test H3b through model (2) and we expect a negative sign of coefficient \(\beta_3\), which means in firms with decentralized IT decision making, lower levels of accomplished IT investments on infrastructure development are less associated with the REM strategy of cutting discretionary expenditure. We estimate models (1) and (2) using system-of-equations three-stage-least-square (3SLS) estimation. In 3SLS, \(\text{AITI}\) is taken as the endogenous variable and cross-equation correlation is assumed.

It is worth noticing that both AITI and ABDX are continuous variable. A continuous variable of AITI may represent both excess and shortfall of IT infrastructure investment relative to the planned level. Also, a continuous variable of ABDX may represent both cases with and without REM. To better assess firms’ likelihood of missing their planned levels of IT infrastructure investments and engaging in REM, we also estimate two logistic models as the robustness check of the insights. The two logistic equations are:

\[
\begin{align*}
\text{Logit}[P(I(\text{AITI}_t)=1)] &= \alpha + \alpha_1 \text{REM}_{t-1} + \alpha_2 \text{ITDEC}_t + \alpha_3 \text{ITDEC}_t \times \text{REM}_{t-1} + \text{[Other Controls]} + \epsilon_t \\
\text{Logit}[P(I(\text{ABDX}_t)=1)] &= \beta + \beta_1 I(\text{AITI}_t) + \beta_2 \text{ITDEC}_t + \beta_3 \text{ITDEC}_t \times I(\text{AITI}_t) + \text{[Other Controls]} + \zeta_t
\end{align*}
\]

where the logit function is \(\text{Logit}(P) = \ln(P/1-P)\). \(I(\text{AITI}_t)\) is an indicator where \(I(\text{AITI}_t)=1\) if \(\text{AITI}_t<0\) (i.e., the actual IT infrastructure investment falls short of the plan) and \(I(\text{AITI}_t)=0\) otherwise. \(P(I(\text{AITI}_t)=1)\) is the probability that the actual IT infrastructure investment falls short of the plan. \(I(\text{ABDX}_t)=1\) is an indicator where \(I(\text{ABDX}_t)=1\) if \(\text{ABDX}_t<0\) (i.e., engaging in REM with abnormally low discretionary expenditure)
and $I(ABDX_t)=0$ otherwise. $P(I(ABDX_t)=1)$ is probability that the firm engages in REM. In the second equation, the values of the independent variable $I(AITI_t)$ are predicted values from the first equation (to address the potential endogeneity issue). It has been noticed in the existing economics literature that the traditional approach of deriving the coefficients of interaction terms and their significance levels does not apply to nonlinear models, such as logit models (Ai and Norton 2003; Greene 2010). Therefore, in this study, we adopt the method proposed in Ai and Norton (2003) in deriving the coefficients of interaction terms and their significance levels in the logit models.

**Results**

The left portion of Table 2 presents the 3SLS estimation results of a base model without IT infrastructure decentralization. The cross-equation correlation and Breusch-Pagan test results reported in Table 2 suggest the advantage of using 3SLS (that incorporates cross-equation correlation in estimation) over 2SLS (that estimates the two equations separately). In the model on AITI, we find a negative relation between AITI and the magnitude of REM in the previous period. Specifically, the estimated coefficient of REM$_{t-1}$ is negative and significant ($p<0.01$), suggesting that firms engaging in more REM are less capable to accomplish their IT infrastructure investments in the subsequent periods to meet or exceed their plans. This result supports H1. In the model on ABDX, we observe a positive relation between ABDX and AITI. Specifically, the estimated coefficient of AITI is positive and significant ($p<0.01$), indicating that when firms accomplish less IT infrastructure investments, such budget reduction significantly contributes to the overall reduction of discretionary expenditure. Therefore, the cutting of IT infrastructure investment is essentially part of firms’ overall REM strategies to lower discretionary expenditure. This result supports H2.

The results on control variables are largely consistent with expectations. Specifically, the results suggest that firms accomplish more IT infrastructure investments relative to their plans when they have less advertising expenditure and R&D expenditure, and higher MTB ratios. This implies that advertising, R&D, and other potential long-term growth opportunities may compete with IT for capital resources, as also documented in prior studies (Mithas et al. 2012). More accomplishment in IT infrastructure investments is also found in firms with better performance (i.e., higher industry-adjusted ROA) and more surplus cash, which means that these firms have more available resources to realize their planned IT infrastructure investments. Larger firms and firms with more growth in size are found to accomplish more IT infrastructure investments relative to plans, possibly because they have more IT needs. Sales growth is found to be positively associated with more accomplishment in IT infrastructure investments, which is in contrast to the finding of a negative relationship between IT investment and sales growth found in prior studies (e.g., Kobelsky et al. 2008) which used data on IT budgets instead of the accomplishment of planned IT investments. A potential explanation is that firms with sales growth are also likely to need more IT infrastructure to support the growing operational scales. We have also conducted a robustness check by using a firm fixed-effect model and found that our results are qualitatively consistent.

The right columns of Table 2 presents the results with the decentralization of IT infrastructure decisions and related interaction terms included in the models. ITDEC is found not to be significantly associated with either AITI or ABDX, suggesting that the decentralization of IT infrastructure decisions does not directly influence the accomplishment of IT infrastructure investments or the strategic reduction of discretionary expenditure in REM. However, in the model for AITI, the coefficient of the interaction term ITDEC× REM is positive and significant ($p<0.01$). This indicates that in firms with more decentralized IT infrastructure decisions, the negative impact of REM on the accomplishment of IT infrastructure investments is weaker, supporting H3a. In the model on ABDX, the coefficient of the interaction term ITDEC× AITI is negative and significant ($p<0.01$), suggesting that in firms with more decentralized IT infrastructure decisions, the less accomplishment of IT infrastructure investment is less associated with the strategic actions of REM (the reduction of discretionary expenditure). Therefore, H3b is supported.

Table 3 presents the results of logistic regressions, which are consistent with the 3SLS results. The positive coefficient of REM suggests that REM makes it more likely for firms to fall short of their plans in IT infrastructure development, supporting H1. The positive coefficient of $I(AITI_t)$ suggests that when firms fall short of their IT infrastructure investment plans ($AITI_t<0$), they are also likely to engage in REM. This result supports H2. The negative coefficient of ITDEC×REM suggests that decentralization
Earnings Management and IT Investments

mitigates the impact of REM on missing the IT infrastructure investment plans, and the negative coefficient of ITDEC × AITI suggests that decentralization weakens the relationship between missing the IT infrastructure investment plans and the engagement in strategic reduction of discretionary expenditure. Therefore, H3a and H3b are also supported by the results of logit models.

Discussion and Conclusion

This study focuses on how IT investments may be influenced by managers’ strategic actions of REM. Our main proposition is that REM affects the firm’s capability of realizing their planned IT investments and IT investments, as part of the firm’s discretionary expenditure, is also likely to be manipulated by strategic managers for the purpose of REM. In this regard, IT investments decisions are influenced by the agency issue, and are not always driven by rationalistic goals of value-creation. Using a unique dataset, our study specifically tests this proposition by examining the relation between REM and the IT infrastructure development of firms.

Our findings suggest that REM makes it more likely for firms to fall short of their plans in IT infrastructure development, and managers are also likely to forgo their plans of IT infrastructure development as a way to realize their REM strategies. As a result, IT investments are affected by both the intention for and the consequence of REM. Our study further considers how the relation between IT infrastructure development and REM may be influenced by the governance arrangement of IT. We find that in firms with more decentralized IT infrastructure decisions, IT infrastructure development is less subject to the impact of REM and the reduction of IT infrastructure development is also less associated with the strategic actions of REM.

Our findings suggest two important research implications. First, our study points to the agency problem in IT investments decisions. Although agency problems have been mentioned in the literature on IT investments (e.g., Ravichandran et al. 2009), prior studies focused more on how self-interested managers may be driven to make IT investment by various motives (e.g., reputation building, conforming to institutional pressure, etc.). Less attention has been paid to the adverse effect of the agency problem on IT investments. Our study suggests that the agency problem is likely to cause IT investments to be sacrificed for other strategic purposes, such as earnings management. Similar to other discretionary spending, IT investments is likely to be manipulated by managers as part of their REM strategies. Moreover, when REM adversely affects firm operations, such adverse effect also undermines the firm’s capability of investing in IT in the future. In this regard, the negative impact of the agency problem on IT investments is likely to be multifaceted.

Second, this study shows how IT governance arrangements may influence the relationship between earnings management and IT investments. Our findings generate a new insight about the value of decentralized IT decision making. The existing IT governance literature, when considering decentralized IT decision making, has mainly focused on how decentralized IT decision making benefits the firm by allowing IT decisions to better adapt to local organizational environment. This study suggests that another benefit of decentralized IT decision making is to mitigate the adverse effect of earning management on IT investments. Decentralized IT decision making constrains the control of individual managers, especially that of top managers, over the overall IT investments. It then becomes more difficult for strategic managers to sacrifice the overall IT investments for the purpose of earnings management. As a result, the overall IT development may be subject less to the adverse effect of earnings management.

Among implications for practice, our findings suggest that investors and boards should pay close attention to firms’ investments in IT infrastructure and IT capabilities. Recent high profile security breaches at Target and other reputed companies highlight the importance of managing IT infrastructure of firms; in some of these cases, such breaches were followed by CIOs and CEOs losing their jobs. Because IT investments of firms are a large fraction of discretionary investments at par with other such investments such as those in R&D and marketing, investors and boards should closely scrutinize changes in IT investments for any abnormal deviations, particularly when such changes are more driven by agency problems. Some of this also requires that companies disclose more of their IT practices in their annual reports and other disclosures (Bloch, Brown and Sikes 2012; Desmet and Mesøy 2009; Nolan and McFarlan 2005; Willmott 2013). It would be in the interest of boards to get more engaged in developing IT infrastructure and IT capabilities because they are not only profitable (Mithas et al. 2012) but are
eventually rewarded by the stock market (Mithas et al. 2014). Our findings suggest that boards should consider creating an IT governance committee involving the CIO to mitigate potential managerial discretion that affects IT investments, and use decentralized governance arrangements when they are appropriate as a potential way to mitigate agency problems.

Institutional investors, regulators and financial analysts should also demand IT related market-relevant information from firms for a more complete assessment of performance and to reduce risks due to poor management of IT that expose firms to loss of customer or investor trust. Regulators have an important role to consider mandating higher levels of disclosure of IT spending and IT initiatives in annual reports and financial statements because despite the importance of managing information flows within and across firms, very few firms on their own volunteer such information. This opaqueness gives firms greater flexibility to engage in earnings management than they would have otherwise.

To conclude, this study shows that real earnings management can affect firms’ capability to realize their planned IT infrastructure development in subsequent periods. In addition, firms can use reductions in IT investments as a mechanism to cut current-period discretionary expenditures to manage earnings. The study also points to an important role of decentralized IT governance in shielding IT investments from the negative impact of real earnings management. These findings are important for investors, boards and regulators as they make assessments of firms’ competitive performance and externalities due to poor management of IT resources.
Table 1. Variable Definition and Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Notation</th>
<th>Definition</th>
<th>Mean</th>
<th>Std.</th>
<th>25%</th>
<th>75%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal (AB) Cash Flow</td>
<td>ABCF</td>
<td>Deviations from the predicted values from the corresponding industry-year regression: CFO/A_{t-1} = a_0 + a_1(A_{t-1}) + \beta_1(S_{t-1}) + \beta_2(\Delta S_{t-1}) + \epsilon_t.</td>
<td>0.065</td>
<td>0.176</td>
<td>-0.015</td>
<td>0.143</td>
</tr>
<tr>
<td>AB Production Costs</td>
<td>ABPC</td>
<td>Deviations from the predicted values from the corresponding industry-year regression: PC/A_{t-1} = a_0 + a_1(A_{t-1}) + \beta_1(S_{t-1}) + \beta_2(\Delta S_{t-1}) + \beta_3(\Delta S_{t-1}) + \epsilon_t.</td>
<td>-0.081</td>
<td>0.327</td>
<td>-0.257</td>
<td>0.078</td>
</tr>
<tr>
<td>AB Discretionary Expenses</td>
<td>ABDX</td>
<td>Deviations from the predicted values from the corresponding industry-year regression: DX/A_{t-1} = a_0 + a_1(A_{t-1}) + \beta_1(S_{t-1}) + \epsilon_t.</td>
<td>-0.056</td>
<td>0.352</td>
<td>-0.303</td>
<td>0.118</td>
</tr>
<tr>
<td>Real Earnings Management</td>
<td>REM</td>
<td>An aggregate measure of ABCF, ABPC, and ABDX, as -ABCF+ABPC-ABDX (with higher values meaning more real earnings management).</td>
<td>-0.072</td>
<td>0.580</td>
<td>-0.328</td>
<td>0.212</td>
</tr>
<tr>
<td>AB Accruals</td>
<td>ABA</td>
<td>Deviations from the predicted values from the corresponding industry-year regression: Accruals/A_{t-1} = a_0 + \alpha(\Delta REV-\Delta REC) / A_{t-1} + \beta_3(\Delta IBXI_{t-1}) + \epsilon_t.</td>
<td>0.001</td>
<td>0.119</td>
<td>-0.033</td>
<td>0.035</td>
</tr>
<tr>
<td>Accomplished IT Investment on Infrastructure Development</td>
<td>AITI</td>
<td>A composite measure (using factor analysis) that combines the accomplished IT investment in three IT infrastructure areas: PCs/workstations, servers and network equipment. In each area, the accomplished IT investment is measured by [(realized \Delta IT)<em>{t-1}-(planned \Delta IT)</em>{t-1}]/IT_{t-1}, and \Delta IT is the change in number of {PCs/workstations, servers, network equipment}.</td>
<td>0.018</td>
<td>0.298</td>
<td>-0.101</td>
<td>0.142</td>
</tr>
<tr>
<td>IT Intensity</td>
<td>ITINT</td>
<td>A composite measure (using factor analysis) that combines PCs/workstations per employee, servers per employee, and network equipment per employee.</td>
<td>0.249</td>
<td>0.422</td>
<td>0.077</td>
<td>0.284</td>
</tr>
<tr>
<td>IT Infrastructure Decentralization</td>
<td>ITDEC</td>
<td>A composite measure (using factor analysis) that combines the firm-level decentralization of the three IT infrastructure areas. In each area, the establishment-level decentralization is 1 (0) if the establishment has the (has no) decision right. Firm-level decentralization is aggregated from the establishment level, weighted by the establishment employee numbers.</td>
<td>0.587</td>
<td>0.208</td>
<td>0.455</td>
<td>0.734</td>
</tr>
<tr>
<td>Advertising</td>
<td>ADV</td>
<td>Advertising expenditure to total assets.</td>
<td>0.032</td>
<td>0.046</td>
<td>0.006</td>
<td>0.037</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>RND</td>
<td>Research and development expenditure to total assets.</td>
<td>0.061</td>
<td>0.086</td>
<td>0.006</td>
<td>0.063</td>
</tr>
<tr>
<td>Capital Expenditure</td>
<td>CAPX</td>
<td>Capital expenditure to total assets.</td>
<td>0.044</td>
<td>0.049</td>
<td>0.010</td>
<td>0.060</td>
</tr>
<tr>
<td>Adjusted ROA</td>
<td>AROA</td>
<td>Return on assets, expressed as deviation from the corresponding industry-year mean.</td>
<td>0.045</td>
<td>0.069</td>
<td>-0.004</td>
<td>0.082</td>
</tr>
<tr>
<td>Firm Leverage</td>
<td>LEVR</td>
<td>Total debts (long-term debt + debt in current liabilities) to total assets.</td>
<td>0.271</td>
<td>0.235</td>
<td>0.089</td>
<td>0.388</td>
</tr>
<tr>
<td>Market-to-Book</td>
<td>MTB</td>
<td>Total market value to total book value of equity.</td>
<td>2.419</td>
<td>3.052</td>
<td>1.189</td>
<td>2.815</td>
</tr>
<tr>
<td>Diversification</td>
<td>DIVR</td>
<td>Entropy measure of firm diversification, as in Palepu (1985).</td>
<td>0.493</td>
<td>0.683</td>
<td>0</td>
<td>0.805</td>
</tr>
<tr>
<td>Firm Size</td>
<td>SIZE</td>
<td>Nature logarithm of total employees.</td>
<td>8.004</td>
<td>1.914</td>
<td>6.729</td>
<td>9.297</td>
</tr>
<tr>
<td>Sales Growth</td>
<td>SGRW</td>
<td>Log value of one-year sales growth rate.</td>
<td>0.078</td>
<td>0.225</td>
<td>-0.012</td>
<td>0.167</td>
</tr>
<tr>
<td>Size Growth</td>
<td>SZGW</td>
<td>Log value of one-year growth rate of employees.</td>
<td>-0.006</td>
<td>0.480</td>
<td>-0.058</td>
<td>0.087</td>
</tr>
<tr>
<td>Surplus Cash</td>
<td>SPLS</td>
<td>Cash from asset-in-place to total assets, as in Richardson (2006).</td>
<td>0.084</td>
<td>0.100</td>
<td>0.035</td>
<td>0.130</td>
</tr>
</tbody>
</table>

Note: 1. REV=net revenue; REC=net receivables; PPE=gross property, plant, and equipment; IBXI=income before extraordinary items; A=total assets; S=sales; CFO=cash flow from operations; PC=production cost, defined as COGS+\Delta INV, where COGS=cost of goods sold and INV=inventory; DX=discretionary expenses, defined as R&D+advertising+SG&A expenses; 2. N=24122.
## Table 2. Accomplished IT Infrastructure Investments and Real Earnings Management

<table>
<thead>
<tr>
<th></th>
<th>3SLS</th>
<th></th>
<th>3SLS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AITI</td>
<td>ABDX</td>
<td>AITI</td>
<td>ABDX</td>
</tr>
<tr>
<td>Intercept</td>
<td>-0.210*** (0.027)</td>
<td>-0.195*** (0.029)</td>
<td>-0.204*** (0.028)</td>
<td>-0.135* (0.076)</td>
</tr>
<tr>
<td>AITI_t</td>
<td></td>
<td>0.186*** (0.021)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REM_{t-1}</td>
<td>-0.089*** (0.003)</td>
<td></td>
<td>-0.163*** (0.009)</td>
<td></td>
</tr>
<tr>
<td>ITDEC_t</td>
<td></td>
<td></td>
<td>0.003 (0.009)</td>
<td>-0.039 (0.025)</td>
</tr>
<tr>
<td>ITDEC_t \times REM_{t-1}</td>
<td></td>
<td></td>
<td>0.181*** (0.014)</td>
<td></td>
</tr>
<tr>
<td>ITDEC_t \times AITI_t</td>
<td></td>
<td></td>
<td>-0.383*** (0.043)</td>
<td></td>
</tr>
<tr>
<td>IT Intensity_{t-1}</td>
<td>0.232*** (0.005)</td>
<td></td>
<td>0.206*** (0.005)</td>
<td></td>
</tr>
<tr>
<td>AB Accruals_{t}</td>
<td>0.059*** (0.017)</td>
<td></td>
<td>0.091*** (0.041)</td>
<td></td>
</tr>
<tr>
<td>Advertising_{t}</td>
<td>-0.292*** (0.044)</td>
<td>2.127*** (0.045)</td>
<td>-0.189*** (0.043)</td>
<td>2.078*** (0.114)</td>
</tr>
<tr>
<td>R&amp;D_{t}</td>
<td>-0.133*** (0.024)</td>
<td>0.702*** (0.025)</td>
<td>-0.104*** (0.024)</td>
<td>0.643*** (0.064)</td>
</tr>
<tr>
<td>Capital Expenditure_{t}</td>
<td>-0.014 (0.045)</td>
<td>0.049 (0.048)</td>
<td>-0.005 (0.045)</td>
<td>0.002 (0.121)</td>
</tr>
<tr>
<td>Adjusted ROA_{t-1}</td>
<td>0.059* (0.036)</td>
<td>-0.907*** (0.038)</td>
<td>0.057 (0.036)</td>
<td>-0.811*** (0.096)</td>
</tr>
<tr>
<td>Firm Leverage_{t-1}</td>
<td>0.003 (0.008)</td>
<td>0.007 (0.009)</td>
<td>0.005 (0.008)</td>
<td>-0.018 (0.023)</td>
</tr>
<tr>
<td>Market-to-Book_{t-1}</td>
<td>-0.004*** (0.001)</td>
<td>0.009*** (0.001)</td>
<td>-0.003*** (0.001)</td>
<td>0.010*** (0.002)</td>
</tr>
<tr>
<td>Diversification_{t-1}</td>
<td>0.003 (0.006)</td>
<td>-0.062*** (0.006)</td>
<td>0.003 (0.006)</td>
<td>-0.058*** (0.015)</td>
</tr>
<tr>
<td>Firm Size_{t-1}</td>
<td>0.021*** (0.001)</td>
<td>-0.021*** (0.001)</td>
<td>0.018*** (0.001)</td>
<td>-0.022*** (0.003)</td>
</tr>
<tr>
<td>Sales Growth_{t}</td>
<td>0.095*** (0.008)</td>
<td>0.082*** (0.009)</td>
<td>0.078*** (0.008)</td>
<td>0.072*** (0.022)</td>
</tr>
<tr>
<td>Size Growth_{t}</td>
<td>0.038*** (0.004)</td>
<td>-0.006 (0.004)</td>
<td>0.033*** (0.004)</td>
<td>-0.007 (0.011)</td>
</tr>
<tr>
<td>Surplus Cash_{t-1}</td>
<td>0.054*** (0.024)</td>
<td>0.513*** (0.026)</td>
<td>0.018 (0.024)</td>
<td>0.310*** (0.066)</td>
</tr>
</tbody>
</table>

Industry dummies and year dummies are used.

<table>
<thead>
<tr>
<th></th>
<th>3SLS</th>
<th></th>
<th>3SLS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>R-Squared</td>
<td>0.102</td>
<td>0.300</td>
<td>0.120</td>
<td>0.303</td>
</tr>
</tbody>
</table>

Note: N=24122; *p<0.1, **p<0.05, ***p<0.01; In parentheses are standard errors.
### Table 3. Logit Models

<table>
<thead>
<tr>
<th></th>
<th>Logit[P(I(AITI_{t})=1)]</th>
<th>Logit[P(I(ABDX_{t})=1)]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>1.485*** (0.219)</td>
<td>2.240*** (0.293)</td>
</tr>
<tr>
<td>I(AITI_{t})</td>
<td></td>
<td></td>
</tr>
<tr>
<td>REM_{t-1}</td>
<td>0.827*** (0.074)</td>
<td></td>
</tr>
<tr>
<td>ITDEC_{t}</td>
<td>-0.027 (0.071)</td>
<td>-0.049 (0.114)</td>
</tr>
<tr>
<td>ITDEC_{t} × REM_{t-1}</td>
<td>-0.264*** (0.026)</td>
<td></td>
</tr>
<tr>
<td>ITDEC_{t} × I(AITI_{t})</td>
<td></td>
<td>-0.111*** (0.025)</td>
</tr>
<tr>
<td>IT Intensity_{t-1}</td>
<td>-1.850*** (0.070)</td>
<td></td>
</tr>
<tr>
<td>AB Accruals_{t}</td>
<td></td>
<td>-0.832*** (0.151)</td>
</tr>
<tr>
<td>Advertising_{t}</td>
<td>0.181 (0.327)</td>
<td>-11.922*** (0.401)</td>
</tr>
<tr>
<td>R&amp;D_{t}</td>
<td>0.375** (0.180)</td>
<td>-3.598*** (0.212)</td>
</tr>
<tr>
<td>Capital Expenditure_{t}</td>
<td>-0.061 (0.336)</td>
<td>0.532 (0.394)</td>
</tr>
<tr>
<td>Adjusted ROA_{t-1}</td>
<td>-0.747*** (0.277)</td>
<td>3.708*** (0.323)</td>
</tr>
<tr>
<td>Firm Leverage_{t-1}</td>
<td>-0.104 (0.064)</td>
<td>0.287*** (0.077)</td>
</tr>
<tr>
<td>Market-to-Book_{t-1}</td>
<td>0.007 (0.005)</td>
<td>-0.054*** (0.005)</td>
</tr>
<tr>
<td>Diversification_{t-1}</td>
<td>-0.059 (0.042)</td>
<td>0.553*** (0.054)</td>
</tr>
<tr>
<td>Firm Size_{t-1}</td>
<td>-0.099*** (0.009)</td>
<td>0.109*** (0.010)</td>
</tr>
<tr>
<td>Sales Growth_{t}</td>
<td>-0.312*** (0.065)</td>
<td>-0.126 (0.077)</td>
</tr>
<tr>
<td>Size Growth_{t}</td>
<td>-0.182*** (0.031)</td>
<td>-0.010 (0.036)</td>
</tr>
<tr>
<td>Surplus Cash_{t-1}</td>
<td>-0.347* (0.185)</td>
<td>-3.269*** (0.224)</td>
</tr>
</tbody>
</table>

Industry dummies and year dummies are used.

R-Squared                  | 0.065                     | 0.290                     

Note: N=24122; *p<0.1, **p<0.05, ***p<0.01; In parentheses are standard errors; The coefficients of the interaction terms and their standard errors are derived using the approach in Ai and Norton (2003).
References


Han, K., and Mithas, S. "Information technology outsourcing and non-IT operating costs: An empirical investigation," *MIS Quarterly* (37:1) 2013, pp 315-331.


