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# The Effect of ERP System Implementations on the Management of Earnings and Earnings Release Dates

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**ABSTRACT:** ERP systems have become the system of choice for the majority of publicly traded companies and have radically changed the way accounting information is processed, prepared, audited, and disseminated. In this study, we examine whether ERP system implementations have affected the extent to which firms manage earnings amounts and release dates. We find, for a sample of ERP adopters, that implementations led to increases in the absolute value of discretionary accruals (i.e., greater earnings management). We also find a positive relationship between the extent of ERP module adoption and the extent of earnings management. With respect to earnings release dates, firms with incentives to increase the timeliness of their release dates experienced a decrease in reporting lag after implementing ERP systems. These results should be of interest to financial statement preparers initially adopting or implementing new versions of ERP applications, auditors serving clients with ERP systems, and regulators overseeing the financial markets and consolidation in the ERP industry.

**Keywords:** ERP systems; discretionary accruals; implementation; reporting lag.

**Data Availability:** Key data items used in this study were obtained from a proprietary source. All other sources of data are described in the study.

## I. INTRODUCTION

This study examines how enterprise resource planning (ERP) system implementations affect the extent to which earnings amounts and release dates are managed. We investigate whether, after adoption, the absolute value of firms' discretionary accruals increase and if ERP implementations lead to reductions in reporting lags for firms motivated to release earnings quickly. ERP systems are defined as "information systems packages that integrate information and information-based processes within and across functional areas in an organization" (Kumar and Hillegrersberg 2000, 22). The implementation and utilization of ERP systems represent a radical change from the legacy systems of the past

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as business functions are integrally linked through workflow automation and one authoritative database. By 1999, 70 percent of Fortune 1000 firms had either adopted or were in the process of implementing ERP systems (Cerullo and Cerullo 2000). The potential advantages of ERP systems (e.g., assisting business process reengineering, reducing complications with Sarbanes-Oxley Act compliance) have made them the system of choice among many corporations (O'Leary 2000; Bradford and Roberts 2001; Winters 2004). Prior accounting research supports these positive expectations. ERP adoption announcements engender positive market responses and ERP implementations have been linked to improved operational performance (e.g., Hayes et al. 2001; Hunton et al. 2003).

ERP systems collect and disseminate timely information to managers and thus improve their ability to process and analyze accounting information (Davenport 1998; Hitt et al. 2002). ERP systems provide management with a unified enterprise view of the firm's financial condition at all times (Dillon 1999). In addition, these integrated systems eliminate barriers between firm functions, allowing managers unprecedented access to accounting information (O'Leary 2000). However, recent research indicates that there may be reductions in internal control effectiveness and audit quality in ERP system settings (Wright and Wright 2002; Hunton et al. 2004; Brazel and Agoglia 2007). This combination of increased manager access and greater discretion over accounting information with a weaker system of checks and balances could lead to enhanced opportunities to manage earnings in ways that meet managers' objectives (e.g., beat earnings expectations).

The standardized, automated, and integrated ERP system environment is also expected to efficiently process transactions and reduce reporting lags (e.g., O'Leary 2000; Hitt et al. 2002; Jacobs and Bendoly 2003). Anecdotal evidence supports this expectation, indicating that ERP system adoptions positively affect the timeliness of financial accounting information by decreasing the financial close cycle (e.g., Brown 1997; Jensen and Johnson 1999; Wah 2000). Thus, if managers are motivated to quickly disseminate accounting information to external users, ERP adoptions should assist in this process. Yet, to our knowledge, there is no empirical evidence to support the conclusion that ERP adoptions enhance firms' abilities to manage the timing of their earnings release dates. This perceived benefit of ERP adoption is now especially salient as the SEC has substantially reduced the 10-K filing period for large accelerated and accelerated filers from 90 to 60 and 75 days, respectively (Securities and Exchange Commission [SEC] 2005).

In this paper, we develop and test hypotheses that ERP implementations influence the degree to which firms manage earnings and the timing of their earnings release dates. We also test whether the extent of ERP module (i.e., number of modules implemented) adoption magnifies these effects. To test our hypotheses, we obtained a sample of ERP system adoptions from a proprietary dataset of license agreements maintained by an international ERP system provider. Consistent with prior research, we use the absolute value of discretionary accruals and the reporting lag between fiscal year-end and the earnings release date to measure the extent to which adopting firms manage earnings and release dates, respectively (e.g., Chambers and Penman 1984; Jones 1991). We compare the pre- and post-implementation discretionary accrual levels and reporting lags for our sample of ERP system adopters.

The results of our study suggest that ERP system adoptions allow firms more flexibility to manage earnings and the timing of their earnings release dates. Management at these firms appear to use more discretion in the reporting of accruals after adoption than prior to adoption. We also find the extent of ERP module adoption to be positively associated with the level of earnings management. With respect to earnings release dates, for firms

with incentives to disseminate "good news" to the market through the timely release of financial statement information, we find that ERP implementations appear to reduce reporting lags. We do not find this effect to be more acute for more extensive adopters.

Our findings should be of interest to financial statement preparers considering ERP adoption, changing ERP suppliers, or adopting the next version of an ERP system. Regulators overseeing the public markets might be interested that ERP system adoption could concurrently result in greater earnings management, but also more timely earnings release dates for market participants. Last, this study provides auditors with empirical data to support concerns that ERP systems can potentially increase the likelihood of financial statement management.

The remainder of this paper is organized as follows. The next section discusses the background and related research and develops hypotheses. Section III discusses the sample selection and the research design. Section IV presents results and Section V offers conclusions and implications.

## II. BACKGROUND AND HYPOTHESES DEVELOPMENT

### ERP System Implementations

The decision to implement an ERP system represents a significant investment of firm resources. ERP systems, sold by vendors such as SAP AG and Oracle Corporation, on average, cost \$15 million and implementations take, on average, 21 months to complete (O'Leary 2000).

Over the past decade, corporations have experienced both successful and unsuccessful ERP implementations, and the benefits, complexities, and risks of ERP systems have been documented in the popular press (e.g., Bartholomew 1997). Recently, the majority of ERP systems press coverage has been devoted to Oracle's acquisition of rival PeopleSoft Inc. and its battle with industry leader SAP AG for market share (e.g., Bank and Clark 2004; Bank and Boslet 2005; Abboud and Vara 2007).

Empirical research related to ERP system implementations can be divided into three research streams. First, given the formidable challenge posed by ERP system implementations, studies have identified factors which positively influence the success of ERP installations. For example, Nah et al. (2001) review this literature and identify ERP team composition and changing management culture as critical to a successful ERP implementation. Bradford and Florin (2003) draw upon Diffusion of Innovation and Information Systems Success theories to determine that the level of employee training in the ERP system and competitive pressure to adopt the system positively impact implementation performance.

A second research stream suggests that the market reacts positively to ERP system adoption announcements. Hayes et al.'s (2001) archival results show a positive standard cumulative abnormal return for a sample of ERP system adoption announcements. They conclude that investors expect future positive net cash flows to arise from ERP system implementations. Hunton et al. (2002) find analysts positively revise their earnings forecasts after receiving ERP adoption announcements.

Third, research studies have investigated whether implementations of ERP systems lead to improved operational performance. These studies, using accounting-based performance measures (e.g., financial ratios), have generally found mixed results related to the link between ERP adoption and post-implementation firm performance (e.g., Poston and Grabski 2001; Hitt et al. 2002). However, researchers find that positive relationships become more evident when adopters are compared to nonadopters (Hunton et al. 2003) and adopters use

nonfinancial performance incentives in executive compensation contracts (Wier et al. 2005). The results are also stronger when they control for the ERP system vendor used and ERP system modules installed (Nicolaou 2004).

While prior research suggests that ERP system adoptions may affect firm performance described by financial statements, whether these systems affect the quality of accounting information supplied to external users is unknown. Specifically, given the importance investors (and others) place on earnings (e.g., Berenson 2003), we examine if earnings management increases after a firm has adopted an ERP system. Also, with advances in information technology providing more market-related information to investors on a more timely basis, we investigate if ERP adoptions enhance firms' ability to manage the timeliness of their earnings release dates. If ERP systems represent a radical change from the legacy systems of the past and accounting information is a product of the ERP system, it is likely that these two important qualitative characteristics are impacted by ERP adoptions.

### Earnings Management

Prior research suggests there are incentives for firms to manage earnings in order to avoid missing earnings forecasts (Kasznik and McNichols 2002), smooth earnings (Barth et al. 1999), and avoid losses (Brown 2001), and that these incentives intensified contemporaneously with the wave of ERP system adoptions in the mid to late 1990s (Cerullo and Cerullo 2000; Berenson 2003).<sup>1</sup> Graham et al. (2006), in a survey of 401 senior financial executives and additional in-depth interviews, find that the presence of earnings management in response to market incentives is pervasive and accruals are seen as a method of meeting earnings benchmarks. One CFO in the Graham et al. (2006) study stated, "You have to start with the premise that every company manages earnings" (Graham et al. 2006, 30).

We argue that adoptions of ERP systems, given their integral role in the financial reporting process and for reasons described below, should improve management's ability to exercise discretion with accruals to manage earnings. At a minimum, it is unlikely that management would choose to adopt a system that would constrain their ability to manage earnings during a period of time (i.e., mid to late 1990s) when meeting earnings expectations was considered the chief determinant of stock valuation (Berenson 2003).

Poston and Grabski (2001) state that one of the two chief benefits of ERP system implementations is enhanced managerial decision-making via the provision of accurate and timely enterprise-wide information. With respect to financial reporting, ERP systems are expected to collect and disseminate timely operational data (e.g., customer relations) to managers and thus improve their ability to process and analyze related accounting information/accruals (e.g., allowance for doubtful accounts) (Davenport 1998; Hitt et al. 2002). These integrated systems allow managers to share information, and this information can be used by managers to better monitor firm performance (Oliver 1999; Davenport 2000). ERP systems also provide management with real-time information concerning the financial condition (e.g., earnings) of the company and eliminate barriers between accounting cycles, allowing managers unprecedented access to accounting information (Dillon 1999; O'Leary 2000).

While the above advantages likely improve internal management accounting/decision-making and should cause ERP adopters to outperform nonadopters (Hunton et al. 2003),

<sup>1</sup> The implementation of ERP systems by U.S. publicly traded corporations appears to have heightened in the mid to late 1990s (Cerullo and Cerullo 2000). The database of ERP adoptions used in this study reflects this period with implementations ranging from 1993 to 1999.

the ERP setting may likewise improve managers' ability to manage the financial information they provide to external users. First, ERP systems should improve the information set of management, exacerbating the level of information asymmetry between managers and external users of financial reports. Prior research has empirically shown that higher levels of information asymmetry and related agency costs fuel investor concerns related to the quality of reported earnings (e.g., Chow 1982; Francis and Wilson 1988). In short, greater levels of information asymmetry between management and investors inflate the moral hazard problem as management is enabled to use greater discretion in reporting because management (the investor) is more (less) aware of internal information about the true financial condition of the firm. Second, the inherent information time lags present in legacy systems often required management to manage external accounting information through more transparent year-end adjustments. Such adjustments are more likely to be identified and questioned by external auditors (Lanza and Gilbert 2007). In contrast, the constant stream of accounting information and enterprise-wide view provided by ERP systems may endow management with the opportunity to manage financial accounting information intermittently throughout the year.

Third, earnings management is not a simple game; it requires multiperiod planning because accrual manipulations in one year will affect (and need to be unwound in) subsequent years. One of the chief selling points for ERP systems is their ability to enhance the planning of an organization (see [sap.com](http://sap.com), [oracle.com](http://oracle.com)). ERP adoptions may therefore facilitate multiperiod accrual planning similar to the way that it assists in managing a firm's supply chain. Fourth, if ERP implementations allow managers greater access and control over financial accounting data (Dillon 1999), the opportunity for management to construe financial statements to meet incentives is increased. Increased opportunities leading to financial statement management is consistent with Statement on Accounting Standards (SAS) No. 99 and literature studying the fraud triangle and accounting restatements (e.g., American Institute of Certified Public Accountants [AICPA] 2002; Wilks and Zimelman 2004; Brazel et al. 2007). In summary, ERP implementations should improve the ability of managers to respond to market and contractual incentives by managing earnings.

The previous discussion has focused on management's ability to manage earnings. However, financial statements can be viewed as a joint effort of both management and the auditor (Antle and Nalebuff 1991). Financial statement audits and related internal controls are means in which the aforementioned managerial incentives and opportunities are kept in check and, in turn, provide reliable financial statements to external users. Prior research has linked audit quality to the extent to which earnings are managed. Positive relationships have been found between discretionary accrual levels and audit quality proxies such as auditor changes (DeFond and Subramanyam 1998), the issuance of qualified audit opinions (Bartov et al. 2000), and eventual auditor litigation (Heninger 2001). Similar to audit quality, internal control effectiveness has been found to constrain earnings management (Bell and Carcello 2000; Chan et al. 2005; Doyle et al. 2007).

But recent research indicates that these two safeguarding mechanisms may be impaired in an ERP system setting. For example, the results of Hunton et al. (2004) and Brazel and Agoglia (2007) suggest that auditor risk assessment and testing quality may be inadequate for clients that have implemented an ERP system. Also, there are concerns in practice with respect to the competency of IT auditors assigned to test the ERP system (e.g., Bagranoff and Vandrzyk 2000; Janvrin et al. 2004). With respect to internal controls, Wright and Wright (2002), through semi-structured interviews with IT audit specialists, find that 31.8 percent of their participants had experiences in practice where their client's ERP system lacked adequate controls. These systems often remove traditional internal controls such as

segregation of duties and supervisory review and require bolt-on internal control systems (Moore and Warrick 1998; Weinberg 1998). Similarly, inadequate system controls have been cited in SEC filings as a chief source of material weaknesses (Solomon 2005).<sup>2</sup>

Thus, following an ERP system implementation, the ability for firms to manage earnings to meet incentives may increase due to enhanced information access/control and reductions in the safeguards of audit quality and internal control effectiveness.<sup>3</sup> We test the following hypothesis:

**H1:** ERP system implementations lead to increases in earnings management.

### Earnings Release Date Management

The other chief benefit of ERP system implementations cited by Poston and Grabski (2001) is improved efficiencies through computerization. From the perspective of financial accounting information, this indicates a reduction in the financial reporting cycle for ERP system adopters. Indeed, anecdotal evidence and surveys suggest that ERP systems reduce reporting lags by processing business transactions more efficiently and reducing the financial close cycle (e.g., Mabert et al. 2000; Wah 2000; Hitt et al. 2002; Olhager and Selldin 2003).

Consider business mergers and acquisitions which have become increasingly commonplace. Mergers and acquisitions can lead to substantial changes in firm characteristics, including size and scope of operations (Lipson and Mortal 2006). Each business merged together or acquired typically has its own legacy information system, which may not be compatible with other company systems. At the end of each quarter it is necessary to acquire the accounting information from all the systems (sometimes worldwide) and aggregate the information in financial statements. Sometimes, even for very large firms, this may involve compiling the information from various sources by hand and entering the results into spreadsheets or other summary databases. For such firms, the adoption of an ERP system provides standardized data/procedures/general ledger and a common database. Information from various sources (covered by the adoption) can be aggregated immediately and reports can be generated automatically, subject to input assumptions such as management's estimates (Elliott 2002).<sup>4</sup> A reduction in the length of the reporting cycle should allow adopters to provide financial statements to external users in a more timely fashion. Presently,

<sup>2</sup> It is important to note that the majority of the aforementioned studies indicating reductions in audit and internal control quality after ERP adoptions were conducted during the earlier years of ERP implementations (late 1990s/early 2000s). Given the archival database used to test our hypotheses involves implementations occurring from 1993 to 1999, we will rely on this concurrent research which leads us to expect lower levels of audit/internal control quality following these implementations. However, it is likely that both of these safeguards have improved over time. For example, audit firms have developed professionals who specialize in types of ERP software (e.g., SAP specialists, Oracle specialists) and ERP vendors (and others) now promote their systems as a solution to Sarbanes-Oxley (SOX) Section 404 compliance (e.g., Winters 2004). Whether audit and internal control quality are better able to constrain earnings management in today's ERP settings is an empirical question for future research.

<sup>3</sup> The expectation that the presence of incentives and increased opportunities results in otherwise moral individuals becoming involved in financial statement management is consistent with the fraud triangle (AICPA 2002) and appears to be an accounting application of Wilson and Kelling's (1982) Broken Window Theory. This theory suggests that the impetus to engage in certain inappropriate behavior does not come from a certain personality type, but rather when environmental features allow such behavior (e.g., broken windows not fixed) and suggest such behavior is acceptable (Kelling and Coles 1996). See Berenson (2003) for similar descriptions of the financial reporting environment in the 1990s and how such a climate induced otherwise moral individuals to engage in earnings management.

<sup>4</sup> Additional information regarding how an ERP adoption can enhance the timeliness of earnings release dates is available at: [sap.com](http://sap.com): *Financial Management: The Accelerated Financial Close*.

reducing reporting lags is an important objective as accelerated filers now face a shorter window to file their 10-Ks (i.e., annual financial statements) with the SEC (SEC 2005).

Studies examining the timeliness of earnings release dates indicate that firms publish financial reports earlier when they have “good news.” For example, Givoly and Palmon (1982) define “good news” and “bad news” via an earnings expectation model, and their results suggest “bad news” reports tended to be delayed. Consistent with this finding, Whittred (1980) and Keller (1986) show that firms delay the reporting of financial statements when they have received a qualified audit opinion. Graham et al. (2005) and Bagnoli et al. (2007) find recent evidence that suggests firms intentionally delay releasing bad news to investors until after trading hours or until later in the week.

The ramifications of these studies are that firms appear to manage the timing of their earnings release dates and that, historically, firms providing “good news” to external users have incentives to shorten the time lag between their fiscal year-end and reporting date. As previously discussed, expectations and anecdotal/survey evidence suggest that ERP system adoptions should enhance management’s ability to provide more timely accounting information to external users. This leads to our second hypothesis:

**H2:** ERP system implementations shorten reporting lags for “good news” firms.

### Extent of ERP System Implementations

Firms implementing ERP systems can choose to install some or all of the modules (e.g., financial accounting, human resources) offered by their ERP system vendor. They also rarely select different modules from different ERP vendors (Sumner 2005). Therefore, accounting cycles (e.g., sales and collection cycle) not covered by an ERP module adoption are likely to be accounted for by a noncompatible legacy system, providing less manager access to/control over accounting information and a less efficient cycle close. Mabert et al. (2000) find that the most popular module implemented by U.S. firms is the financial accounting module. In studies evaluating the effects of ERP system module adoptions, both Hitt et al. (2002) and Nicolaou (2004) find stronger post-implementation performance for firms implementing more modules of the systems. Similarly, the extent of ERP implementation may augment the aforementioned effects of ERP implementations on the management of earnings and release dates.

Adopting more ERP system modules should allow management to access and control more accounting information. For example, implementing modules related to customer relations management (supply chain management) enhances management’s knowledge about transactions at or around reporting dates and thus may improve their ability to manipulate revenue (expense) recognition, alter supporting documentation, stuff channels, perpetrate “ghost” shipments, etc. At the same time, Brazel and Agoglia (2007) find evidence that the complexities associated with more ERP module installations may decrease audit and control quality.

The extent of module adoption should also lead to more seamless integration and improve efficiencies in the reporting cycle. Accounting data can be collected from standardized modules (e.g., inventory data from the materials management module) using the same chart of accounts. Accounting processes (e.g., reconciliations, asset management) which were once manual become automated as the extent of module adoption increases.<sup>5</sup>

<sup>5</sup> Additional information regarding how extensive ERP adoption can enhance the timeliness of earnings release dates is available at: sap.com: *Best-Practice Financial Accounting*; mySAP ERP Financials; and *Financial Management: The Accelerated Financial Close*.

Thus, the extent to which firms adopt the ERP system should positively affect their ability to manage earnings and shorten reporting lags. Therefore, the following hypotheses are tested:

**H3a:** The extent of ERP system implementation (i.e., the number of modules implemented) is positively related to the extent of earnings management.

**H3b:** The extent of ERP system implementation is negatively related to reporting lags for “good news” firms.

### III. SAMPLE SELECTION AND RESEARCH DESIGN

#### Sample Selection

We obtain our sample of ERP system adopters from a proprietary database supplied by a leading international provider of ERP systems. The unique dataset is a record of all license agreements sold by the company to U.S. firms from 1993 to 1999.<sup>6</sup> The dataset includes the name of the firm that purchased the license, the start date of implementation, the date when the installation was complete and the system went live, and the modules (e.g., financial accounting, human resources) that the firm implemented. This dataset is used for real operational decisions at the ERP provider; thus we believe that the dataset is extremely accurate.

We begin with 625 unique firms that purchased the ERP system and started the implementation process between 1993 and 1999. The years when the ERP systems went live range from 1994 to 1999. The average implementation period was 1.73 years. We searched the Ticker IDs for these firms on COMPUSTAT by firm names, and 315 firms that did not have Ticker IDs were removed from our sample.<sup>7</sup> As described below, we use the absolute value of discretionary accruals as our measure of earnings management. Therefore, data from COMPUSTAT needed to estimate discretionary accruals using the cross-sectional modified Jones model (Dechow et al. 1995) are required. Earnings announcement dates, available on COMPUSTAT, must also be available as we use reporting lag (i.e., days between the fiscal year-end and earnings announcement date) in our analysis of earnings release date management.

In this study, we investigate whether ERP implementations positively affect the management of earnings (increases in the absolute value of discretionary accruals) and earnings release dates (decreases in reporting lags for “good news” firms) using a one-group pre- and post-test design. The chief advantage of such a design is that it allows for adopters, in the pre-adoption phase, to serve as their own control group to evaluate post-adoption effects. Such a design is commonly used when the majority of publicly traded companies undergo an event (e.g., ERP adoption, SOX Section 404 compliance), rendering a matched-pair design less effective (e.g., Bathala and Carson 1995; Cassell et al. 2007).<sup>8</sup> A pre- and

<sup>6</sup> We obtained the implementation data from a leading provider of ERP systems in 2003. At that time, for researchers, implementation data were available only up to the year 1999. We later attempted to acquire more recent data. However, the vendor has decided to stop providing implementation data for academic research.

<sup>7</sup> The majority of firms that did not have Ticker IDs on COMPUSTAT were foreign companies, not-for-profit organizations, or private firms.

<sup>8</sup> An alternative approach would be to use a matched-pair design, matching our sample of adopting firms with nonadopters. However, a matched-pair design might include matched pairs that implemented another ERP vendor's system. This is highly likely given the preponderance (approximately 70 percent) of large, publicly traded firms that potentially implemented ERP systems during our sample period (Cerullo and Cerullo 2000). Attempts to match adopters with nonadopters led to a severe reduction in sample size due to the difficulty of finding a match (using conventional matching methods) that had not implemented some form of ERP system during the sample period.



post-test design has been used in a prior study of the effects of ERP implementations (Poston and Grabski 2001).

The dependent variables in pre- and post-ERP implementation periods are analyzed. Thus, we select firms that have data available in the year(s) of implementation ( $t = 0$ ), at least one year before the start of implementation ( $t - 1$ ), and at least one year after the system went live ( $t + 1$ ) during the time span of  $t - 3$  to  $t + 3$ . For example, if a firm started the implementation in 1993 and the system went live in 1994 (for 1993 and 1994,  $t = 0$ ), the analysis period for this firm will range from 1990 ( $t - 3$ ) to 1997 ( $t + 3$ ) assuming all required data are available from  $t - 3$  to  $t + 3$ . For a company that started and finished the implementation in 1999, the analysis period for this company will range from 1996 ( $t - 3$ ) to 2002 ( $t + 3$ ). In other words, our analysis period may begin as early as 1990 and finish as late as 2002. Therefore, in our dataset, the pre-adoption period for some adopting firms overlaps the post-adoption period for others (and vice versa).<sup>9</sup> Such lapsing negates the effects of environmental conditions that might only be present in either the pre- or post-test period, as would likely be the case if all of our implementations occurred in one year. Still, we include a time trend variable (as well as dummy variables for years) in our models to control for changes in the economic climate during our sample period.<sup>10</sup>

Two hundred and four firms (202) were used for earnings (earnings release date) management analysis. The final sample size in firm years is 1645 (1585) for earnings (release date) management analysis. See Table 1 for sample selection procedures and sample sizes. The number of observations for each year is different because not all firms selected have data available from year  $t - 3$  to year  $t + 3$ .

Since we examine the effect of ERP system implementations on the management of earnings and release dates via a pre- and post-test design, the primary independent variable is a dummy variable *AFT* (i.e., after implementation went live). *AFT* is set to 1 for the years falling after ERP system went live (year  $t + 1$  to year  $t + 3$ ) and 0 for the years falling before the system went live (year  $t - 3$  to year  $t = 0$ ). We also test whether the *extent* of ERP implementations affects the management of earnings and release dates. Although all sample firms purchased and implemented the ERP system, the modules adopted differ across firms. We include *EXTENT*, which is measured as the number of modules implemented, to examine the effects of more extensive ERP implementations.<sup>11</sup>

Table 2 presents the industry distribution for the sample firms. Most of the firms in our sample are from manufacturing and, to a lesser extent, service industries.

<sup>9</sup> For example, in our sample,  $t - 3$  ranges from 1990 to 1996,  $t = 0$  ranges from 1993 to 1999, and  $t + 3$  ranges from 1996 to 2002.

<sup>10</sup> Tabulated results include the time-trend variable. When we replace the time-trend variable with individual year dummy variables our results are qualitatively the same as those reported in the tables.

<sup>11</sup> To examine the effects of *EXTENT*, we will interact *EXTENT* with *AFT* due to the fact that *EXTENT* = 0 for the years falling before the system went live (when *AFT* = 0). Ninety-seven percent of our sample firms adopted the financial accounting module which produces the financial statements. Removing firms that did not adopt the financial accounting module from our sample does not qualitatively change our results. We also examined two other alternative *EXTENT* measures (results not tabulated). One measure is similar to the methods used by Hitt et al. (2002) and Nicolaou (2004). To be classified as a more extensive adopter, a firm had to implement *both* a manufacturing module and the financial accounting module, as well as either the human resources or project management modules. The dummy variable *EXTENT* is set to 1 (0) for more extensive (less extensive) implementers. The other measure is time (days) taken to implement the ERP system. We measure the time taken to implement as the number of days between the date the implementation started and the date the system went live. Using either of these alternative measures of *EXTENT* yields results that are qualitatively similar to those tabulated and reported in the text.

**TABLE 1**  
**Data Selection and Sample Size**

**Panel A: Selection Procedure**

<u>Earnings Management Analysis</u>		<u>Earnings Release Date Management Analysis</u>	
Unique firms with Implementation Data	625	Unique firms with Implementation Data	625
Less: Firms without Ticker IDs on COMPUSTAT	315	Less: Firms without Ticker IDs on COMPUSTAT	315
Firms not meeting data requirements for earnings management analysis <sup>a</sup>	106	Firms not meeting data requirements for disclosure management analysis <sup>a</sup>	108
Firms selected for reliability analysis	204	Firms selected for relevancy analysis	202

**Panel B: Sample Size**

<u>Year</u>	<u>Earnings Management Analysis Number of Observations in Each Year</u>	<u>Earnings Release Date Management Analysis Number of Observations in Each Year</u>
-3	180	155
-2	189	181
-1	201	183
0 <sup>b</sup>	517	511
1	200	196
2	183	183
3	175	176
Final Sample No. of Firm Years	1645	1585

<sup>a</sup> We require that each firm selected have all data available for analysis from COMPUSTAT and each firm have the required data at least one year before and one after the implementation year(s).

<sup>b</sup> The same firm may appear more than one time because, on average, it takes more than one year to complete the ERP system implementation. All the years falling between the ERP start year and ERP live year are considered as year 0.

**Research Design**

***Earnings Management***

Because managers may have incentives to manage accruals/earnings upwards and downwards, consistent with previous research (e.g. Becker et al. 1998), we use the absolute value of discretionary accruals to measure earnings management. Discretionary accruals are estimated using the cross-sectional modified Jones model (Dechow et al. 1995).<sup>12</sup> Using such an approach, actual total accruals are compared with forecasted total accruals from an accrual prediction model. The differences between actual total accruals and predicted accruals are assumed to represent discretionary accruals, or earnings management. Similar to the accrual measure in Bharath et al. (2007) and Hribar and Collins (2002), actual total

<sup>12</sup> Dechow et al. (1995) evaluate alternative accrual models and their results suggest that the modified Jones model has the highest power in detecting discretionary accruals. Our results are robust to standard Jones models using working capital accruals and cash flows, as well as the modified Jones model using working capital accruals (Jones 1991; Dechow et al. 1995; Richardson et al. 2005).

**TABLE 2**  
**Industry Distribution**

	<u>Earnings Analysis</u>		<u>Disclosure Analysis</u>	
Agricultural Production-Crops	1	0.49%	1	0.50%
Oil and Gas Extraction	2	0.98%	2	0.99%
Food and Kindred Products	8	3.92%	7	3.47%
Textile and Mill Products	3	1.47%	3	1.49%
Apparel and Other Textile Products	2	0.98%	2	0.99%
Lumber and Wood Products	1	0.49%	2	0.99%
Furniture and Fixtures	3	1.47%	3	1.49%
Paper and Allied Products	6	2.94%	6	2.97%
Printing and Publishing	2	0.98%	2	0.99%
Chemical and Allied Products	23	11.27%	24	11.88%
Petroleum and Coal Products	4	1.96%	4	1.98%
Rubber/Misc. Plastic Products	4	1.96%	4	1.98%
Leather and Leather Products	1	0.49%	1	0.50%
Stone, Clay, Glass, and Concrete Products	2	0.98%	2	0.99%
Primary Metal Industries	10	4.90%	10	4.95%
Fabricated Metal Products	3	1.47%	3	1.49%
Industrial and Commercial Machinery and Computer Equipment	31	15.20%	30	14.85%
Electrical Equipment and Components	24	11.76%	23	11.39%
Transportation Equipment	2	0.98%	3	1.49%
Measurement Analyzing, Control Instrument, and Related Products	18	8.82%	19	9.41%
Misc. Manufacturing Industries	4	1.96%	3	1.49%
Transportation by Air	1	0.49%	0	0.00%
Communications	1	0.49%	2	0.99%
Electric, Gas, and Sanitary Services	7	3.43%	5	2.48%
Wholesale-Durable Goods	4	1.96%	4	1.98%
Wholesale-Non-Durable Goods	5	2.45%	5	2.48%
Building Materials, Hardware, Garden Supplies and Mobile Home Dealers	2	0.98%	1	0.50%
Eating and Drinking Places	0	0.00%	2	0.99%
Misc. Retail	4	1.96%	3	1.49%
Depository Institutions	0	0.00%	1	0.50%
Insurance Carriers	1	0.49%	1	0.50%
Real Estate	1	0.49%	1	0.50%
Personal Services	0	0.00%	1	0.50%
Business Services	24	11.76%	22	10.89%
Total	204	100.00%	202	100.00%

accruals, *TAC*, are calculated as the difference between income before extraordinary items (COMPUSTAT #123) and operating cash flows (COMPUSTAT #308), net of cash flows from extraordinary items (COMPUSTAT #124) scaled by lagged total assets (COMPUSTAT #6). Total accruals are scaled by total assets to control for firm size effect. In fact, "total

accruals,"  $TAC$ , is a percentage of total assets. Consistent with the aforementioned literature, we run the following prediction model for each year within each industry that contains at least 15 firms:

$$TAC_{i,j,t} = \alpha_{1jt} \left( \frac{1}{TA_{i,j,t-1}} \right) + \alpha_{2jt} \frac{(\Delta Rev_{i,j,t} - \Delta AR_{i,j,t})}{TA_{i,j,t-1}} + \alpha_{3jt} \frac{PPE_{i,j,t}}{TA_{i,j,t-1}} + \varepsilon_{ijt} \quad (1)$$

where:

- $TAC_{i,j,t}$  = total accruals scaled by total assets for sample firm  $i$  in industry  $j$  at period  $t$ ;
- $TA_{i,j,t-1}$  = lagged total assets for sample firm  $i$  in industry  $j$  at period  $t - 1$ ;
- $\Delta REV_{i,j,t}$  = change in net revenues for sample firm  $i$  in industry  $j$  at period  $t$ ;
- $\Delta AR_{i,j,t}$  = change in net receivables for sample firm  $i$  in industry  $j$  at period  $t$ ; and
- $PPE_{i,j,t}$  = gross property plant and equipment for sample firm  $i$  in industry  $j$  at period  $t$ .

We perform OLS regression to estimate parameters in the above model and then use the estimated parameters to predict expected or nondiscretionary accruals. In other words, nondiscretionary accruals are calculated as the fitted values of equation (1). Removing the nondiscretionary accrual component from the actual total accruals will yield the discretionary accruals component. Therefore, the absolute value of discretionary accruals, our measure of earnings management, are the absolute values of the residuals of equation (1).

To test whether the level of earnings management increases after ERP implementations, we conduct regression analysis using panel data covering from three years before the first year of ERP installation to three years after the system went live. The dependent variable,  $ABSDA$ , is the absolute value of discretionary accruals estimated from the cross-sectional Jones model (Dechow et al. 1995).

Additional factors that might have an effect on discretionary accruals are included in the model as control variables. Company size ( $LGTA$ ), measured as the logarithm of total assets, is included to control for size effects. Prior research suggests that leverage ( $LEV$ ) might be associated with discretionary accruals (DeFond and Jiambalvo 1994; Becker et al. 1998). As suggested by Zhou and Elder (2002), a firm's market-to-book value ( $MTB$ ) is a proxy for growth opportunities and may affect discretionary accruals. Becker et al. (1998) argue that the firm's operating cash flows ( $OCF$ ) also might affect the magnitude of discretionary accruals. Therefore,  $LEV$ ,  $MTB$ , and  $OCF$  are also included as control variables in our model. Last, we control for the influence of general economic changes over our sample period by including a time-trend variable ( $TREND$ ). Consistent with research that adopts a time-trend variable (e.g., Canina et al. 2003),  $TREND$  is coded as 0 in 1990 and incremented by 1 for each year thereafter. To test H1 and H3a, we test the signs and significances of  $AFT$  and  $AFT*EXTENT$ , respectively, in the following regression model:

$$ABSDA = \beta_0 + \beta_1 AFT + \beta_2 AFT*EXTENT + \beta_3 LGTA + \beta_4 LEV + \beta_5 MTB + \beta_6 OCF + \beta_7 TREND + \varepsilon \quad (2)$$

### Earnings Release Date Management

Following the prior literature (e.g., Givoly and Palmon 1982; Chambers and Penman 1984; Haw et al. 2000), we use reporting lag ( $LAG$ ), the difference between the firm's actual earnings announcement date and fiscal year-end, to evaluate the management of earnings release dates. To test whether earnings release date management increases after

adoptions, we again perform regression analysis using panel data covering from three years before the first year of ERP installation to three years after the system went live. The dependent variable is *LAG*. As suggested by previous studies (e.g., Patell and Wolfson 1982), firms with “good news” tend to report their earnings earlier than firms with “bad news.” Therefore, we specifically test whether the reporting lag for good news firms has shortened after ERP adoption (i.e., evidence of increased levels of earnings release date management). Similar to Haw et al. (2000), we identify good news firms with the variable *ESURP*, calculated as the difference between the earnings per share (*EPS*) in year *t* and year *t* - 1, scaled by *EPS* in year *t* - 1. Positive (negative) earnings surprises represent good (bad) news. *EXTENT* is included in the model to test whether the extent of ERP implementation affects the management of earnings release dates. To test H2 and H3b, we examine the signs and significances of the interaction terms *AFT\*ESURP* and *AFT\*EXTENT\*ESURP*, respectively.

We also control for factors that might affect *LAG*. For example, firm size might affect the timeliness of earnings releases (SEC 2002). Since we adopt a pre- and post-ERP implementation design, we also control for the influence of economic changes over our sample period. Last, Whittred (1980) and Keller (1986) show that firms delay the reporting of financial statements when they have received a qualified audit opinion. Therefore, firm size (*LGTA*), a time-trend variable (*TREND*), and audit opinion (*AUDOPN*)<sup>13</sup> are controlled for in our earnings release date management analysis. Our model is specified as follows:

$$\begin{aligned} LAG = & \delta_0 + \delta_1 AFT + \delta_2 AFT*EXTENT + \delta_3 ESURP + \delta_4 AFT*ESURP \\ & + \delta_5 AFT*EXTENT*ESURP + \delta_6 LGTA + \delta_7 TREND \\ & + \delta_8 AUDOPN + \varepsilon \end{aligned} \quad (3)$$

#### IV. RESULTS

##### Earnings Management Analysis

We examine whether ERP implementations have an impact on earnings management (H1), as measured by the absolute value of discretionary accruals. Specifically, we test if the magnitude of discretionary accruals increased after the ERP systems went live. Table 3 shows descriptive statistics for discretionary accruals (*DA*), the absolute value of discretionary accruals (*ABSDA*), the log of total assets (*LGTA*), cash flows from operating activities and cash flows from operating activities scaled by total assets (*CF* and *OCF*, respectively), leverage (*LEV*), and market-to-book value (*MTB*) for the pre- and post-implementation periods. We find that *DA*, *ABSDA*, and *CF* show obvious increases from the pre-implementation to the post-implementation period. We also find mean discretionary accruals (*DA*) to be negative (i.e., income-decreasing) pre-ERP implementation (*t* - 3 to *t* = 0) and positive (i.e., income-increasing) post-ERP implementation (year *t* + 1 to year *t* + 3). Firms, on average, appear to be managing earnings upward after ERP system adoption.

To test whether the absolute values of discretionary accruals are significantly higher for the post-implementation period (H1), we conduct the multivariate regression analysis

<sup>13</sup> We find that none of our sample firms in any years received qualified audit opinions. However, we did find variation in the audit reports of our sample firms (*AUDOPN*). Specifically, our sample firms either received unqualified opinions with no explanatory language or unqualified opinions with explanatory language. Therefore, we set *AUDOPN* as a dummy variable with 0 = unqualified opinion without explanatory language and 1 = unqualified audit opinion with explanatory language.

**TABLE 3**  
**Descriptive Statistics—Earnings Management Analysis**

Variable	Pre-ERP Implementation			Post-ERP Implementation		
	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
<i>DA</i>	-0.003	-0.001	0.117	0.08	0.011	0.322
<i>ABSDA</i>	0.095	0.056	0.103	0.226	0.093	0.326
<i>LGTA</i>	7.017	6.736	1.657	7.326	7.169	1.657
<i>CF</i>	440.593	89.82	776.67	521.334	114.2	890.494
<i>OCF</i>	0.112	0.105	0.0778	0.089	0.092	0.107
<i>LEV</i>	0.204	0.194	0.142	0.233	0.223	0.166
<i>MTB</i>	3.081	2.337	2.308	3.167	2.165	2.933

Variable definitions:

*DA* = discretionary accruals estimated using the modified Jones Model;

*ABSDA* = the absolute value of discretionary accruals estimated using the modified Jones Model;

*LGTA* = natural logarithm of total assets;

*CF* = cash flows from operating activities;

*OCF* = operating cash flows scaled by total assets.

*LEV* = total debts divided by total assets; and

*MTB* = market to book value of equity.

discussed in the previous section. We winsorize all continuous variables in all of our analyses at the fifth and ninety-fifth percentiles to minimize the impact of extreme values or outliers. Table 4 presents regression results. Results show a significant ( $p = 0.013$ ) and positive coefficient for *AFT*. Earnings management appears to have increased after the ERP system went live. This result supports H1. We also test if the extent of ERP implementation is positively associated with the level of earnings management (H3a). As shown in Table 4, consistent with our expectation, the coefficient on *AFT\*EXTENT* is positive and significant ( $p = 0.048$ ). Therefore, H3a is also supported by our regression result.

### Earnings Release Date Management Analysis

In this section, we investigate whether ERP system implementations shorten the reporting lag for “good news” firms and therefore provide evidence that ERP adoptions facilitate earnings release date management (H2). Table 5 exhibits the descriptive statistics for pre- and post-ERP implementation periods. We find that the mean of the reporting lag, *LAG*, is slightly greater for the post-implementation period compared to the pre-implementation period. However, concurrently, we find that the mean of earnings surprise is positive in pre-implementation period, but negative in the post-implementation period. This combined result is consistent with previous findings by Givoly and Penman (1982) (i.e., that good (bad) news firms accelerate (delay) their reporting releases).<sup>14</sup>

To test whether reporting lags have decreased in the post-implementation period for good news firms (H2), our primary variable of interest is the interaction between the post-implementation dummy *AFT* and the proxy for good news *ESURP*. Multivariate regression

<sup>14</sup> Descriptive statistics in Table 5 show that the average reporting lag is longer in the post-implementation periods compared with the pre-implementation periods. However, we also find (not tabulated) that firms reported a net loss more often in the post-implementation period than in the pre-implementation period. Therefore, the longer average reporting lag may be due to higher frequencies of losses in the post-implementation periods, assuming that management has the incentive to withhold bad news (Graham et al. 2005; Bagnoli et al. 2007).

**TABLE 4**  
**Regression Analysis—Earnings Management Analysis**

$$ABSDA = \beta_0 + \beta_1 AFT + \beta_2 EXTENT * AFT + \beta_3 LGTA + \beta_4 LEV + \beta_5 MTB + \beta_6 OCF + \beta_7 TREND + \varepsilon$$

<u>Variable</u>	<u>Coefficient</u>	<u>Standard Error</u>	<u>p-value</u>
(Intercept)	0.101***	0.025	<0.001
AFT	0.061**	0.027	0.013
AFT*EXTENT	0.005**	0.003	0.048
LGTA	-0.011***	0.003	<0.001
LEV	-0.101**	0.036	0.005
MTB	0.009***	0.002	<0.001
OCF	0.142**	0.062	0.018
TREND	0.009***	0.002	<0.001
Adj. R <sup>2</sup>	0.126		
F-statistic	34.95***		

\*\*\*, \*\*, \* Indicate the coefficients are significant at 0.01, 0.05, and 0.1 levels, respectively.

Variable definitions:

ABSDA = the absolute value of discretionary accruals estimated using the modified Jones Model;

AFT = dummy variable, set to one for the years falling after the ERP went live (t + 1 to t + 3) and 0 for the years falling before the ERP system went live (t - 3 to t = 0);

EXTENT = measured by the number of modules implemented;

LGTA = logarithm of total assets;

LEV = total debts divided by total assets;

MTB = market to book value of equity;

OCF = operating cash flows scaled by total assets; and

TREND = is a trend variable taking a value of 0 in 1990 and incremented by 1 for each year thereafter.

**TABLE 5**  
**Descriptive Statistics—Earnings Release Date Management Analysis**

<u>Variable</u>	<u>Pre-ERP Implementation</u>			<u>Post-ERP Implementation</u>		
	<u>Mean</u>	<u>Median</u>	<u>Std. Dev.</u>	<u>Mean</u>	<u>Median</u>	<u>Std. Dev.</u>
LAG	33.395	31	11.709	35.061	31	14.689
ESURP	0.318	0.082	1.173	-0.03	-0.013	1.667
LGTA	7.176	6.979	1.73	7.419	7.336	1.811
AUDOPN	0.295	0	0.456	0.23	0	0.421

Variable definitions:

LAG = the difference between the firm's actual earnings announcement date and fiscal year-end;

ESURP = difference between the earnings per shares in year t and year t - 1, scaled by EPS in year t - 1;

LGTA = logarithm of total assets; and

AUDOPN = audit opinion, is set to 0 for unqualified audit opinions without explanatory language and 1 for unqualified opinion with explanatory language.

analysis is presented in Table 6. The result shows a negative and significant coefficient ( $p = 0.013$ ) for the interaction term  $AFT * ESURP$ . This result indicates that the reporting lags of good news firms are significantly decreased after ERP implementations. Thus, our results support H2. ERP implementations appear to increase the ability of good news firms to

**TABLE 6**  
**Regression Analysis—Earnings Release Date Management Analysis**

$$LAG = \delta_0 + \delta_1 AFT + \delta_2 ESURP + \delta_3 AFT * EXTENT + \delta_4 AFT * ESURP \\ + \delta_5 AFT * EXTENT * ESURP + \delta_6 LGTA + \delta_7 TREND + \delta_8 AUDOPN + \epsilon$$

Variable	Coefficient	Standard Error	p-value
(Intercept)	46.638***	1.555	<0.001
AFT	0.766	1.577	0.627
ESURP	-0.199	0.313	0.526
AFT*EXTENT	-0.095*	0.050	0.059
AFT*ESURP	0.643**	0.325	0.013
AFT*EXTENT*ESURP	-0.105	0.104	0.156
LGTA	-2.733***	0.170	<0.001
TREND	0.978***	0.157	<0.001
AUDOPN	0.593***	0.227	0.009
Adj. R <sup>2</sup>	0.157		
F-statistic	39.96***		

\*\*\*, \*\*, \* Indicate the coefficients are significant at 0.01, 0.05, and 0.1 levels, respectively.

Variable definitions:

LAG = the difference between the firm's actual earnings announcement date and fiscal year-end;

AFT = dummy variable, set to 1 for the years falling after the ERP went live (t + 1 to t + 3) and 0 for the years falling before the ERP system went live (t - 3 to t = 0);

EXTENT = number of modules implemented;

ESURP = difference between the earnings per shares in year t and year t - 1 scaled by EPS in year t - 1.

LGTA = logarithm of total assets;

TREND = is a trend variable taking a value of 0 in 1990 and incremented by 1 for each year thereafter; and

AUDOPN = auditor opinion. A dummy variable with value 0 for unqualified opinion without explanatory language and 1 otherwise.

manage earnings release dates.<sup>15</sup> Hypothesis 3b predicts that as the extent of ERP adoption increases, the level of earnings release date management will increase for good news firms. Table 6 shows that the effect of the interaction between AFT and EXTENT is marginally significant and negative (p = 0.059), indicating a shorter reporting lag in the post-ERP implementation period for both good and bad news firms that have more extensively implemented the system. To test H3b, however, our variable of interest is the three-way interaction term AFT\*EXTENT\*ESURP (i.e., we examine the management of release dates in the good news condition). Unlike the effect for AFT\*EXTENT, this interaction term is not significant (p = 0.156). Therefore, H3b is not supported.<sup>16</sup>

## V. CONCLUSIONS

We examine whether a firm's decision to implement an ERP system has a positive effect on the management of earnings and release dates. Due to market incentives and the

<sup>15</sup> For all analyses of ESURP as measured by the percentage change in EPS, we find qualitatively similar results (not tabulated) using another proxy for good news firms: "positive earnings." We measure "positive earnings" by coding observations as 1 if net income is positive and 0 otherwise.

<sup>16</sup> Given the literature on reporting lags (e.g., Givoly and Penman 1982), we hypothesized that the extent of ERP system implementations is positively related to the extent of earnings release date management for good news firms. Contrary to this literature, we find evidence that the extent of adoption leads to shortened reporting lags for both good news and bad news firms. It should be noted that our finding in relation to H2 is consistent with the prior literature (i.e., ERP system implementations shorten the reporting lag for good news firms).



combination of increased manager access to accounting data and decreased audit and control quality following an ERP adoption, earnings management may increase post-adoption. Efficiencies promoted by ERP systems should reduce the reporting cycle and facilitate the management of earnings releases to external users. Last, we examine whether the extent of module adoption augments the aforementioned effects.

Our results suggest that, following ERP adoptions, the extent of earnings management increases. Specifically, the absolute value of discretionary accruals in financial statements rises significantly after the system is installed. We also find a positive relationship between the number of modules implemented and earnings management. With respect to the management of earnings release dates, ERP systems appear to assist firms in reducing the reporting lags (i.e., earlier earnings release dates) when disseminating good news to the market.

These findings have implications for future research and individuals involved with ERP system implementations. First, our results document the effects of ERP adoption through three years after implementation. Additional studies could attempt to discern whether the trends observed in this study abate, continue, or become more acute in the long term. Second, if ERP systems apparently allow managers more discretion over accounting information, then the quality of accounting information (e.g., ratios) used to evaluate post-ERP adoption performance may be suspect. Future research looking into the relationship between ERP and performance may want to use nonfinancial measures (e.g., number of facilities, new products, and customer satisfaction ratings) to complement financial measures when measuring operational improvement. Third, our finding that ERP systems can reduce reporting lags suggests that a chief advantage of these systems may be the ability to meet reduced 10-K filing deadlines recently imposed by the SEC. Fourth, given the recent consolidation in the ERP industry and the anticipation of the next generation of ERP applications from the major vendors, the results of this study should provide researchers with some insight as to future effects associated with their adoption. Fifth, given the mixed results in this study related to the extent of module adoption, discerning when more extensive module implementation affects ERP system performance (and when it does not) may be a fruitful area of future research. Last, the results documented in this study should be of interest to financial statement preparers initially adopting or implementing new versions of ERP applications, auditors serving clients with ERP systems, and regulators overseeing the financial markets and consolidation in the ERP industry.

This study is subject to several limitations. Although our data are very accurate, there might be a selection bias because we obtained our data from only one primary provider of ERP systems. This limitation suggests caution in generalizing the findings of this study. Also, in the development of our earnings management hypotheses, we rely on prior research indicating that the safeguards of audit and internal control may have been suspect during our sample period. Whether these two checks on earnings management have improved over time, thus attenuating the relationship between ERP implementations and earnings management, is an empirical question for future research.

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