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A Study of How Underperforming Firms Follow Industry Leaders When Adopting ERP Systems and the Economic Effects of Their Adoption Decisions

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Abstract:

Researchers have proposed but not tested that early-stage adopters of ERP systems tend to be higher-performing firms that adopt as a means of gaining or maintaining a competitive advantage. In contrast, they have proposed that late-stage adopters are underperforming firms that experience institutional pressures and make adoption decisions partly in response to those pressures and to try to improve performance and catch-up to industry leaders. In this study, we examine the relationship between firm performance and ERP adoption. We found that late-stage adopters tend to have lower financial performance relative to the overall market in the years leading up to adoption decisions as compared to early-stage adopters that tended to outperform the market in years leading up to adoption decisions. This finding demonstrates the relationship between firm performance and ERP adoption. We also found that, post-adoption, the relative performance of late-stage adopters tends to improve more than early-stage adopters. This finding suggests that following the actions of industry leaders and adopting ERP systems can have economic benefits for underperforming firms.

Keywords: Institutional Theory, Systems Adoption, Contagion, Isomorphism, ERP.

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1 Introduction

Institutional theory posits that firms experience various types of pressures to adopt organizational structures and technologies including: 1) coercive pressure from outside influencers such as government entities or powerful customers; 2) normative pressure to follow best practices that other firms typically undertake; or (3) mimetic pressure to emulate the actions of highly successful firms (DiMaggio & Powell, 1983, 1991).

Theorists propose that institutional pressures are particularly strong when firms adopt complex structures that make systematic cost benefit analyses difficult and when firms are interconnected, which makes it easier for them to share information about technologies and structures. Institutional pressures are also strong among underperforming firms whose managers look to emulate more successful firms and industry norms as a means of legitimizing their decisions (Hawley, Boland, & Boland, 1965; Tuttle & Dillard, 2007; Ugrin, 2009). Research has found linkages between the primary facets of institutional theory and systems adoption decisions (Teo, Wei, & Benbasat, 2003) and have provided evidence to suggest that the interconnectedness between firms indeed amplifies institutional pressures (e.g., Mezias & Scarselletta, 1994). Research also shown that firms considering complex structures, such as enterprise resource planning (ERP) systems, are more susceptible to institutional pressures (Ugrin, 2009). The literature has not; however, provided evidence of the relationship between firm performance and institutional theory.

Classical institutional theorists have also argued that adopting systems because of institutional pressures rather than systematic analyses can be problematic for firms because they may adopt systems that do not fit their organizations, which may, in turn, be one reason that systems such as ERP systems sometimes fail to provide expected returns (Hong & Kim, 2002). If ERP systems do not fit, adoption would ultimately hurt firm performance post-adoption, and their underperformance would continue and perhaps become even greater (Westphal, Gulati, & Shortell, 1997). However, we find that unlikely when considering system adoption through a neo-institutional lens (Tuttle & Dillard, 2007). From that perspective, underperforming firms would not blindly follow the lead of high performers—they would wait and see if technologies previously adopted by high-performing firms provide the expected benefits and adopt similar technologies if they do. By following the lead of early adopters, late-stage adopters learn valuable insights and avoid costs associated with research, development, and analyses while gaining the same benefits as early adopters who have endured such costs. Thus, late-stage adopters may ultimately gain more from ERP adoption. We do not know about any ERP study that has shown such an effect. However, other literatures, such as the diffusion of innovations literature (Rogers, 1983) and the literature on first mover advantages and disadvantages (Porter, 1985), recognize the idea that early-stage adopters may face a disadvantage because they incur exploration and learning costs while late-stage adopters do not.

In this paper, we examine if late-stage adopters tend to be underperforming firms and see if their performance improves post-adoption. We explore the first objective by examining the relationship between the performance of firms that have adopted ERP systems and the timing of their adoption. Consistent with propositions that Rumelt (1974), Tolbert and Zucker (1983) and Young, Charns, and Shortell (2001) have made, we propose that early-stage adopters tend to be higher-performing firms who are more likely to adopt by way of more detailed systematic analyses to expand their competitive advantage and that late-stage adopters tend to be lower-performing firms who are less likely to adopt due to detailed systematic analyses and, thus, mimic or follow the norms set by the higher-performing firms to legitimize their actions and to catch-up to leading firms. We empirically demonstrate the relationship between firm performance and stage of adoption by examining the relative performance of early and late-stage adopters of ERP systems using data from public reporting companies that adopted ERP systems between 1994 and 2001. We explore the second objective by testing if late-stage adopters of ERP systems obtain a benefit and see their performance improve relative to the market after following the lead of successful firms. We demonstrate that relationship empirically by testing our sample of adopting firms and measuring if the abnormal market returns of the late-stage adopters improve or decline post-adoption relative to early-stage adopters.

We found that late-stage adopters tend to have significantly lower abnormal market returns versus early-stage adopters leading up to the implementation decision. This pattern is consistent with our proposition that late-stage adopters tend to be underperforming firms. We also found that, post-adoption, late-stage adopters' abnormal market returns improve relative to early-stage adopters, which suggests they benefit from their adoption decision and make progress towards catching up.

These findings contribute to the ERP literature by moving beyond simplistically explaining that firms perform thorough cost-benefit analyses and make adoption decisions based solely on those analyses when adopting ERP systems. We also contribute to the institutional theory literature by: 1) examining a previously untested condition that would theoretically amplify institutional pressures and firm performance and 2) showing that adopting technologies at later stages in response to institutional pressures can be more than a legitimatizing action but an economically advantageous one.

This paper proceeds as follows. In Section 2, we review the relevant literature on ERP adoption, institutional theory, and ERP adoption from an institutional theory perspective. Based on that review, we formulate hypotheses. In Section 3, we discuss the paper's methodology and data sample and, in Section 4, present the results. Finally, in Section 5, we discuss our study's limitations and implications and conclude the paper.

2 Background

In a competitive environment practical use of technology can positively position firms in their industry. An enterprise resource planning (ERP) system is one such technology that can give firms a competitive advantage by altering processes in the organizational value stream (Hayes, Hunton, & Reck, 2001; Markus & Tanis, 2000). ERP systems evolved in the 1990s from manufacturing resource planning (MRPII) systems and materials requirements planning (MRP) systems (Umble, Haft, & Umble, 2003). They consolidate all of the back-office information processing requirements of a typical business into one integrated system, which includes accounting/finance, human resources, operations, supply chain, and customer information (Davenport, 1998). This common system design allows firms to capture information once and then share it across functional areas, which enables "information congruence" (O'Leary, 2002). Although the potential benefits of ERP systems are well accepted, the economic returns for ERP adopters have been inconsistent (Markus & Tanis, 2000; Nicolaou, 2004; Nicolaou & Bhattacharya, 2006; Morris, 2011).

The literature on ERP adoption tends to assume that managers adopt ERP systems only after performing systematic cost/benefit analyses aimed at quantifying the operational efficiencies that their firm can obtain through the ERP system. For instance, in reviewing ERP research, Grabski, Leech, and Schmidt (2011, p. 38) state that "ERP system adoption is motivated by management's need for timely access to consistent information across the diverse functional areas of a company". However, some information systems researchers have offered a different perspective using institutional theory as a lens to investigate the adoption of ERP and other information systems (Orlikowski & Barley, 2001; Fichman, 2004; Teo et al., 2003; Jeyariaj, Charles, Balser, & Griggs, 2004; Ugrin, 2009; Lyytinen, Newman, & Al-Muharfi, 2009).

Orlikowski and Barley (2001, p. 25) found that the systems literature had a narrow focus and had yet to "make much use of more recent developments in organization theory that include themes of institutionalization, globalization, entrepreneurship, and post-modernity". They go on to state that "an institutional perspective would offer IT researchers a vantage point for conceptualizing the digital economy as an emergent, evolving, embedded, fragmented, and provisional social production that is shaped as much by cultural and structural forces as by technical and economic ones". Likewise, Fichman (2004, p. 325) suggests that a failing in systems research is that the "dominant paradigm is that organizations each make independent assessment of the innovation and decide whether and when to adopt based on the inherent merits of the technology (e.g., potential to improve the organization versus the cost to adopt)". As a heed to those calls, other researchers have used institutional theory to depict how some firms look outside their own firms for technologies to adopt rather than systematically analyzing internal information system needs (Teo et al., 2003). Research has shown the effect of institutional pressures to be particularly strong on firms that adopt ERP systems due ERP systems' high complexity and because it is difficult to systematically assess the potential costs and benefits of adopting them (Ugrin, 2009).

2.1 Institutional Theory

Institutional theory describes the effects of social pressures on organizational decisions and includes three facets that influence how individuals formulate organizational decisions after considering outside influences (DiMaggio & Powell, 1983, 1991). The three facets of institutional theory are: 1) compliance to coercive pressures, 2) conformity to established norms, and 3) mimicry of perceived legitimate organizations.

The coercive facet of institutional theory depicts how firms comply with powerful entities, such as governments or powerful customers. It describes how firms can feel obligated to adopt technologies and structures due to real or perceived pressures that powerful entities place on them. Compliance with

coercive pressures is less "voluntary" than the other two facets (DiMaggio & Powell 1983, 1991). For example, some firms may have adopted ERP systems prior to the year 2000 to avoid so-called Y2K problems[1] (DePrince & Ford, 1998). Those firms may have felt compelled to adopt to avoid the risk of damaging the firm or going out of business if the dire predictions came true. Research has shown the coercive facet of institutional theory to influence how firms are structured (Fligstein, 1985), and, when evaluated in the context of ERP adoption, research has conjectured it to be a significant driver of ERP adoption in firms (Lyytinen et al., 2009).

Conformity to established norms depicts how organizations go along with industry norms and standards. Conformity tends to occur more easily in industries because interaction between firms allows them to exchange ideas (Greenwood, Oliver, Suddaby, & Sahlin, 2008). Teo et al. (2003, p. 24) state: "A focal organization with direct or indirect ties to other organizations that have adopted an innovation is able to learn about that innovation and its associated benefits and costs, and is likely to behave similarly". Thus, involvement in professional, trade, or other business organizations amplifies normative pressure (Teo et al., 2003; Ugrin, 2009). In another context (accounting), Mezias and Scarselletta (1994) attributed consensus building among the Financial Accounting Standards Board members to conformity. They found that, when the task force members had a common background, they reached consensus more quickly and with less debate. In the context of ERP, Ugrin (2009) found that managers were more likely to indicate they would adopt an ERP system when ERP systems had already been adopted by their firms' suppliers and customers.

The mimetic facet of institutional theory depicts how underperforming firms tend to follow the lead—or mimic—firms that are performing well. Industry leaders tend to be innovators that focus on developing new ways to maintain their advantage and make decisions through cost-benefit analyses aimed at improving operational and organizational effectiveness (Rumelt, 1974; Tolbert & Zucker, 1983; Tuttle & Dillard, 2007). As industry leaders, early-stage adopters also have the resources to invest in new technologies. Underperformers lack resources to develop technologies on their own and also feel pressured to legitimize their decisions by mimicking industry leaders or following the norms in their industry. Mimicry can be advantageous as mimicking firms that use a "wait-and-see-what-happens–at-other-firms" approach to management can avoid the costs and pitfalls of developing and implementing new technologies on their own. Researchers have used mimicry to explain many organizational decisions such as the adoption of different organizational structures (Fligstein, 1985) and the adoption of governmental policies (Radaelli, 2000). In Ugrin's (2009) study, managers were more likely to indicate they would adopt an ERP system if they perceived that successful competitors had already done so.

From a classical perspective, both mimicry and conformity to norms are rooted in insecurity, risk, and uncertainty. Firms attempt to eliminate these factors by imitating other organizations they perceive to be successful or conforming to the practices undertaken by other firms in their industry. Mimicry and conformity ease the insecurity caused by ambiguity and give decision makers a feeling of assurance that they are making good decisions; the decision makers expect that important constituents will evaluate their decisions favorably regardless of the eventual outcome (Donaldson, 1995). For example, even if the result of a decision to adopt an ERP system goes bad or the performance of an underperforming firm that elects to adopt an ERP system does not improve, an organization will find it easier to justify the decision itself if it follows the actions of highly successful firms or industry norms. This type of action—following the behavior of industry leaders—brings legitimacy to underperforming managers' decisions, which is part of the institutional process that Tuttle and Dillard (2007, p. 390) describe:

> *As one or more entities or groups gain advantage through whatever means and begin to accumulate resources and power, the organizational field stratifies and institutional legitimacy rises to force. ….For those who are already in force, their modes of behavior (processes and procedures) become routine, facilitating stability. As these routine behaviors decouple from competitive measures, they are more likely to become ceremonial and political influences. For those who are not in force, forces within the organizational field create pressure to adopt behaviors similar to those of "successful" entities.*

[1] Prior to the year 2000, many software applications used only a two digit field to represent the year. A concern developed that, when the century changed, many applications that used date functions would experience problems. Many felt that the problems could even crash entire systems as date ranges would be confused because the year 00, for instance, would be considered earlier than the year 99.

Initially, classical institutional theorists intended to challenge the rational/functionalist perspective on management by "depicting organizations as irrational and their managers as duplicitous" (Donaldson, 1995, p. 80). From this point of view, underperforming firms should quickly embrace practices and technologies implemented by leading firms without even waiting to evaluate the effects of those practices and technologies. Thus, adopting organizational mechanisms becomes a social process in which innovation is replaced by management's attempt to justify their organization's actions by adopting mechanisms that have been adopted by leading firms. The more contemporary point of view is that late-stage adopters observe the actions of innovative firms that differentiate themselves through creative using new technologies and structures, and, if those implementation decisions are successful, the late-stage adopters follow suit. Late-stage adopters observe and process outcome information rather than perform a systematic analysis conducted in an orderly fashion that evaluates each component of the system, the processes the new system impacts, and the potential savings the new system will bring through process improvements (e.g., Tuttle & Dillard, 2007). Thus, both innovation and pressures to comply with industry practices and norms that have developed through initial success guide the late-stage adoption of technologies and structures.

As a final point, researchers have traditionally suggested that increased homogeneity among firms evidences institutional theory. In industries, institutional pressures result in increased homogeneity, and, as organizations become increasingly homogeneous, that pressure amplifies, which results in even greater homogeneity (Hawley et al., 1965). How firms in an industry adopt technologies evolves over time from a state in which firms independently evaluate technologies and innovation to a state of homogeneity in which firms identify best practices in using technologies, which leads to most firms adopting those technologies.

2.2 Institutional Theory and ERP Adoption: Existing Literature, Missing Elements and Hypotheses

In the systems-adoption literature, Teo et al. (2003) found that perceived institutional pressures influenced managers' intent to adopt information systems (financial electronic data interchange), and Ugrin (2009) extended that research by examining the effects of institutional pressures on managers' intent to adopt ERP systems specifically. Ugrin (2009) also tested the moderating effects of managers' perceptions of the complexity of the system and their perceptions that the ERP system will integrate firms up and down the supply chain. Ugrin (2009) found that ERP adoption decisions are particularly susceptible to institutional pressures because of the difficulty in quantifying the benefits of an ERP system due to the system's size and complexity. Managers were more likely to mimic when they perceived that the ERP system was complex and a systematic cost-benefit analysis would be hard to perform. They were also more likely to be influenced by normative pressures when they perceived that the system would integrate firms. Taken as a whole, these findings suggest that firms make ERP adoption decisions through both functional (integration up and down the supply chain that would seemingly reduce cost) and non-functional processes (mimicking other firms because the cost-benefit of ERP is hard to evaluate).

In another study, Lyytinen et al. (2009) used an "ethnographic" approach to evaluate the factors that influenced a Saudi steel company's decision to adopt an ERP system. They interviewed 63 people involved in designing and implementing the system. Their findings suggest that the company first adopted the ERP system because its previous system lacked future support (a coercive pressure). Other pressures from its observing its competitors and governmental pressure to modernize also influenced its ultimate decision to implement an ERP system and how it did so.

The studies cited in the previous two paragraphs evidence the linkages between institutional pressures and ERP adoption decisions and examine several moderating factors that amplify institutional pressures. However, research has yet to examine empirical data to test assertions made by institutional theorists that poor-performing firms tend to be late-stage adopters of technologies and structures for reasons such as lack of resources and mounting pressure (Hawley et al. 1965). Poor-performing firms' managers have a greater tendency to look outside their firm for solutions and legitimate courses of action (Rumelt, 1974; Tolbert & Zucker, 1983; Young et al., 2001). Firms perceive the most legitimate courses of action as the actions that other firms have successfully taken (Ugrin, 2009).

An historical look at ERP adoption from early to later stages would offer evidence to support the assertion that institutional pressures, technology adoption, and firm performance interact. To provide evidence of the relationships between firm performance, stage of adoption, and institutional pressure, we propose that archival data will show that the financial performance of late-stage ERP adopters will be worse than that of

early-stage adopters. We expect to see a pattern of adoption in which more successful firms lead the way and underperformers follow. We propose that significant differences in performance for firms in the two stages and a larger number of poor performers in the later years will substantiate our proposition. We make the following hypothesis:

Hypothesis 1: Late-stage ERP adopters are more likely to underperform relative to early-stage ERP adopters.

Our second hypothesis centers on the ultimate outcomes for late-stage adopters. The neo-institutional perspective suggests that late-stage adopters of technologies adopt technologies as a legitimizing action and adopt technologies that others have successfully implemented (Tuttle & Dillard, 2007). Late-stage adopters may not perform a detailed and systematic analysis of the costs and benefits of implementing an ERP system, but they may evaluate the success of others who have implemented ERP instead. Thus, late-stage adopters can avoid the costs associated with systematic analyses but can gain the benefits from ERP adoption. As such, late-stage adopters may see their relative performance to early-stage adopters improve as early-stage adopters expend money and resources on analyzing and researching new technologies such as ERP and late-stage adopters do not—late-stage adopters just implement systems that have been beneficial to others without expending a large amount of resources on the front end.

Note that ERP systems do not fit all firms because not all firms are alike, but they tend to have positive effects on firm performance in general and, thus, we conjecture they will positively benefit late-stage adopters and improve their abnormal market returns. Note also that late-stage adopters' abnormal returns may improve relative to early-stage adopters because they have more to gain by default as their past poor performance leaves them more room for improvement. However, as we illustrate above, late-stage adopters can gain on early-stage adopters by foregoing the costs of detailed research and analysis while enjoying the benefits. We expect to see the abnormal market returns for late-stage adopters to improve relative to early-stage adopters.

Hypothesis 2: The performance of late-stage ERP adopters improves more than the performance of early-stage adopters post-adoption.

3 Methodology and Data Sample

3.1 Methodology

Although one can measure firm performance in several different ways, prior research (mainly in accounting and finance) has used the capital markets pricing of equity as a proxy for the intrinsic value of a firm (Modigliani & Miller, 1958; Ball & Brown, 1968; Ohlson, 1995; Feltham & Ohlson, 1995). The efficient market hypothesis holds that the price of a security is an accurate estimate of the securities true value made by the market. The estimate fully reflects all information that is publicly available (Eakins, 2002). As firms' performance changes, the value of their stock changes to reflect the market's estimate of their value: well- performing firms experience increases in stock price, and poor-performing firms experience decreases. Measuring the change in this price is one way to assess a firm's performance. A better measure is the total returns that shareholders experience based on the change in price (capital appreciation) and dividends earned over a period of time. To test our hypotheses, we examine monthly returns for ERP adopters prior to the ERP implementation decision using the following abnormal returns model adapted from Ang and Zhang (2004):

$$ABRET_{it} = R_{it} - BR_{it} \quad (1)$$

Where $ABRET_{it}$ is the abnormal return for firm i in period t, R_{it} is the total return for firm i in period t, and BR_{it} is the benchmark return for firm i in period t. We obtained the data to calculate returns for each firm from the Center for Research in Securities Prices' (CRSP) monthly database. Our calculation for returns is based on the change in market price for the firm's stock during the holding period adjusted for stock splits and dividend payments. Benchmark returns are based on the CRSP's value weighted index for all firms in the database during the corresponding monthly periods. Therefore, firms with positive abnormal returns have performed above the benchmark and those with negative abnormal returns have performed below it. Since we computed abnormal returns on a relative basis compared to all other returns during the same month, our calculation controls for other macro-economic factors that could affect stock price.

Based on our hypothesis, we would expect late-stage adopters of ERP systems to have lower abnormal returns than early-stage adopters.

To measure the difference in performance between early-stage adopters and late-stage adopters, we compare the frequency of positive and negative abnormal returns over the four-year period leading up to the implementation decision. We also use the following ordinary least squares regression model to measure the average abnormal returns during the same period:

$$ABRET_{it} = \alpha + \beta_1 Late_{it} + \beta_2 MCap_{it} + \varepsilon \quad (2)$$

Where $ABRET_{it}$ is the abnormal return for firm *i* in period *t*. $Late_{it}$ is a dichotomous variable equal to (1) for late-stage adopters and (0) for early-stage adopters, $MCap_{it}$ is the natural log of the market capitalization for firm *i* in period *t*, and ε is the error term. We use market capitalization to control for firm size because prior research has indicated that size may have an impact on firm performance (Hayes et al. 2001).

To test our second hypothesis, we expand the OLS model to include an indicator variable to identify pre- and post-ERP implementation returns and an interaction variable as follows:

$$ABRET_{it} = \alpha + \beta_1 Late_{it} + \beta_2 Post_{it} + \beta_3 Late*Post_{it} + \beta_4 MCap_{it} + \varepsilon \quad (3)$$

Where $ABRET_{it}$, $Late_{it}$, and $MCap_{it}$ are as described in Equation 2 above, and $Post_{it}$ is a dichotomously coded variable equal to 1 for post-ERP implementation and 0 for pre-ERP implementation and $Late*Post_{it}$ is an interaction variable based on *Late* x *Post*. The interaction variable allows one to measure the impact of returns for late-stage adopters, post-ERP implementation relative to early-stage adopters. A positive coefficient would indicate that late-stage adopters improved relative to early-stage adopters. A negative coefficient would indicate that early-stage adopters improved relative to late-stage adopters.

3.2 Data Sample

Table 1 summarizes our data sample, which comprises 137 firms from 36 industries that decided to implement ERP systems between 1994 and 2001. Gartner Group first coined the term ERP in 1990 to describe MRP and MRPII systems that added financial and other business functions (Singleton, 2013). However, firms did not significantly begin to implement these systems until the mid-1990s. Sales by SAP, the largest vendor of ERP software, grew from US$500 million in 1992 to US$3.3 billion in 1997 (Davenport, 1998). We consider implementers of this technology during this time period as early-stage adopters. Our sample begins with the 91 ERP implementation announcements made between 1994 and 1998 from Hayes et al. (2001)[2]. Since we are interested in the period of time leading up to when a firm made the decision to implement an ERP system and not necessarily when they actually implemented it, we consider the announcement date as the event date for this study. We exclude 15 of these firms because they had less than 24 months of return data available in CRSP prior to the implementation decision. We believe that one needs a minimum of 24 months of return data to establish the financial performance of firms prior to implementing ERP systems[3]. We extended the initial sample by searching available newswire services using the Lexis-Nexis service for years after 1998 and key phrases such as "ERP", "enterprise resource planning", and "enterprise systems". As a result, we found an additional 61 firm announcements between 1998 and 2001 for firms that had implemented ERP systems, which yielded a total of 137 firms for which the CRSP database had return data for at least 24 months prior to the ERP implementation decision.

To test our second hypothesis, we collected return data from the CRSP database for each of our sample firms for an additional 48 months following implementation. Although doing so results in different calendar periods for each firm, by using abnormal returns, which measure performance relative to the rest of the market, we control for other economic influences that may be different in each of the calendar periods. As we discuss above, we consider the year of the announcement as the year for implementing the system and exclude it from both the pre- and post-implementation data. We exclude the implementation year because we believe that data can be distorted during that period. Although it is difficult to know for sure how long each firm takes to implement the system and how much distortion could occur during the process, we use one year, which is consistent with Nicolaou (2004) who documents an average implementation of 9.92 months. Therefore, our overall sample contains the available monthly returns for up to 48 months before and 48 months after the implementation year for each firm. Our sample shows a

[2] We thank David C. Hayes and Jacqueline L. Reck for providing this list of firms.
[3] Sensitivity analysis indicates our resulting conclusions would not be effected by inclusion of firms with less than 24 months of data.

large increase in the number of ERP adopters in 1998—from 20 and 24 in 1996 and 1997 to 44 in 1998. We believe many firms adopted ERP systems during the run up to the year 2000 in part to update systems because of the so-called Y2K issue discussed earlier. These late-stage adopters would not only be in a position to mimic the early adopters but also could have experienced coercive pressure to adopt for non-strategic reasons (i.e., Y2K compliance). Therefore, we define firms that implemented ERP systems during the first four years of our sample from 1994 to 1997 as "early-stage adopters" and those during the last four years from 1998 to 2001 as "late-stage adopters". We also note that the contemporary neo-institutional perspective states that late-stage adopters wait and observe early-stage adopters (Tuttle & Dillard, 2007). Thus, there would be less institutional pressure throughout 1994-1997 as compared to 1998-2001 when those late-stage adopters had more opportunity to observe the early-stage adopters. Our sample includes 54 firms identified as early-stage adopters and 83 firms identified as late-stage adopters. We did not extend the sample beyond the initial eight years because we wanted to keep the time periods somewhat proportional (i.e., four years of early and four years of late-stage adopters). We were also concerned that the results beyond 2001 may be impacted by other factors such as improvements in the underlying technology and consolidation of ERP firms.

Because of the early relationship of ERP systems with the manufacturing sector, we also posit that the anticipated relationship will be most pronounced in manufacturing firms. We base this position on Burt (1982), who theorizes that inter-organizational relationships and frequent interaction between firms allow them to learn about each other's practices, strategies, and technologies and the associated outcomes, which results in increased pressure to act alike. Interconnectedness and interaction between firms in industrial sectors amplify mimicry (Donaldson, 1995; Ugrin, 2009). Managers of lower-performing firms will first look towards the actions of higher-performing firms in their industry for strategies. The mutual interaction and increased information exchange in an industry should result in increased mimetic pressures, particularly on late-stage adopters. Consistent with this tenet, we propose that the performance/stage relationship will be more pronounced among firms in the same type of industry. Specifically, because ERP systems have their origins in the manufacturing sector, we expect that relationship to be more pronounced in that industry than in other industries. In supplemental tests, we divided our sample into manufacturing and non-manufacturing sub-samples. We used the Standard Industrial Codes (SICCD) from the CRSP database to make this split: we assigned all firms with SIC codes between 2000 and 3999 to the manufacturing category and all others to the non-manufacturing category. Our sample included 87 manufacturing and 50 non-manufacturing firms: 31 manufacturing firms were early adopters and 56 were late adopters, and 23 non-manufacturing firms were early adopters and 27 were late adopters.

Table 1. ERP Firms by Two-digit SIC Code and Implementation Decision Year

	94	95	96	97	98	99	00	01	Total
13: Oil and gas extraction			1	2	3		1		7
20 (Mfg): Food and kindred products			1		3	1			5
23 (Mfg): Apparel				1		1			2
24 (Mfg): Lumber & wood products					1				1
25 (Mfg): Furniture & fixtures					2		1		3
26 (Mfg): Paper & allied products			1		1	1	1	1	5
27 (Mfg): Printing & publishing	1		1		1	1			4
28 (Mfg): Chemicals		1	2	1	1	2	1	2	10
29 (Mfg): Petroleum refining		1		1	3				5
30 (Mfg): Rubber & misc. plastic		1			1				2
33 (Mfg): Primary metal industries			2		2		1		5
34 (Mfg): Fabricated metal products	1	1	1	1					4
35 (Mfg): Ind. & com. machinery	1	1		1	8	3	3	2	18
36 (Mfg): Electronic & elect. equip.			3	3	4	1	1	1	13
37 (Mfg): Transportation equipment		1		1		1	1		5
38 (Mfg): Measuring & control instr.		1	2		2	1			6

Table 1. ERP Firms by Two-digit SIC Code and Implementation Decision Year

39 (Mfg): Misc. manufacturing					1				1
42: Motor freight transportation					1				1
45: Transportation by air				1	2				3
48: Communications			2		1				3
49: Electric, gas & sanitary services				2					2
50: Wholesale: durable goods				1	2		2		5
51: Wholesale: non-durable goods			2		1		1		4
52: Retail: hardware stores					1				1
54: Retail: food stores				1					1
58: Retail: restaurants				1					1
59: Retail: miscellaneous				1		1			2
60: Commercial banking				1					1
61: Consumer lending					1				1
63: Life insurance carriers				2					2
65: Real estate agents & brokers					1				1
67: Holding & other investment	1		1	1			1		4
73: Automotive repair & service				2	1	1	2		6
80: Health services					1				1
82: Higher education							1		1
87: Engineering, accounting & other								1	1
Totals	**4**	**7**	**19**	**24**	**45**	**14**	**17**	**7**	**137**

4 Empirical Results

Table 2 lists early-stage adopters along with their average abnormal return over the 48 months leading up to their decision to implement an ERP system[4]. Thirty-three of the early-stage adopters had positive abnormal returns and 21 had negative abnormal returns. Table 3 lists the same information for the late-stage adopters. Thirty-one had positive abnormal returns and 52 with negative abnormal returns.

Table 2. Early-stage Adopters of ERP Average Abnormal Returns

Name	ABRET	Name	ABRET
Rainforest Cafe Inc	0.0713	Allergan Inc	0.0019
Jabil Circuit Inc	0.0664	Alcan Inc	0.0015
Cisco Systems Inc	0.0481	Chevron Corp	0.0013
Employee Solutions Inc	0.0469	Daw Technologies Inc	0.0011
Triquint Semiconductor	0.0429	Donnelley (R R) & Sons	0.0007
Qualcomm Inc	0.0351	Toyota Motor Corp	0.0002
Kla-Tencor Corp	0.0349	Toys R Us Inc	-0.0007
Silicon Graphics Inc	0.0326	Snap-On Inc	-0.0014
Teradyne Inc	0.0256	Sonoco Products Co	-0.0014
Plantronics Inc	0.0223	Liz Claiborne Inc	-0.0019
Lsi Logic Corp	0.0212	Honeywell Inc	-0.0034

[4] In some cases, 48 months of returns were not available, in which case we used the number of months of data that were available provided there was at least 24 months.

Table 2. Early-stage Adopters of ERP Average Abnormal Returns

Nabi Biopharmaceuticals	0.0175	Schlumberger Ltd	-0.0046
Cabletron Systems Inc	0.0174	Ihop Corp	-0.0048
Glenayre Technologies Inc	0.0162	Gte Corp	-0.0053
Tektronix Inc	0.0153	Lg&E Energy Corp	-0.0060
Gerber Scientific Inc	0.0136	Watts Water Techn Inc	-0.0063
Furon Co	0.0110	Cooper Cameron Corp	-0.0063
Equifax Inc	0.0101	Apache Corp	-0.0078
Valspar Corp	0.0098	Church & Dwight Inc	-0.0083
Movado Group Inc	0.0098	Southwest Airlines	-0.0087
Walgreen Co	0.0091	Amerada Hess Corp	-0.0107
Dana Corp	0.0066	Perrigo Co	-0.0110
Media General	0.0052	P E C O Energy Co	-0.0150
Allied Chemical & Dye Corp	0.0036	Geneva Steel	-0.0156
Hibernia Corp	0.0034	Torch Energy Rel Trust	-0.0189
Dole Food Co Inc	0.0028	Green Mountain Coffee	-0.0202
General Binding Corp	0.0023	Penn Traffic Co	-0.0297

ABRET = Average monthly abnormal returns prior to ERP implementation decision based on at least 24 and up to 48 monthly returns using the following formula:

$$ABRET_{it} = R_{it} - BR_{it},$$

where R_{it} is the return for firm *i* in period *t*, BR_{it} is the benchmark return for firm *i* in period *t*, and $ABRET_{it}$ is the abnormal return for firm *i* in period *t*.

Table 3. Late-stage Adopters of ERP Average Abnormal Returns

Name	ABRET	Name	ABRET
Network Appliance Inc	0.0877	Ogden Corp	-0.0056
Dell Inc	0.0689	Kerr-Mcgee Corp	-0.0057
Jds Uniphase Corp	0.0654	Hormel Foods Corp	-0.0060
Xeta Technologies Inc	0.0460	Sierra Health Services	-0.0080
Wind River Systems Inc	0.0408	Aviall Inc	-0.0095
American Technical Ceramics	0.0357	Global Industrial Tech Inc	-0.0097
Pemco Aviation Group Inc	0.0282	Department 56 Inc	-0.0098
Artesyn Technologies Inc	0.0262	Adflex Solutions Inc	-0.0109
Capital One Finl Corp	0.0223	Union Carbide Corp	-0.0111
Riverside Group Inc	0.0215	Boeing Co	-0.0116
Technitrol Inc	0.0186	Bassett Furniture Inds	-0.0117
Miller (Herman) Inc	0.0177	Auspex Systems Inc	-0.0123
Bio-Logic Systems Corp	0.0140	Credence Systems Corp	-0.0125
Astec Industries Inc	0.0137	Tennant Co	-0.0126
Tosco Corp	0.0111	Standard Register Co	-0.0128
Genrad Inc	0.0107	Burlington Resources Inc	-0.0130
Hershey Co	0.0098	Neighborcare Inc	-0.0131
Nice Systems Ltd	0.0094	Officemax Inc	-0.0131
Intertape Polymer Group	0.0075	Abitibi Consolidated Inc	-0.0134
Varco International Inc	0.0074	Gundle/Slt Environmental	-0.0157

Table 3. Late-stage Adopters of ERP Average Abnormal Returns

Elcor Chemical Corp	0.0071	Overland Storage Inc	-0.0160
Sara Lee Corp	0.0070	Fsi Intl Inc	-0.0161
Adept Technology Inc	0.0066	Lawson Products	-0.0161
Amx Corp	0.0065	Ferrellgas Partners	-0.0162
Mitel Corp	0.0061	Cummins Inc	-0.0166
Skywest Inc	0.0050	Glatfelter	-0.0173
Home Depot Inc	0.0035	Alamo Group Inc	-0.0181
Pitney Bowes Inc	0.0029	Network Equipment Tech	-0.0208
Halliburton Co	0.0028	Frozen Food Express Inds	-0.0217
Sprint Corp	0.0024	Moore Corp Ltd	-0.0230
Bellsouth Corp	0.0019	Schulman, Inc	-0.0234
Hei Inc	-0.0004	Louisiana-Pacific Corp	-0.0241
Lancaster Colony Corp	-0.0016	Cybex International Inc	-0.0257
Baker (Michael) Corp	-0.0016	Stewart & Stevenson Svcs	-0.0275
Evans & Sutherland Cmp	-0.0020	Titanium Metals Corp	-0.0284
Biogen Idec Inc	-0.0027	Riverside Group Inc	-0.0314
Rohm And Haas Co	-0.0035	Elkcorp	-0.0314
Vf Corp	-0.0038	Business Resource Group	-0.0372
Ametek Inc	-0.0039	Jlm Industries Inc	-0.0404
Stepan Co	-0.0040	Steelcase Inc	-0.0509
Eastman Chemical Co	-0.0045	Nu-Kote Hldg Inc	-0.0522
Posco	-0.0045		

ABRET = Average monthly abnormal returns prior to ERP implementation based on at least 24 and up to 48 monthly returns using the following formula:

$$ABRET_{it} = R_{it} - BR_{it},$$

where R_{it} is the return for firm i in period t, BR_{it} is the benchmark return for firm i in period t, and $ABRET_{it}$ is the abnormal return for firm i in period t.

Figure 1 graphically displays the frequency of positive and negative abnormal returns by implementation-decision year. Note that, in the first four years (early-stage adopters), the frequency of positive returns was equal to or greater than the number of negative returns, whereas, in the last four years (late-stage adopters), the frequency of negative returns exceeded the positive returns. One can also see by examining the breakdown between manufacturing and non-manufacturing that the results were particularly strong in the manufacturing industry.

Table 4 summarizes the frequencies in two ways: panel A shows the frequency of positive and negative average abnormal returns for each firm over the four years leading up to the implementation decision, and panel B shows the frequency of monthly returns over the same period. The chi-square test in both panels shows that, for the overall sample of all firms, the differences were highly significant at the p = 0.01 level, with late-stage adopters having more negative abnormal returns. The sub-sample for manufacturing firms confirms that the overall results were driven by this segment as we anticipated.

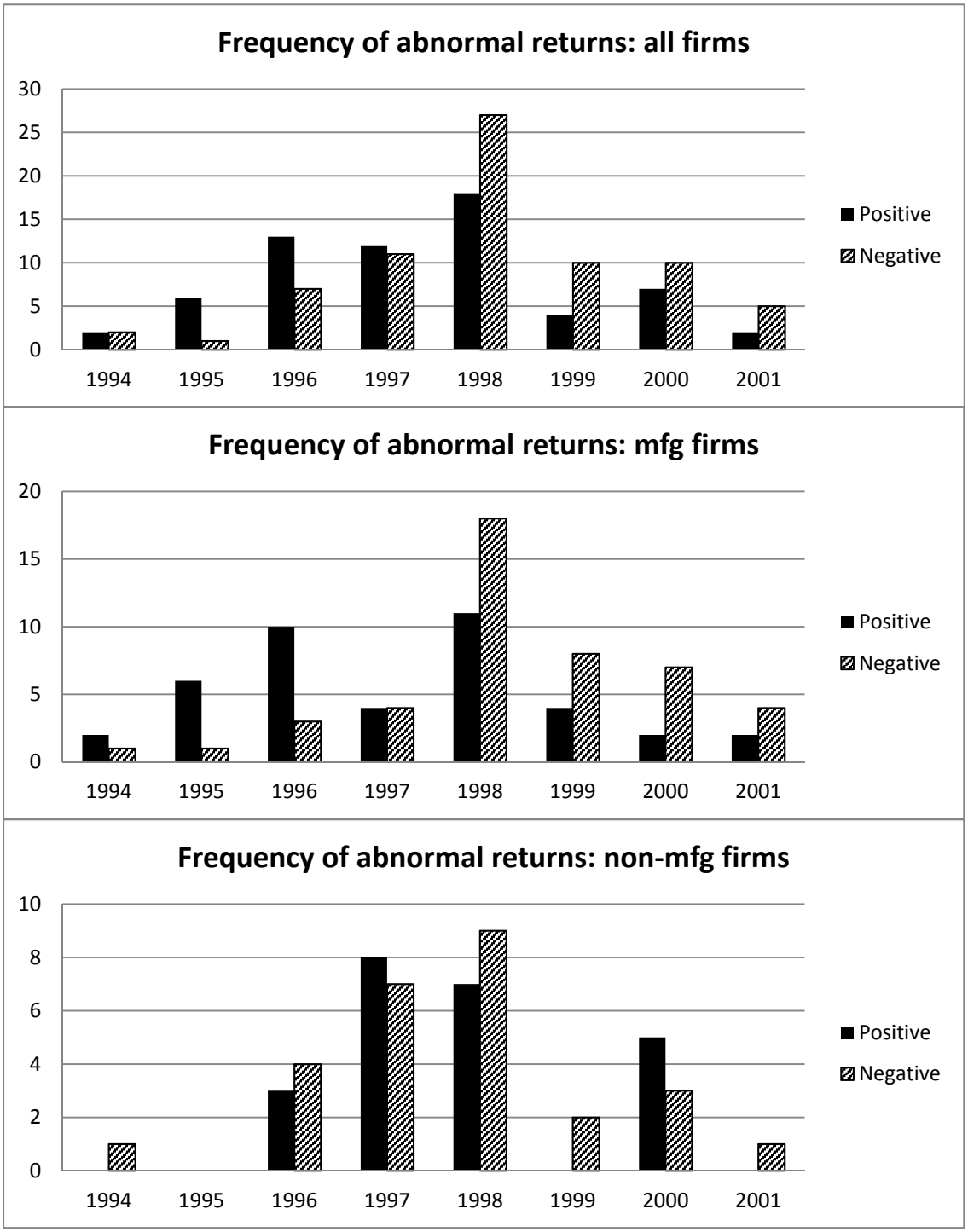

Figure 1. Frequency of Abnormal Returns by Implementation Decision Year

Table 4. Frequency of Average Monthly Abnormal Returns Prior to ERP Implementation Decision

	All firms			Manufacturing firms			Non-manufacturing		
	Early	**Late**	**Total**	**Early**	**Late**	**Total**	**Early**	**Late**	**Total**
Panel A: firm average abnormal returns									
ABRET <= 0									
Frequency	21	52	73	9	37	46	12	15	27
Percent	15%	38%	53%	10%	43%	53%	24%	30%	54%
ABRET > 0									
Frequency	33	31	64	22	19	41	11	12	23
Percent	24%	23%	47%	25%	22%	47%	22%	24%	46%
TOTALS									
Frequency	54	83	137	31	56	87	23	27	50
Percent	39%	61%	100%	35%	65%	100.0	46%	54%	100%
Chi-square:	Value		7.4207			10.986			0.0572
	Prob.		0.0064			0.0009			0.8110
Panel B: firm month average abnormal returns									
ABRET <= 0									
Frequency	1,221	2,060	3,281	723	1,398	2,121	498	662	1,160
Percent	20%	32%	52%	18%	34%	52%	23%	31%	54%
ABRET > 0									
Frequency	1,210	1,784	2,994	750	1,237	1,987	460	547	1,007
Percent	19%	29%	48%	18%	30%	48%	21%	25%	46%
TOTALS									
Frequency	2,431	3,844	6,275	1,473	2,635	4,108	958	1,209	2,167
Percent	39%	61%	100%	36%	64%	100%	44%	56%	100%
Chi-square:	Value		6.7542			5.9675			1.6518
	Prob.		0.0094			0.0146			0.1987

Early = early adopters (prior to 1998); late = late adopters (after 1997).
Manufacturing = firms with SIC codes 2000-3999; non-manufacturing = all other firms.
ABRET = monthly abnormal returns computed as follows:

$$ABRET_{it} = R_{it} - BR_{it},$$

where R_{it} is the return for firm i in period t, BR_{it} is the benchmark return for firm i in period t, and $ABRET_{it}$ is the abnormal return for firm i in period t.
Panel A is based on averages of monthly abnormal returns for each firm (n = 137); panel B is based on the monthly abnormal returns for all firms with at least 24 up to 48 months (n = 6,275 or average of 45.8 months per firm).

Table 5 provides descriptive statistics for the average abnormal returns in our sample. Panel A shows the raw data as extracted from CRSP. Panel B shows the results after winsorizing the values at the 1 percent and 99 percent levels to control for the effects of outliers. Winsorizing is a statistical technique used to reduce the effect of spurious outliers by setting all outliers to a specific percentile of the data. It is commonly used in capital markets archival research where data often contain extreme outliers that would otherwise distort the measure of central tendency. Researchers use it as an alternative to trimming outliers, which minimizes the loss of observations (Barnett & Lewis, 1978; Hastings, Mosteller, Tukey, & Winsor, 1947). We winsorized our sample for each implementation decision year's observations by setting all values less than the first percentile equal to the first percentile and all values greater than the 99th percentile equal to the 99th percentile. We extract monthly return data for each firm for the four years prior to ERP implementation decision. As we discuss above, we excluded any firm that did not have at least 24 months of data. The final sample had 6,275 firm-months of data for the 137 firms, which averages to 45.8 months each. We believe this amount of data is sufficient to establish the values and changes in value for

each firm. Table 6 provides descriptive statistics for market capitalization for our sample. Panel A shows the raw data extracted from CRSP. Panel B shows data for the natural log of the market capitalization level, which is the variable we used to control for size in the regression analysis.

Table 5. Descriptive Statistics for Abnormal Returns

Panel A: abnormal returns raw							
	Firms	**Mos**	**Mean**	**Median**	**Std Dev**	**Min**	**Max**
1994	3	119	0.0160	0.0069	0.0808	-0.1929	0.2795
1995	7	329	0.0120	0.0070	0.0839	-0.2558	0.3090
1996	14	617	0.0083	-0.0012	0.1128	-0.4943	0.5421
1997	9	408	0.0043	-0.0019	0.1167	-0.4730	0.5800
1998	29	1370	-0.0053	-0.0050	0.1175	-0.5946	0.8463
1999	12	576	0.0000	-0.0065	0.1037	-0.3611	0.4124
2000	9	401	0.0019	-0.0045	0.1559	-0.5109	1.3591
2001	6	288	-0.0026	-0.0179	0.1524	-0.5591	0.5711
Manufacturing	**89**	**4108**	**0.0013**	**-0.0035**	**0.1189**	**-0.5946**	**1.3591**
1994	1	36	-0.0007	0.0009	0.0630	-0.1832	0.1007
1996	6	250	0.0019	-0.0080	0.1091	-0.2912	0.6814
1997	15	672	0.0071	-0.0025	0.1215	-0.6874	0.7347
1998	15	715	-0.0024	-0.0088	0.1109	-0.5549	0.8463
1999	2	74	-0.0193	-0.0191	0.1032	-0.5006	0.2941
2000	8	372	0.0197	-0.0206	0.1924	-0.3903	1.2277
2001	1	48	-0.0016	-0.0097	0.1106	-0.2066	0.3814
Non-manufacturing	**48**	**2167**	**0.0043**	**-0.0078**	**0.1308**	**-0.6874**	**1.2277**
All firms	**137**	**6275**	**0.0023**	**-0.0046**	**0.1231**	**-0.6874**	**1.3591**
Panel B: abnormal returns winsorized at 1% and 99% levels							
ABRETW	**Firms**	**Mos**	**Mean**	**Median**	**Std Dev**	**Min**	**Max**
1994	3	119	0.0158	0.0069	0.0797	-0.1832	0.2470
1995	7	329	0.0121	0.0070	0.0830	-0.2013	0.2836
1996	14	617	0.0086	-0.0012	0.1070	-0.2388	0.3701
1997	9	408	0.0050	-0.0019	0.1110	-0.2978	0.4052
1998	29	1370	-0.0060	-0.0050	0.1061	-0.3603	0.3447
1999	12	576	-0.0002	-0.0065	0.1020	-0.2670	0.3321
2000	9	401	0.0003	-0.0045	0.1410	-0.3209	0.5603
2001	6	288	-0.0015	-0.0179	0.1481	-0.3604	0.5376
Manufacturing	**89**	**4108**	**0.0011**	**-0.0035**	**0.1113**	**-0.3604**	**0.5603**
1994	1	36	-0.0007	0.0009	0.0630	-0.1832	0.1007
1996	6	250	0.0002	-0.0080	0.0990	-0.2388	0.3701
1997	15	672	0.0062	-0.0025	0.1090	-0.2978	0.4052
1998	15	715	-0.0031	-0.0088	0.1031	-0.3603	0.3447
1999	2	74	-0.0161	-0.0191	0.0911	-0.2670	0.2941
2000	8	372	0.0155	-0.0206	0.1722	-0.3209	0.5603
2001	1	48	-0.0016	-0.0097	0.1106	-0.2066	0.3814
Non-manufacturing	**48**	**2167**	**0.0030**	**-0.0078**	**0.1186**	**-0.3603**	**0.5603**
All firms	**137**	**6275**	**0.0018**	**-0.0046**	**0.1138**	**-0.3604**	**0.5603**

Table 6. Descriptive Statistics for Market Capitalization

Panel A: abnormal returns raw							
	Firms	**Mos**	**Mean**	**Median**	**Std Dev**	**Min**	**Max**
1994	3	119	4,502,267	4,516,073	1,503,679	849,151	9,303,931
1995	7	329	5,071,005	1,316,058	9,247,606	89,781	32,017,268
1996	14	617	2,744,943	1,367,994	5,272,929	28,423	37,442,732
1997	9	408	1,509,478	448,420	1,704,580	57,852	7,425,972
1998	29	1370	2,364,702	649,234	4,280,901	4,763	27,028,254
1999	12	576	4,420,784	732,782	10,743,250	84,060	54,568,561
2000	9	401	8,783,643	539,790	25,392,571	4,298	139,522,720
2001	6	288	1,399,060	657,732	1,580,114	30,932	5,393,163
Manufacturing	**89**	**4108**	**3,462,709**	**824,519**	**10,044,020**	**4,298**	**139,522,720**
1994	1	36	10,335,622	10,550,273	1,100,137	8,085,616	11,950,419
1996	6	250	8,970,965	2,883,096	12,214,064	17,338	44,556,520
1997	15	672	2,285,454	1,281,348	2,516,295	12,768	13,906,967
1998	15	715	6,094,041	438,218	12,604,753	7,270	68,069,031
1999	2	74	226,395	302,709	122,581	45,679	347,059
2000	8	372	1,981,821	276,381	4,726,491	10,088	40,256,869
2001	1	48	55,209	54,142	10,301	35,623	74,998
Non-manufacturing	**48**	**2167**	**4,275,278**	**555,810**	**9,092,020**	**7,270**	**68,069,031**
All Firms	**137**	**6275**	**3,743,321**	**748,367**	**9,732,741**	**4,298**	**139,522,720**
Panel B: abnormal returns winsorized at 1% and 99% levels							
ABRETW	**Firms**	**Mos**	**Mean**	**Median**	**Std Dev**	**Min**	**Max**
1994	3	119	15.2486	15.3232	0.4211	13.6520	16.0459
1995	7	329	14.1688	14.0902	1.5457	11.4051	17.2818
1996	14	617	13.8549	14.1289	1.4607	10.2550	17.4383
1997	9	408	13.5078	13.0135	1.2491	10.9656	15.8205
1998	29	1370	13.3750	13.3835	1.7476	8.4687	17.1124
1999	12	576	13.8357	13.5046	1.4907	11.3393	17.8150
2000	9	401	13.4537	13.1989	2.2028	8.3658	18.7537
2001	6	288	13.2261	13.3962	1.5319	10.3395	15.5006
Manufacturing	**89**	**4108**	**13.6400**	**13.6223**	**1.6693**	**8.3658**	**18.7537**
1994	1	36	16.1454	16.1717	0.1099	15.9056	16.2963
1996	6	250	14.0203	14.8744	2.6537	9.7606	17.6123
1997	15	672	13.7318	14.0634	1.6225	9.4547	16.4479
1998	15	715	13.4480	12.9905	2.2546	8.8915	18.0360
1999	2	74	12.0857	12.6205	0.7928	10.7294	12.7572
2000	8	372	12.4136	12.5295	2.2121	9.2191	17.5108
2001	1	48	10.9012	10.8994	0.1924	10.4807	11.2252
Non-manufacturing	**48**	**2167**	**13.3663**	**13.2282**	**2.1746**	**8.8915**	**18.0360**
All firms	**137**	**6275**	**13.5455**	**13.5256**	**1.8638**	**8.3658**	**18.7537**

Figure 2 graphically represents the mean abnormal returns from the winsorized values from panel B in Table 5. Notice that most of the early-stage adopters showed positive abnormal returns, which indicates

that their average returns for the four years leading up to the ERP implementation decision were above the benchmark of all firms in the CRSP database. By contrast, the average returns for the late-stage adopters were mixed with most less than zero, which indicates they performed below the benchmark. One can also see that manufacturing firms influenced the overall results because they were above zero in all four of the early-stage adopter years and near or below zero in all four of the late-stage adopter years.

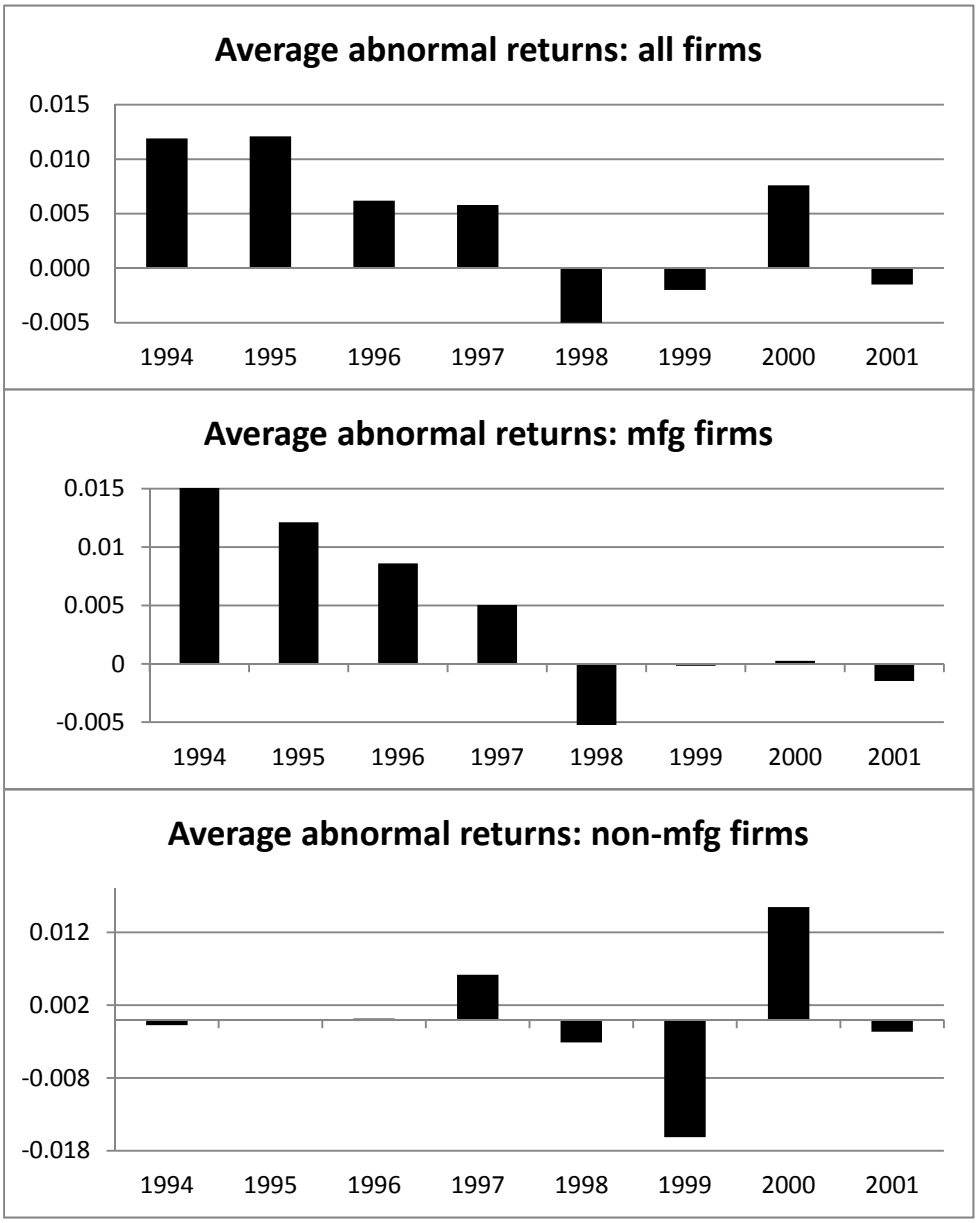

Figure 2. Average Abnormal Returns by Implementation Decision Year

Table 7 provides results of the OLS regression analysis. The results confirm that the differences in the graph were significant. For the overall sample, the variable of interest (LATE) was negative and significant at the p = 0.05 level (-.0070, p<.05), which indicates that late-stage adopters had significantly lower abnormal returns than the early-stage adopters. The results for the manufacturing firms were even more significant with a negative coefficient significant at the p = 0.01 level (-.0107, p<.01). Results for the non-manufacturing sample were not significant, which indicates that the average abnormal returns for the late-stage adopters over the four years prior to their ERP implementation decision were not significantly different than the early-stage adopters.

Table 7. OLS Regression Results

	All firms		Manufacturing firms		Non-manufacturing	
Variable	**Estimate**	**t-Value**	**Estimate**	**t-value**	**Estimate**	**t-value**
Intercept	-0.0283	-2.55**	-0.0376	-2.53**	-0.0229	-1.30
LATE	-0.0072	-2.42**	-0.0107	-2.93***	-0.0007	-0.13
MCAP	0.0026	3.27***	0.0033	3.19***	0.0019	1.59
N	6275		4108		2167	
F-value	9.81		10.84		1.39	
Pr > F	<.0001		<.0001		0.2495	

*** Indicates p-values <0.01; ** Indicates p-values <0.05

Regression based on the following model:

$$ABRET_{it} = \alpha + \beta_1 Late_{it} + \beta_2 MCap_{it} + \varepsilon,$$

where $ABRET_{it}$ is the abnormal return for firm i in period t. $Late_{it}$ is a dichotomously coded variable equal to (1 for late-stage adopter firms and 0 for early-stage adopters, $MCap_{it}$ is the natural log of the market capitalization for firm i in period t, and ε is the error term.

Table 8 summarizes the results of our OLS regression that incorporates post-ERP implementation data. The variable of interest in this regression is "LATE*POST", which is the interaction term. In the overall sample, the coefficient of .0163 was positive and significant at the p = 0.01 level, which indicates that late-stage adopter abnormal returns improved relative to early-stage adopters. Similar results for the manufacturing firms (0.016; p<0.001) are consistent with our earlier findings that these firms drove the results. However, in this case, the non-manufacturing firms also showed positive significant results (0.0171; p<0.05), which indicates that they also experienced more improvement relative to early-stage adopters.

Table 8. OLS Regression Results

	All firms		Manufacturing firms		Non-manufacturing	
Variable	**Estimate**	**t-Value**	**Estimate**	**t-Value**	**Estimate**	**t-Value**
Intercept	-0.0335	-3.89***	-0.0410	-3.55***	-0.0257	-1.96*
LATE	-0.0073	-2.17**	-0.0099	-2.41**	-0.0028	-0.49
POST	-0.0081	-2.21**	-0.0077	-1.61*	-0.0094	-1.55
LATE*POST	0.0163	3.47***	0.0162	2.80***	0.0171	2.10**
MCAP	0.0030	5.12***	0.0037	4.67***	0.0022	2.48**
N	12,263		8,174		4,089	
F-Value	9.78		8.05		2.92	
Pr > F	<.0001		<.0001		0.0199	
Adjusted R-square	.0029		.0034		.0019	

*** Indicates p-values <0.01; ** Indicates p-values <0.05; * Indicates p-values <0.10

Regression based on the following model:

$$ABRET_{it} = \alpha + \beta_1 Late_{it} + \beta_2 Post_{it} + \beta_3 Late*Post_{it} + \beta_4 MCap_{it} + \varepsilon,$$

where $ABRET_{it}$ is the abnormal return for firm i in period t; $Late_{it}$ is a dichotomously coded variable equal to (1 for late-stage adopter firms and 0 for early-stage adopters; $Post_{it}$ is a dichotomously coded variable equal to (1 for post-ERP implementation and 0 for pre-ERP implementation; $Late*Post_{it}$ is a variable based on *Late x Post*; $MCap_{it}$ is the natural log of the market capitalization for firm i in period t, and ε is the error term.

5 Discussion of Results and Conclusion

The results show that late-stage adopters experienced lower financial performance leading up to the time of their adoption as measured by abnormal returns compared to early-stage adopters. This finding provides empirical evidence to support the argument that early-stage adopters of technologies do so in an effort to gain or maintain competitive advantage through innovation, whereas late-stage adopters tend to be under-performers who are susceptible to institutional pressures. The results also show that

interconnectedness amplifies institutional pressures, which the strength of the relationship between the stage of adoption and firm performance among manufacturing firms evidences. The exchange of information between related organizations in a common industry such as manufacturing results in more opportunities to mimic and more pressure to adopt industry norms and best practices.

Perhaps a more interesting result from our study is that it provides evidence that late-stage adopters may benefit more from ERP systems than early-stage adopters. As we discuss above, competing arguments for why such a finding makes sense exist. Perhaps it is as simple as noting that late-stage adopters, which we show were under-performers, have more room to improve and, therefore, to benefit from the features of ERP systems more than the early-stage adopters that we show were better performers prior to implementation. Or perhaps the incremental benefits of ERP adoption may tend to slow or become stagnant at some point after adoption, which allows later adopters to have comparatively larger benefits from ERP in their initial transition, reducing the difference in financial performance. Regardless, engaging in an institutional game of "follow the leader" has produced economic benefits for underperforming firms and helped them make progress towards catching up to other firms—useful information for ERP suppliers and consultants who may find that an effective way to market ERP systems could be to encourage mimicry by highlighting how firms have benefited from following successful early adopters.

Our study has limitations that one should consider when generalizing the results. First, we arrive at our conclusions through deductive reasoning, and we did not specifically study individual firms' decision making processes. For instance, we suggest that that Y2K may have provided coercive pressure on firms to adopt ERP and that underperforming firms are particularly susceptible to those pressures. However, one could argue that some early adopters may have moved toward ERP and toward dealing with risks associated with Y2K sooner because they had the financial strength to do so, while other organizations may have waited either for a stronger financial position or to learn more about the actual risk associated with Y2K. However, by coupling our findings with the existing literature, we find it reasonable to conclude that institutional pressures do indeed influence technology adoption decisions consistent with Teo et al. (2003) and Ugrin (2009) and that institutional pressures are stronger on those firms in later stages that are underperforming. Further, we cannot parcel out which institutional factors influenced the adoption decisions of the firms in our sample with certainty. We still do not know if our firms mimicked early adopters, went along with industry norms, or faced coercion. For instance, some firms may have adopted to mitigate potential Y2K problems, yet we cannot tell which firms those were. Perhaps future studies can find effective ways to evaluate that dilemma.

Our paper has other limitations that future research could explore as well. We cannot parcel out the effects of positive and negative news about ERP adoption on late-stage adopters. There have been many high-profile ERP implementation failures, and it would be interesting to know how negative news of those failures affected adoption decisions. We do not know how failed adoption attempts influence future adoption decisions and implementations. For instance, one company in our late-adopter sample, Hershey, made an initial adoption attempt in 1998-1999 but failed to do so. They subsequently had a successful implementation. It would be interesting to examine how firms learn from their own past experiences and not just observing others. We also do not test any other conditions that may accentuate or impede the effects of institutional pressures beyond performance; future research should consider testing ways to mitigate these effects and examine the characteristics of the firms in our sample, their managers, and the interaction between those characteristics, performance, and adoption. Finally, our sample comprises only a small number of publically traded firms with an emphasis on manufacturing. It would be interesting to test the relationships in other industries, with other technologies, and among firms of different sizes.

In conclusion, this study provides empirical evidence of the differing effects of firm performance on ERP adoption decisions and shows that less-successful firms can achieve economic benefits by following the actions of successful firms. The results fill a void left by limitations in other research, and, although we performed the study in the context of ERP adoption and implementation, the results should be relevant in many contexts and with many emerging technologies.

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