

EXAMINING THE SHAREHOLDER WEALTH EFFECTS OF ANNOUNCEMENTS OF NEWLY CREATED CIO POSITIONS¹

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monstrating the positive impact of IT on firm performance has begun to accumulate. The strategic importance of a firm's IT capabilities is prompting an increasing number of companies to appoint chief information officers (CIOs) to effectively manage these assets. Such moves are reflective of changes in top management thinking and policy regarding the role of IT and firms' approaches to IT governance. This paper uses the event study methodology to examine market reactions to announcements of new CIO positions. Findings strongly support the notion that, for firms competing in industries undergoing IT-driven transformation, announcements of newly created CIO positions do indeed provoke positive reactions from the marketplace.

Keywords: CIO position announcements, IT leadership, IT management, IT assets, IT-driven transformation, organization innovation, external hires, event study

ISRL Categories: AI0105, BA02, EL

Abstract

While information technology (IT) has been transforming the business landscape for a long time now, it is only recently that empirical evidence de-

¹Cynthia Beath was the accepting senior editor for this paper.

Introduction

The increased turbulence of today's competitive environments—reflecting globalization, shortened product life cycles, heightened customer expectations, and supplier/partner demands—are producing unprecedented pressures for most com-

panies to continuously lower costs, increase quality, and innovate with regard to both product/service offerings and business processes. One of the primary vehicles through which firms are able to implement strategic business initiatives in response to ever-changing market conditions is their capability to effectively apply information technology (IT) in the form of IT-enabled business platforms and solutions (Ross et al. 1996).

It is quite evident, however, that firms are not equally blessed with an effective IT capability, i.e., the ability to control IT-related costs, to deliver systems when needed, and to effect business strategies through IT implementations (Ross et al. 1996). Firms that are able to build and regularly demonstrate an effective IT capability have learned to excel in four distinct but mutually enforcing performance domains (Feeny and Willcocks 1998; Rockart et al. 1996; Ross et al. 1996; Sambamurthy and Zmud 1996):

- delivering IT services at low cost and high quality;
- designing and building an IT architecture that provides technology platforms, data platforms, and business platforms that are reliable, scalable, adaptable, and shareable;
- crafting a web of relationships among technology providers, technology implementers, business strategists, and business tacticians that enables appropriate IT-based solutions to be envisioned, tailored and implemented; and
- aligning technology and business strategies such that IT possibilities inform future business direction and that IT strategies both anticipate future business strategies and embrace current business strategies.

What most differentiates those firms able and not able to demonstrate an on-going IT capability? Not surprisingly, one view holds that it is a firm's IT management capabilities; such IT management capabilities are undoubtedly heterogeneously distributed across firms. They reflect the unique histories of firms and are reflected in "taken for granted" organizational routines. They are largely based on socially complex relationships within the IT function and between the IT function and its

(internal and external) stakeholders (Mata et al. 1995).

What most differentiates those firms able and not able to build strong IT management skills? A very likely answer lies with the quality of IT leadership, as evidenced in the capabilities and character of the IT function's most senior executive, popularly referred to as the chief information officer (CIO). Consider, for example, the following excerpts from announcements of recent CIO appointments:

"It has become clear that information technology and the many work processes it drives can make a breakthrough contribution to achieving Procter & Gamble's business goals. Mr. Garrett's appointment as chief information officer in his senior management position will help us capitalize fully on this opportunity," said John Pepper, chairman and chief executive. (*PR Newswire*, September 10, 1996)

Bernard F. Mathaisel has been named an Executive Director and Chief Information Officer of Ford Motor Company to provide a single point of responsibility for information technology throughout the Company. Mathaisel will be dedicated to helping Ford better serve its customers, dealers, suppliers, and employees through the most effective use of information technology. This newly-created position recognizes the growing importance of information technology to Ford's future success. (*PR Newswire*, March 6, 1997)

General Electric Company today announced that it had named Gary M. Reiner to the new post of Senior Vice President—Chief Information Officer. In this position, Reiner, formerly vice-president, Corporate Business Development, will use information technology to provide competitive advantages and growth opportunities for all of GE's businesses. "This new position recognizes the importance that information tech-

nology will play in GE's future," said GE Chairman and CEO John F. Welch. "It is the key to improving all our business processes from the customer to the supplier." (*Financial News*, April 8, 1996)

As suggested by such press announcements, the CIO position has gained increased prominence over the past decade. Not only has the CIO role become increasingly common in all types of firms, CIOs are also beginning to contend for CEO openings, especially with technology- or information-based businesses searching for a chief executive possessing a strong combination of technology and business skills (Hutheasing 1999; Mateyaschuk 1999).

While the information systems literature has long recognized the critical role of senior leadership in effectively exploiting IT (Jarvenpaa and Ives 1991; Lederer and Mendelow 1988; Meador et al. 1984; Sambamurthy and Zmud 1994), it is only over the last decade that research attention has been directed toward the CIO role. Recent findings, for example, indicate that CIOs add value to their firms by building relationships with other senior executives, gaining the confidence of the CEO, and otherwise succeeding in making IT a key element that informs overall business strategy (Armstrong and Sambamurthy 1999; Feeny et al. 1992; Feeny and Wilcocks 1998).

If the CIO position does add real value to a business through its potential to enrich the business's IT management skillbase, then it would be likely that announcements of a *newly created* CIO position would be of great interest to the business's primary stakeholders—its shareholders—as such announcements could be interpreted as signaling both changes in the collective mindset of the business's senior executive team regarding the importance and role of IT and, implicitly, subsequent effects on the business's strategies and performance. The purpose of the study described herein is to examine market reactions to these signals of IT-related change.

This study's primary research question is, "Do investors perceive that significant value arises

when a new senior executive role associated with the management of the business's IT assets is created?" More specifically, event-study methodology (Dos Santos et al. 1993) is applied to assess the impact of CIO position announcements on the market value of a firm. The next section develops the study's research hypotheses. Then, the methodology and the results are both described. The article concludes with a discussion of the study's implications.

Development of Research Hypotheses

Executive leadership has long been embraced as necessary for firms to fully exploit the benefits of IT (Freeman 1969; O'Toole and O'Toole 1966; Rockwell 1968). Rockhart and Crescenzi (1984, p. 3), for example, asserted "executives are indeed recognizing that information is a strategic resource ...and increasingly feeling the need to be informed, energized, and engaged in information systems." Case studies describing early IT-enabled strategic initiatives at Frito-Lay (Linder 1986), Lockheed-Georgia (Houdeshel and Watson 1987); USAA (Elam 1988), and Phillips (Applegate and Osborn 1988) serve to reinforce this wisdom of executive leadership. An empirical study (Jarvenpaa and Ives 1991) in the early 1990s confirmed a positive association between executive involvement and firms' efforts to make progressive use of IT.

The significant role of executive leadership in championing and/or facilitating technology-based strategic and tactical initiatives also finds considerable support in the organization innovation literature. Organizational researchers have outlined three distinct roles of senior executives in influencing the adoption and diffusion of innovations: as orchestrators (Galbraith 1982), as retroactive legitimizers (Burgelman 1983), and as judges or arbiters (Angle and Van de Ven 1989). As *orchestrators*, they are in a position to create an organizational climate that is conducive for the development and implementation of innovations. For instance, the senior leadership at 3M encouraged innovative activity through various

substantive and symbolic actions. These included creating pools of resources, establishing formal controls and policies, and devising ceremonies and awards (Day 1994). As *retroactive legitimizers*, they publicize as exemplars projects that have proven to be successful. Finally, as *judges or arbiters*, they resolve conflict between those championing a venture and those critiquing or blocking it.

To effectively orchestrate, legitimize, and arbitrate innovative uses of IT, senior executives must develop a rich understanding of the business potential of IT. One of the primary motivations for creating the CIO role is to establish an IT-focused peer to associate with other of a firm's senior executives, as a peer is more likely to be brought into and accepted by the "inner circle" of the firm's leadership and, thus, to be more successful in educating, advising, and actively influencing other senior executives (Armstrong and Sambamurthy 1999; Earl 1996; Earl and Feeny 1994; Feeny et al. 1992; Feeny and Willcocks 1998; Ross and Feeny 2000). The CIO is uniquely positioned to devise and disseminate visions of the role of IT and of the IT function in furthering business strategies. This view of the CIO's "sense-making" role is reflected in the following comment of Gary Vilchik, chief financial officer of Spyglass Inc., on Tim Seaman's appointment as CIO.

We are impressed with Tim's fundamental understanding of technology deployment, and we are confident that he will help us translate our strategic business direction into corporate information systems that will support that direction. (*Financial News*, September 10, 1996)

In addition to this visioning and sense-making role, the CIO is also the chief executive of the IT function and thus can fashion an effective IT management capability. An effective IT management capability has been positively associated with an organization's extent of IT use (Boynton et al. 1994; Kraemer et al. 1989).

Rich overviews of what the CIO must attend to in order to build and maintain effective IT management capability have been provided in earlier

research (Earl 1996; Feeny and Willcocks 1998; Rockart et al. 1996; Ross and Feeny 2000). A synthesis of these positions suggests that the following set of CIO responsibilities is both concise and complete:

- Build and manage the three core IT assets identified by Ross et al. (1996): the IT infrastructure, the IT skillbase, and the web of relationships (both internal and external to the enterprise) enabling appropriate IT-based initiatives to be surfaced and successfully undertaken such that organizational competitiveness is enhanced.
- Devise, implement, and improve the management processes that result in the IT function being seen as an efficient and effective "production engine" capable of installing new applications in a timely manner and to operating the installed-base of applications in a cost-effective and dependable manner.
- Build relationships with vendors and partners and then devise, implement, and improve the requisite management processes ensuring the optimality of IT sourcing decisions as well as the facilitation and monitoring of the resulting contracts with third-party service and asset providers.

In essence, an effective CIO role incumbent promises not only to increase the likelihood that IT strategy both influences and is aligned with business strategy but also to efficiently and effectively manage and leverage the firm's IT assets (as well as the IT assets of technology partners) in order to successfully carry out the firm's IT-enabled strategic and tactical actions.

The preceding discussion on the potential value to be derived from the CIO role (i.e., both as a facilitator-participant of senior executive envisioning of IT-based strategic initiatives and as the architect-leader of an effective IT management capability) is supportive of the study's basic premise: that announcements of **newly created** CIO positions are likely to have a positive signaling effect on the market. This is clearly seen with the following comment:

and Willcocks 1998; and Feeny 2000). A study suggests that the benefits of IT are both

three core IT assets (Barua et al. 1996): the IT infrastructure, the web of internal and external to the organization, and the appropriate IT-based processes. IT is a valuable asset and successfully implemented organizational competence.

to improve the management of IT in the IT function, to implement efficient and effective processes, and to facilitate the role of installing new applications in a systematic manner and to facilitate the use of applications in a systematic manner.

vendors and partners, to improve the IT processes ensuring the quality of decisions as well as the monitoring of the third-party service

The role incumbent in the IT function is the likelihood that IT is aligned with the business strategy to efficiently and effectively manage the firm's IT assets, to facilitate the use of technology, and to fully carry out the tactical actions.

The potential value to the firm (i.e., both as a strategic asset and as a source of competitive advantage) of executive initiatives and as the result of IT management is the study's basic premise. The study's basic premise is that the role of newly created CIO positions will have a positive impact on the firm's performance. This is clearly evident.

"The senior executive appointment of a chief information officer is among the first steps in a new strategic plan to increase the effectiveness of the company's information technology resources and make sure those resources are aligned with business needs," said Donald R. Parfet, Executive Vice President for Administration of The Upjohn Company. (*Financial News*, September 21, 1994)

It might be argued that the value-adding contributions of the CIO position will be most apparent and most important for those firms that have chosen to make IT a strategic asset. However,

every firm that finds itself information dependent—and that includes most firms—is likely to encounter situations in which competitors develop IT applications that become competitive necessities. (Ross et al. 1996, p. 37)

Thus, regardless of whether a firm desires to aggressively move forward with IT-enabled strategic initiatives or to catch up with faster-moving competitors within an IT-dependent marketplace, an effectual management tactic for both energizing/transforming a complacent internal IT function and communicating this strategic shift to stakeholders is to create a CIO position and to fill this position with a highly-capable individual. This leads to the study's first hypothesis:

Hypothesis 1: Announcements of newly created CIO positions are positively associated with abnormal stock market returns.

Firms first began to apply IT to improve their efficiency and effectiveness in the 1950s and over time have increasingly invested in and received value from these IT assets. Much debate has arisen over the years by both practitioners and scholars regarding the wisdom of steadily increasing firms' investments in IT (Barua and Mukhopadhyay 2000). Within the past few years, the e-business phenomenon (and its trans-

formational effects on both organizations and market performance) seems to have led to a greater awareness of the business value of IT. However, this rise in the strategic importance of IT has not occurred in isolation. A strong "complementarity effect" seems to exist, where IT investments must be aligned with other organizational changes in order for the potential of IT to be fully realized. Barua and Mukhopadhyay (p. 78) nicely explain:

As identified by Barua, Lee and Whinston (1996), Brynjolfsson et al. (1997), and Barua and Whinston (1998), IT inputs are a component in organizational design, and investments in IT must be complemented by investments in appropriate business strategies, processes, incentives and control systems. If a firm does not invest in the implementation of complementary changes, the true payoff is likely to be limited.

The creation of the CIO role thus positions the IT function such that IT-based initiatives are implemented simultaneously with corresponding organizational changes required to realize the full effects of the IT-enabled functionality being gained.

In addition to these complementary changes within firms, associated complementary investments have also occurred, with the passage of time, across firms and throughout industries. Today, a firm introducing a new information product or service within its upstream or downstream business processes is much more likely to find that its suppliers, partners, or customers are able to (relatively) easily adopt the new information product or service.

Because of this increased investment in complementary assets (knowledge, process reengineering, IT infrastructures, industry standards, etc.), the potential for installed IT platforms and applications to be more readily leveraged has increased with time. Correspondingly, over time, firms' stakeholders would more readily understand the signaling effects of new CIO position announcements. This leads to the study's second hypothesis:

Hypothesis 2: The abnormal stock market returns of firms announcing newly created CIO positions will be positively associated with time.

While the CIO position is appearing in all types of firms, a stronger impetus to create such a senior executive role will likely be felt in those industries for which IT serves a decisive competitive role. According to the rational-comprehensive model of the strategy making process, effective strategy implementation is contingent upon achieving a fit between the organization's strategy and the principal organizational design components of structure, people, tasks, and reward systems (Frederickson and Mitchell 1980; Galbraith and Kazanjian 1986). Aligning executive managerial talent with strategic direction is a necessary condition for achieving organizational effectiveness (Szilagi and Schweiger 1984). It would be quite understandable that firms in industries undergoing IT-driven transformation would feel a compelling need for "digital strategists" to help formulate new business models and execute the resultant business strategies. This leads to the study's third hypothesis:

Hypothesis 3: The abnormal stock market returns of firms announcing newly created CIO positions will be positively associated with a firm's membership in an industry undergoing IT-driven transformation.

Finally, this study also examines whether the stock market reacts more positively to hiring CIOs externally as opposed to promoting someone from within the organization. There are several appealing rationales for hiring an external candidate for a senior management job like that of a CIO. First and foremost, the external CIO brings into the organization extensive knowledge of how IT was being applied in another firm as well as having already demonstrated the ability to serve effectively in the complex, multi-faceted CIO role. A number of other advantages also accrue to external rather than internal hires, such as a greater ability to

- more objectively assess the current state and needs of the IT function;

- disregard, if appropriate, existing IT plans and practices as no personal attachment to these would have been developed; and
- build effective relationships with other senior executives throughout the business as no prior, dysfunctional history exists.

This rational view of the executive selection process finds broad support in the succession literature (Bibeault 1982; Goodstein and Boeker 1991; Hofer 1980; Starbuck et al. 1978). The literature also suggests that when external environments are changing, hiring of senior executives from the outside is an effective adaptive mechanism for the organization. In addition to introducing new perspectives and new ties to the external environment, the external hire also triggers second-order learning by challenging current assumptions and beliefs and by developing new interpretive schemes and standard operating procedures (Bartunek 1984; Virany et al. 1992). Such second-order learning is especially critical in order to ensure that necessary complementary changes to IT-based initiatives are both recognized and undertaken.

It is nonetheless recognized that benefits might also accrue from hiring an internal candidate for a new CIO position. The internally-hired CIO most likely (1) possesses a rich knowledge of the company, its relative position in its marketplace, and the strengths and weaknesses of its IT capabilities and (2) has developed effective working relationships with other of the firm's senior executives.

Considering all of the arguments developed above regarding the advantages of hiring externally or internally, we believe that an announcement of an external hire for a newly created CIO position has the potential to create a sharper reaction within the firm's stakeholders. This leads to the study's fourth and final hypothesis:

Hypothesis 4: The abnormal stock market returns of firms announcing newly created CIO positions will be positively associated with the occurrence of external hires.

The Research Methodology

The objective of this study is to analyze the stock price behavior of firms announcing a newly created CIO position. Accordingly, an event study methodology was applied. In this section, the data set created for the analysis and the estimation method are both described.

Building the Study's Data Set

Event dates for announcements of newly created CIO positions were identified from *Lexis-Nexis Wire Index (News/Wires Library)* by conducting searches using the key words "new" or "create" along with the following position titles: chief information officer, CIO, chief technology officer, CTO, vice president of information systems, vice president of information services, and vice president of information technology. The use of different position titles as search terms was necessitated by the fact that companies often use different designation labels for their most senior IT executive. When scrutinizing the search results, we insured that the role and responsibility description associated with the position announcement was that of a senior IT executive charged with the responsibilities of a CIO, e.g., building and operating an IT infrastructure as well as seeding, developing/acquiring and operating IT applications. In other words, the job description *and not the label* was used to ensure that our sample consisted of announcements of a newly created CIO position.

A total of 137 press releases were found. In order to assess the stock return performance related to each announcement, the common stock of each firm must be listed on either the New York Stock Exchange (NYSE), the American Stock Exchange (AMEX), or on NASDAQ. The firm must also be included on the *Center for Research for Security Prices (CRSP)* daily stock returns file. Firms also need to be continuously listed over the estimation and event periods to be included. This requirement reduced the sample to 113 announcements. For the remaining 113 announcements, the *Lexis-Nexis* database was checked for news that might contaminate the price data (e.g., earnings, divi-

dends, or other major announcements on the day before, the day of, or the day after the CIO announcement). The final sample consists of 96 announcements of newly created CIO positions. This sample was broadly distributed across the 1987-1998 time period (see Figure 1) and across 30 Standard Industrial Classification (SIC) code two-digit industry groups (see Table 1).

Two distinct time periods were utilized in assessing whether or not the "time effect" was present: 1987-1994 and 1995-1998. The "event" used in selecting these two time periods was the emergence of the Internet as a recognized and viable business platform.

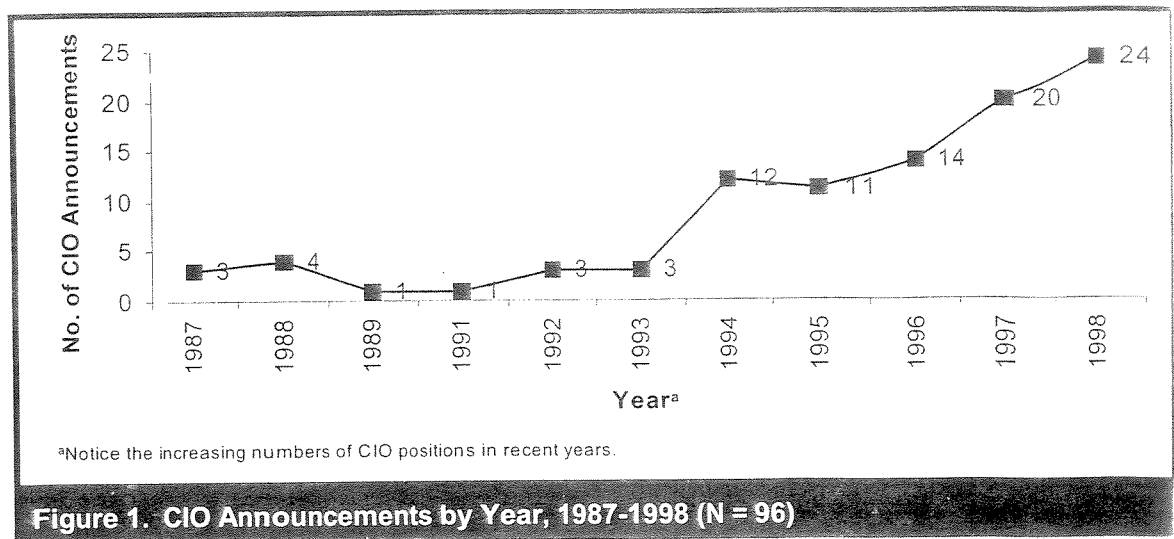
In order to assess the extent of IT-driven transformation in industries represented in the sample, an instrument (provided as Appendix A) was designed and sent to four judges. These four judges are well-recognized scholars who both research and teach in the area of IT strategy. Each judge was asked to indicate whether the role that IT served within an industry in that specific time period would best be represented as automate, informate up or down, or transform. These IT roles were defined as follows:

Automate: Replace human labor by automating business processes.

Informate Up/Down: Provide data/information to empower management and employees.

Transform: Fundamentally alter traditional ways of doing business by redefining business processes and relationships.

While automate represents virtually no IT-driven transformation efforts, informate up/down implies an intermediate level of transformation. The above description of IT roles is consistent with the Schein (1992) categories of strategic IT vision. This categorization has recently been used to assess the role that IT serves in a firm's business activities and competitive strategies (Armstrong and Sambamurthy 1999). On receipt of the responses from the judges, a numerical scale of 1 to 3 was used to replace the alphabetical scores



(of IT roles—A, I, or T) assigned by the judges. The highest score (of 3) was assigned to those industries where the role of IT was to transform traditional ways of doing business by redefining business processes and relationships. The interrater reliability was then computed; it was 0.80 for the 1987-1994 time period and 0.82 for the 1995-1998 time period. Finally, a mode value for the level IT-driven transformation was computed for each industry.

The classification of an announcement as representing an internal or external hire was based on the text of the announcement. In other words, a new CIO hire whose just-previous position was with another firm was denoted as an "external hire" and a new CIO whose just-previous position was with the firm making the announcement was denoted as an "internal hire."

A listing of the announcements comprising our sample is provided as Appendix B. This list contains the company's name, announcement date, CIO source (external or internal), industry, and IT-driven transformation score.

Estimation Method

The impact of announcements on stock prices is computed using event study methodology, an ap-

proach commonly utilized in accounting, finance, and management studies (see Ball and Brown 1968; Brown and Warner 1985; McWilliams and Siegel 1997). In the IS literature, Dos Santos et al. (1993) use an event study to measure the stock market impact of announcements of IT investments.

Information effects on the stock prices of announcing firms are reported for the day before the announcement (day -1), the day of the announcement (day 0), and the day following the announcement (day +1) for all firms, and for each relevant subsample. Determining whether these CIO announcements represent new information to investors and affect the stock price requires an estimate of a firm's stock market performance in the absence of the CIO announcement.

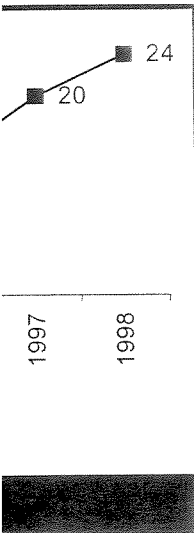
We assume that the market model, which is based on the capital asset pricing model that is specified as follows, describes daily common stock returns:

$$R_{jt} = \alpha_j + \beta_j R_{mt} + \epsilon_{jt}$$

where:

R_{jt} is the rate of return on the common stock of the j^{th} firm on day t ;

R_{mt} is the market rate of return using the equally-weighted CRSP index on day t ;

**Table 1. CIO Announcements by Industry (Two-Digit SIC Code), 1987-1998 (N = 96)**

SIC	Industry	#	SIC	Industry	#
87	Accounting, Bookkeeping, Collection and Credit Reporting	1	73	IT Consulting Services	1
73	Advertising	1	72	Long Term Care Facilities	1
35	Agricultural Machinery Manufacturing	2	27	Media—Diversified	2
47	Air Delivery, Freight and Parcel Service	1	33	Metals (Aluminum, Steel) Manufacturing	2
45	Airlines	4	28	Pharmaceuticals Manufacturing	3
37	Automotive Manufacturing	2	73	Printing, Photocopying and Graphic Design	2
37	Automotive Parts and Service	3	27	Publishing—News Services, Newspapers and Periodicals	2
60	Banking	4	64	Reinsurance	2
28	Biotechnology Products/Services	2	56	Retail—Apparel/Accessories and Specialty Products	1
28	Cleaning Products—Manufacturing	1	53	Retail—Department Stores and Discount/Variety Stores	6
35	Computer Manufacturing	5	54	Retail—Grocery Stores	1
73	Computer Software Products/Services	8	36	Semiconductor Equipment/Materials Manufacturing	1
32	Diversified Building Materials Manufacturing	1	73	Staffing, Outsourcing and Other Human Resources	5
28	Diversified Chemicals Manufacturing	1	63	Surety, Title and Miscellaneous Insurance	1
20	Diversified Foods Manufacturing	3	48	Telecommunications Services	1
36	Electronic and Scientific Test and Measurement Instruments Manufacturing	4	73	Telemarketing, Call Centers and Other Direct Marketing	6
62	Financial Services	2	40	Transportation—Railroad	1
28	Fluid Systems Manufacturing	1	41	Transportation—Ground	1
58	Food Services	1	37	Transportation Equipment Manufacturing	1
80	Health Care Products Distribution	2	49	Utilities—Electric	1
16	Heavy Construction	1	51	Wholesaler—Floral Products and Groceries	1
73	Information Collection and Delivery Services	1	36	Wire and Cable Manufacturing	2
73	Internet and Online Service Providers	1			

- α_j is an intercept and β_j is a slope parameter that measures the sensitivity of R_{jt} to the market index
- ϵ_{jt} equals the disturbance terms with the usual OLS properties

The OLS market model is employed to estimate the abnormal return, AR, for the common stock of firm j on day t , such that

$$AR_{jt} = R_{jt} - (\alpha_j + \beta_j R_{mt})$$

To estimate these returns, a 255-day estimation period is used that begins 300 trading days before the event date, $t = -300$, and ends 45 trading days before the event date, $t = -45$. The event date, $t = 0$, is typically assumed to be the *Lexis-Nexis* announcement date, but may be the prior day if an earlier announcement is specifically noted in *Lexis-Nexis*. Similar to other event studies, we begin cumulating abnormal returns over a three-day event period that begins the day before ($t = -1$) to allow for possible leakage of the information before the actual announcement. The event period also includes the day of the announcement ($t = 0$) as well as the day following the announcement ($t = +1$).

Daily abnormal returns are averaged over the sample of N firms and over the three days between $T_1 = \text{day } -1$ and $T_2 = \text{day } +1$ of the event period to yield cumulative abnormal returns, $CAR_{T_1 T_2}$:

$$CAR_{T_1 T_2} = \frac{\sum_{j=1}^N \sum_{t=T_1}^{T_2} AR_{jt}}{N}$$

The test statistic, $Z_{T_1 T_2}$, uses the standardized residual based on the standardized abnormal return, SAR_{jt} , which is derived by dividing firm j 's abnormal return (AR_{jt}) by its standard deviation (S_{AR_j}).

The test statistic, $Z_{T_1 T_2}$, tests if $CAR_{T_1 T_2} = 0$, with $T_1 = \text{day } -1$ to $T_2 = \text{day } +1$ corresponding to the event period dates. The test statistic, $Z_{T_1 T_2}$, follows the normal distribution under the null hypothesis. It is computed as follows:

$$Z_{T_1 T_2} = \frac{1}{\sqrt{N}} \sum_{j=1}^N Z_{T_1 T_2}^j$$

where

$$Z_{T_1 T_2}^j = \frac{1}{\sqrt{Q_{T_1 T_2}^j}} \sum_{t=T_1}^{T_2} SAR_{jt}$$

and

$$Q_{T_1 T_2}^j = (T_2 - T_1 + 1) \frac{D_j - 2}{D_j - 4}$$

D_j is the number of trading day returns used to estimate the parameters for firm j .

Results

It is interesting to note from Figure 1 that the incidence of new CIO position announcements is increasing, especially over the last two years. Generally, firms seem to be aware of the desirability of sharing information about IT governance with investors.

Table 2 depicts the cumulative abnormal returns (CAR) for all firms announcing a newly created CIO. Estimation results for the stock market reaction to announcements of newly created CIO positions are given by announcement period, level of IT-driven transformation, and CIO type (internal vs. external hire).

Table 3 provides sensitivity tests of the event study returns using parametric, nonparametric, and bootstrap testing in order to examine the robustness of our results.

Table 4 provides a multivariate regression analysis of the three-day market model adjusted returns ($t = -1$ to $t = +1$) around the announcements of the newly created CIO positions. The explanatory variables attempting to explain the three-day stock market reaction to the newly created CIO position include whether the newly created CIO position is filled with an outside candidate (external), is in a industry with a high level of IT-driven transformation, and the period of the announcement.

Table 2. Cumulative Abnormal Returns (CAR) Around the Announcement of Newly Created CIO Positions, 1987-1998 (N = 96)

Market-model adjusted cumulative abnormal returns (CARs) and z-statistics are shown for the day before (-1), the day of (0), and the day after (+1) the newly created CIO position announcements. We also cumulate returns over the (-1,0) and the (-1, 0, +1) periods. Panel A presents the results for the full sample. Panel B details the results by the period of the announcement. Panels C and D provide the results by the IT-driven transformation level of the industry and CIO source. Statistical tests are performed using standardized residuals. (N = 96; z-statistic from standardized residuals in parentheses.)

Window	Day -1	Day 0	Day +1	Day -1, Day 0	Day -1, Day 0, Day +1
Panel A: Full Sample of Newly Created CIO Position Announcements					
Full Sample (N = 96)					
Mean CARs	0.49%	0.38%	0.27%	0.88%	1.16%
z-statistic	(1.78)**	(1.15)	(0.70)	(2.07)**	(2.09)**
Panel B: Breakdown by Period of Announcement					
Years 1987-1994 (N = 27)					
Mean CARs	0.39%	-0.29%	0.03%	0.10%	0.13%
z-statistic	(0.96)	(-0.09)	(0.56)	(0.61)	(0.82)
Years 1995-1998 (N = 69)					
Mean CARs	0.54%	0.65%	0.36%	1.19%	1.56%
z-statistic	(1.50)*	(1.41)*	(0.47)	(2.06)**	(1.95)**
Panel C: Breakdown by Level of IT-Driven Transformation in Industries					
Firms in industries with virtually no IT-driven transformation (N = 23)					
Mean CARs	0.77%	0.05%	-0.39%	0.82%	0.43%
z-statistic	(1.55)*	(0.13)	(-0.49)	(1.19)	(0.69)
Firms in industries where IT plays an informational role (N = 43)					
Mean CARs	-0.19%	0.47%	0.01%	0.28%	0.28%
z-statistic	(-0.19)	(1.04)	(0.28)	(0.60)	(0.65)
Firms in industries with high level of IT-driven transformation (N = 30)					
Mean CARs	1.27%	0.51%	1.17%	1.79%	2.97%
z-statistic	(2.04)**	(0.69)	(1.35)*	(1.93)**	(2.35)**
Panel D: Breakdown by Source of CIO					
External candidate named as CIO (N = 61)					
Mean CARs	0.63%	0.39%	-0.01%	1.02%	1.02%
z-statistic	(1.87)**	(0.75)	(-0.34)	(1.85)**	(1.31)*
Internal candidate named as CIO (N = 35)					
Mean CARs	0.26%	0.38%	0.72%	0.65%	1.37%
z-statistic	(0.48)	(0.91)	(1.61)*	(0.98)	(1.73)**

*Significant at the .10 level; **Significant at the .05 level; ***Significant at the .01 level.

Table 3. Sensitivity Tests of Event Study Returns Using Parametric, Nonparametric, and Bootstrap Testing

Window	Day -1	Day 0	Day +1	Day -1, Day 0	Day -1, Day 0, Day +1
Panel A: Parametric Testing Using Standardized Residuals and Standardized Cross-Sectional Residuals (Full Sample, N = 96)					
Mean CARs	0.49%	0.38%	0.27%	0.88%	1.16%
z-statistic computed using Standardized Residuals	(1.78)**	(1.15)	(0.70)	(2.07)**	(2.09)**
t-statistic computed using Standardized Cross-Sectional Residuals	(1.76)**	(1.22)*	(0.66)	(2.54)***	(2.40)***
Panel B: Nonparametric Testing (Full Sample, N = 96)					
Median CARs (#Positive:#Negative)	0.23% (54:42)	0.13% (53:43)	0.06% (51:45)	0.38% (56:40)	0.91% (57:39)
Generalized Z test (z-statistic)	(1.71)**	(1.50)*	(1.09)	(2.12)**	(2.32)**
Rank Z test (z-statistic)	(1.54)*	(1.36)*	(0.57)	(2.05)**	(2.01)**
Years 1995-1998 (N = 69) Mean CARs z-statistic					
Panel C: Bootstrapping Testing (Full Sample, N = 96)					
Bootstrapping (p-value) (one-tailed)	0.062*	0.114	0.200	0.004***	0.008***

*Significant at the .10 level; **Significant at the .05 level; ***Significant at the .01 level.

Nonparametric,	
Day -1, Day 0	Day -1, Day 0, Day +1
Cross-Sectional	
0.88%	1.16%
2.07)**	(2.09)**
1.54)***	(2.40)***
0.38%	0.91%
56:40)	(57:39)
2.12)**	(2.32)**
2.05)**	(2.01)**
0.04***	0.008***

Table 4. Estimated Coefficients from Regressing Newly Created CIO Announcement Excess Returns on Type of Announcement, Year of Announcement, and Industry Variables (N = 96)

The dependent variable is the three-day CIO announcement market-model adjusted cumulative abnormal returns (CARs) over the (-1, +1) window for the i^{th} firm in the sample.

Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Intercept	0.014 (1.66)*	0.003 (0.58)	0.001 (0.20)	-0.001 (-0.15)	0.004 (0.31)
External	-0.003 (-0.33)				-0.008 (-0.75)
IT-Driven Transformation Level		0.026 (2.51)**		0.024 (2.23)**	0.026 (2.33)**
Time			0.014 (1.29)	0.007 (0.66)	0.007 (0.59)
Adjusted R ²	-0.9%	5.3%	0.7%	4.7%	4.3%
F Statistic	0.11	6.31**	1.67	3.36**	2.41*

Notes:

External = 1 if the newly created CIO position is being filled by a candidate external to the company; 0 otherwise

IT-Driven Transformation = 1 if the announcing firm is an industry subject to a high level of IT-driven transformation; 0 otherwise

Time = 1 if the announcement is made during 1995-1998; 0 otherwise

*Significant at the .10 level; **Significant at the .05 level.

A discussion of the results for each of the hypotheses follows.

Hypothesis 1

The results in Table 2 provide evidence that event-period cumulative abnormal returns are positive and statistically significant at the .01 level for the overall sample of N = 96 announcements of newly created CIO positions. On average, announcements of newly created CIO positions lead to uniform large and statistically significant price reactions of 1.16% (at the .05 level) over the three-day event period. These findings are consistent with the hypothesis that announcements of newly created CIO positions signal that firms and their stakeholders do recognize the current and future importance of both IT and effectual IT leadership.

We note that the abnormal return on day -1 is positive and significant and that the abnormal returns for days 0 and +1 are positive but not significant. There are a number of potential explanations for this finding. We suspect that the news of newly created CIO positions leaks out to institutional investors and others before the press announcement. For example, a headhunter firm would likely be involved in filling the CIO position with an external hire and would thus be aware of this information before the press release. Institutional investors are also likely to be made aware of the hiring of an outside senior executive prior to the formal press release. To assess such arguments, we posit that newly created CIO positions being filled by external candidates would be more likely to have news leakage than those filled by internal candidates. Panel D of Table 2 confirms our intuition, showing a positive and significant reaction on the day before the press

release and no stock market reaction on the other two days. Further, as is detailed in Appendix C, we have found no evidence that influential or outlier observations drive the day -1 result. Finally, to alleviate concern that the significant stock market reaction over the event period completely relies on the day -1 result, we have performed an event study for days 0 and +1 and found a positive, significant reaction (at the 0.10 level).

Table 3 provides additional assessments of the first hypothesis using alternative parametric, non-parametric, and bootstrapping techniques to test for the robustness of the cumulative abnormal returns. In Panel A, the statistically significant cumulative abnormal returns are tested using standardized cross-sectional residuals (Brown and Warner 1985), indicating the robustness of the parametric testing. In Panel B, results of non-parametric tests such as the binomial sign test (Chen et al. 1991) and the rank test (Corrado 1989) provide additional evidence of statistically significant positive cumulative abnormal returns. In addition, Panel C of Table 3 displays the results of standard errors generated using bootstrapping techniques (Kramer 1996), suggesting significantly positive cumulative abnormal returns around the announcements of newly created CIO positions.²

We undertook additional analyses to examine the potential influence of outliers and to control for the possibility of firm size and industry effects. These analyses are proved as Appendix C. As the interested reader can observe, the results are both robust to outliers and not explained through firm size or industry effects.

Hypothesis 2

The second hypothesis suggests that the abnormal stock returns of firms announcing CIO

²In addition, we performed nonparametric and bootstrapping techniques for hypotheses 2 through 4 (not reported here) and found similar results to the parametric tests reported in Table 2.

positions are positively associated with time. Panel B of Table 2 provides cumulative abnormal returns by period of the announcement. Breaking our sample down into two time periods, we find no significant cumulative abnormal returns in the earlier time period (1987-1994). In contrast, we do find some evidence that cumulative abnormal returns are higher in the more recent time period (1995-1998). However, the multiple regression analysis in Table 4 fails to detect this time effect, suggesting that the observed univariate time effect may be spurious and explained by a relationship between time and another of the predictor variables, specifically IT-driven transformation level of the industry.

Hypothesis 3

The third hypothesis argues that the cumulative abnormal stock returns of firms announcing a new CIO position will be higher for firms belonging to industries undergoing IT-driven transformation. Panel C of Table 2 provides evidence of the announcement period effects of firms announcing newly created CIO positions. Consistent with the third hypothesis, announcements made by firms in industries with relatively higher levels of IT-driven transformation exhibit positive event-period cumulative abnormal returns of 2.97% that are statistically significant at the .01 level for the sample of $N = 30$ announcements of newly created CIO positions. Announcements of new CIO positions in the $N = 23$ firms in industries with virtually no IT-driven transformation and $N = 43$ firms in industries with intermediate-level IT-driven transformation exhibit positive returns that are not significantly greater than zero.

The multiple regression analysis in Table 4 suggests that announcing firms in the highest level of IT-driven transformation have significantly higher returns (approximately 2.6%; $t = 2.33$) and that the effect of the "IT-driven transformation" variable does dominate other predictors. These findings lend strong credence to the notion that strong IT leadership is considered most critical for firms in industries with a relatively high level of IT-driven transformation.

Hypothesis 4

The fourth hypothesis suggests that announcements of hiring external candidates to fill newly created CIO positions are associated with greater positive share price reactions. The results (as shown in Panel D of Table 2) suggest that there is no significant difference in the cumulative abnormal returns for firms filling their newly created CIO positions with internal or external candidates. The multiple regression analysis in Table 4 finds no significant difference between internal or external hires.

It is interesting to note that a difference does seem to exist regarding the external and internal hires: the positive returns are associated with an earlier observation window ($t = -1$ and $t = -1$ to $t = 0$) for external hires and a later observation window ($t = +1$ and $t = -1$ to $t = +1$) for internal hires. This suggests, perhaps, that either (as suggested earlier) more leakage occurs with external hires or that the value of an externally hired new CIO might be more readily interpreted while the value of an internally hired new CIO might require additional assessment. However, we have no basis for assessing or distinguishing among these explanations and leave this to future research.

Limitations

It should be noted that the sample in this study only considers those firms making announcements of newly created CIO positions and thus may limit the generalizability of the results. There are at least two possible constraints on this sample. First, in order for firms to be included in our sample, the press release had to clearly indicate that there is a newly created CIO position. There is always a possibility of missing an announcement of a newly created CIO position due to lack of clear evidence in the press release.

Second, despite our efforts to isolate the new CIO position announcements from all other announcements (see above), it is possible that the results are driven by other contemporaneous events not covered in a press announcement.

There is also the possibility that the CIO position announcement could have been anticipated (by the market) because of related events like changes in senior management. To reduce this possibility, we looked at all announcements of corporate control changes or turnover of senior level management over the six-month period before the CIO announcement. We found no evidence suggesting that the CIO position announcements could have been anticipated.

Finally, extent of institutional ownership of firms could have a potential impact on stock price changes caused by announcements of newly created CIO positions. According to the asymmetry-reduction hypothesis proposed by financial theorists, share price reactions are likely to be more subdued for firms that are high in institutional ownership. This is because of the reduction in pre-announcement information asymmetries caused by the information gathering and analyzing activities of institutional investors (Szewczyk et al. 1992).

Implications of the Findings

The primary purpose of this paper was to examine stock market reactions to announcements of newly created CIO positions. While the first and third research hypotheses were supported, i.e., positive cumulative abnormal returns were observed for both the entire sample and the IT-driven transformation industry subsample, it should be noted that the observed effect regarding the entire sample is largely attributed to the influence of the effect associated with the IT-driven transformation industry subsample. Clearly, the market has rewarded companies for legitimizing the strategic role of IT in supporting business initiatives, but primarily for those firms competing in an industry in which IT has the potential to transform the nature of competition.

The second and fourth research hypotheses were not supported. While abnormally positive returns were observed with the latter time period, this finding is best explained by the increasing propensity, with time, for IT to possess the potential

to radically transform the nature of competition within more industries. The announcements of hiring internal or external candidates to fill the newly created CIO positions seemed to produce similar outcomes. Apparently, the market does not distinguish between external and internal CIO hires.

The major contribution of this study is that it lends considerable credibility to beliefs regarding the critical importance of both IT and, more importantly, IT capability (as reflected in the CIO role) within competitive environments in which IT potentially serves a strategic role. This study's results (1.16% for the entire sample and 2.97% for the IT-driven transformation industry subgroup) compare quite well with the results of other event studies examining stock market reactions (see Table 5).

For firms competing in industries with high levels of IT-driven transformation, investors expect that a visible and coherent IT leadership structure, commensurate with the heightened role of IT for these firms, has been put in place. Senior management teams of such firms are advised to have developed carefully thought-out IT governance structures (Sambamurthy and Zmud 2000) and to have positioned the senior IT executive such that he/she can effectively contribute to the formulation and execution of IT-enabled business strategies.

With the passage of time, the portion of industries in which IT serves a transformational role is likely to increase. As a consequence, senior executive teams of all firms are encouraged to continuously reassess the appropriateness of their current IT governance structures. It might prove far better for a firm to anticipate a heightened strategic role for IT and put in place an IT governance structure to facilitate the transition to this heightened role (Brown and Sambamurthy 1999) than risk the possibility of having to react to a competitor's moves via a misaligned IT governance structure.

A number of potentially fruitful research directions also emerge from a consideration of this study's findings. First, future event studies of stock market reactions to newly created CIO positions

could include additional explanatory variables such as the prior reputation, experience-base, and visibility of the appointed person. Second, perhaps more definitive findings could be observed with the question of external versus internal hires through the inclusion of covariates, i.e., external hires might be more valued when either firm performance or the reputation of the IT function were impaired. Third, we also encourage studies that broaden their focus to include all executive appointments into existing CIO positions and that examine the movement of senior IT executives into general executive (CEO, COO, etc.) roles. With regard to broadening the scope of such investigations to include existing CIO positions, anecdotal evidence suggests that CIOs experience a high turnover rate, relative to other senior executives. Is this solely a function of poor performance by incumbents? Or, are there indirect economic explanations behind this high turnover rate? With regard to examining the effects of IT executives moving into general executive positions, anecdotal evidence suggests that such movements are increasing, especially within industries with relatively high levels of IT-driven transformation. It would be both interesting and important to determine if, and under what conditions, a firm's shareholders value such executive appointments.

We also encourage scholars to employ research strategies other than that of the event study in our collective efforts to unravel the complex relationships between IT capabilities, governance structures for these capabilities, and firm performance. In particular, it would be highly desirable to categorize distinctive IT capabilities and to discover the nature of cause-effect relationships that might exist among categories of IT capabilities, endowments of and governance structures for these capabilities, situational factors, and firm performance. The knowledge produced through such studies would be invaluable for both senior management teams (as it would enable them to more selectively invest in technology, organization designs, management systems, and human resources) and researchers (as it would provide the foundation to better understand the value-adding nature of IT and IT capabilities in today's evolving competitive arena).

Table 5. Sample of Recent Event Studies Reporting CAR

Event Studies	CAR
Barth et al. (1999): Effect of Initial Returns of Thrift versus Non-Thrift IPOs	27.33 and 11.73
Subramani and Walden (1999): Effects of Business-to-Commerce E-Commerce Announcements	10.50
Subramani and Walden (1999): Effects of Business-to-Business E-Commerce Announcements	3.30
This Study: Industries with high level of IT-driven transformation (Table 2, Panel C)	2.97
MacKinlay (1997): Effect of Earnings Announcements	2.30
Das et al. (1998): Effects of Strategic Alliances	1.60
This Study: Entire study (Table 2, Panel A)	1.16
Lane and Jacobson (1995): Effects of Announcements of Brand Leveraging	0.32
Agrawal and Kamakura (1995): Effect of Celebrity Endorsement	0.20
Przasnyski and Tai (1999): Effects of Malcolm Baldrige National Quality Award Announcements	.011
Meznar et al. (1998): Effects of Withdrawal from South Africa Revisited	-.001
Strange and Ezzel (2000): Effects of Health Cost Containment Measures	-.01
Ghani and Childs (1999): Effects of the Passage of the Nutrition Labeling and Education Act of 1990 for Large U.S. Multinational Food Corporations	-1.89
Robin (1998): Effect of Impact of Dividend Omission Announcements	-6.57

Conclusion

This study's findings provide strong support for the proposition that announcements of newly created CIO positions do indeed provoke positive reactions from the marketplace, but primarily for firms competing in industries with high levels of IT-driven transformation. Within such industries, IT is being applied in innovative ways for competitive purposes. For firms to engage in such strategic behaviors, they must first develop and then effectively exploit an appropriate set of IT capabilities. Strong executive leadership, as reflected in the CIO role, is likely to play a crucial enabling role in the effective deployment of these IT capabilities, and hence be highly valued by a firm's shareholders.

Just how valuable is a newly created CIO role? One way to consider the magnitude of the stock

market reaction is to compute the impact on each firm's market valuation of common equity. A conservative approach would calculate this effect through the median statistic (multiplying the median stock market reaction by the median market valuation of common equity); a less conservative approach would use the mean statistic (multiplying the mean stock market reaction by the mean market valuation of common equity). For our entire sample of firms, the net impact per firm of a newly created CIO position is in a range from \$7.5 million (median approach) to \$76 million (mean approach). If only the IT-driven transformation subgroup is considered, the net impact is in a range from \$8 million (median approach) to \$297 million (mean approach). Even with the trend in escalated executive salaries, the expected return from such an investment in IT capability appears quite reasonable!

Acknowledgments

The authors would like to specially thank Cynthia Beath, the Senior Editor, for her exceptional guidance in enhancing the quality of the manuscript. We are also indebted to the associate editor, and the reviewers for their excellent comments and suggestions. We are also grateful to Michael Ettredge, Leonard Jessup, Rajiv Sabherwal, V. Sambamurthy, and Albert Segars for their assistance during the data collection and analysis phase of the project.

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Appendix A

Instrumentation for Assessing Level of IT-Driven Transformation Across Industries

Please indicate which of the following best reflects the role of IT in the specified list of industries during the periods 1987-1994 and 1995-1998:

Automate: Replace human labor by automating business processes.
 Informate Up/Down: Provide data/information to empower management and employees.
 Transform: Fundamentally alter traditional ways of doing business by redefining business processes and relationships.

Rating Scale: Automate (A); Informate Up/Down (I); Transform (T)

Table A1. Instrumentation for Assessing Level of IT-Driven Transformation Across Industries, 1987-1994

Industry	Role of IT
Airlines	T
Banking	A
Computer Manufacturing	I
Computer Software Products and Services	A
Diversified Chemicals Manufacturer	I
Diversified Foods Manufacturer	I
Electric Equipment, Electronic/Scientific Test, and Measurement Instruments Manufacturer	A
Financial Services	A
Fluid Systems Manufacturer	A
Food Services	A
Health Care Products Division	A
Heavy Construction	A
IT Consulting Services	I
Media—Diversified	I
Pharmaceutical Manufacturing	A
Publishing—News Services, Newspapers, and Periodicals	A
Retail—Department Stores	I
Retail—Grocery Stores	A
Semiconductor Equipment and Materials Manufacturing	I
Telecommunications Services	A
Transportation—Ground and Railroad	A
Transportation Equipment Manufacturing	A

Table A2 Instrumentation for Assessing Level of IT-Driven Transformation Across Industries, 1995-1998

Industry	Role of IT
Accounting, Bookkeeping, Collection, and Credit Reporting	T
Advertising	T
Agricultural Machinery Manufacturing	I
Airlines	T
Automotive Manufacturing	I
Automotive Parts and Services	I
Banking	T
Biotechnology Products/Services	I
Cleaning Products Manufacturing	I
Computer Manufacturing	A
Computer Software Products and Services	T
Diversified Building Materials Manufacturing	I
Diversified Chemicals Manufacturer	I
Diversified Foods Manufacturing	I
Electronic Equipment, Electronic/Scientific Test and Measurement Instruments Manufacturer	I
Financial Services	T
Fluid Systems Manufacturing	I
Food Services	I
Health Care Products Distribution	I
Heavy Construction	I
Information Collection and Delivery Services	T
Internet and Online Service Providers	T
IT Consulting Services	I
Long Term Care Facilities	T
Media—Diversified	T
Metals (Aluminum, Steel) Manufacturer	A
Pharmaceuticals Manufacturer	I
Printing, Photocopying, and Graphics Design	I
Publishing—News Services, Newspapers, and Periodicals	T
Reinsurance	I
Retail—Apparel/Accessories and Specialty Products	I
Retail—Department Stores and Discount/Variety Stores	I
Retail—Grocery Stores	I
Semiconductor Equipment and Materials Manufacturer	I
Staffing, Outsourcing, and Other Human Resources Services	T
Surety, Title, and Miscellaneous Insurance	A
Telecommunications Services	T
Telemarketing, Call Centers, and Other Direct Marketing	T
Transportation—Ground and Railroad	A
Utilities—Electric	A
Wholesaler—Floral Products and Groceries	T
Wire and Cable Manufacturer	I

Appendix B

Attributes of Companies in Sample

Company	Announcement Date	External/ Internal	IT-Driven Transformation Score	Industry
Apple Computer, Inc.	06/26/87	External	I	Computer Manufacturing
Sears	11/11/87	Internal	I	Retail—Department Stores
Kraft	12/10/87	External	I	Diversified Foods Manufacturer
Continental Illinois Corp	02/01/88	External	A	Banking
Northwest Airlines	02/10/88	External	T	Airlines
Pan American World Airways	04/15/88	Internal	T	Airlines
Fruehauf Corporation	05/05/88	Internal	A	Transportation Equipment Manufacturing
Tribune Company	12/13/89	Internal	I	Media—Diversified
Tektronix	07/22/91	External	A	Electric Equipment, Electronic/Scientific Test/Measurement Instruments Manufacturing
PPG Industries	02/05/92	External	I	Diversified Chemicals Manufacturer
JWP Information Services	06/09/92	External	I	Computer Manufacturing
Microsoft	10/09/92	Internal	A	Computer Software Products and Services
AT&T	06/10/93	External	A	Telecommunications Services
PacifiCare Health Systems, Inc.	06/11/93	External	A	Health Care Products Distribution
Continental Corp	10/27/93	Internal	T	Airlines
Rykoff Sexton	01/13/94	External	A	Food Services
Greyhound Lines	01/14/94	External	A	Transportation—Ground and Railroad
Kroger	02/14/94	Internal	A	Retail—Grocery Stores
Compaq	03/01/94	External	I	Computer Manufacturing
Lam Research Corp.	06/08/94	External	I	Semiconductor Equipment and Materials Manufacturing
Computer Task Group	07/07/94	External	I	IT Consulting Services
LCI International	07/15/94	External	A	Fluid Systems Manufacturing
SafeCard Services, Inc.	07/27/94	External	A	Financial Services
Sallie Mae	08/04/94	External	A	Financial Services
Upjohn	09/21/94	Internal	A	Pharmaceuticals Manufacturing
Mentor Graphics	11/21/94	External	A	Computer Software Products and Services

Company	Announcement Date	External/ Internal	IT-Driven Transformation Score	Industry
Fluor Corp.	12/05/94	Internal	A	Heavy Construction
Fisher Scientific	01/13/95	Internal	I	Electric Equipment, Electronic/Scientific Test/Measurement Instruments Manufacturing
Aurora Electronics, Inc.	01/23/95	External	T	Computer Software Products and Services
Bank South	01/25/95	External	T	Banking
Dayton Hudson	04/17/95	Internal	I	Department Stores and Discount/Variety Stores
Cadmus Communications Corp.	04/24/95	External	I	Printing, Photocopying and Graphic Design
Owens & Minor, Inc.	05/04/95	Internal	I	Health Care Products Distribution
Kellogg	05/17/95	Internal	I	Diversified Foods Manufacturer
Diebold	08/15/95	Internal	A	Computer Manufacturing
Incyte Pharmaceuticals	10/13/95	External	I	Biotechnology Products/Services
AmeriQuest Technologies, Inc.	10/20/95	External	T	Computer Software Products and Services
Genesis Health Ventures	12/06/95	External	I	Long Term Care Facilities
Frederick's of Hollywood	01/30/96	External	I	Retail—Apparel/Accessories and Specialty Products
General Electric	04/08/96	Internal	I	Electric Equipment, Electronic/Scientific Test/Measurement Instruments Manufacturing
Cable & Wireless	05/29/96	External	T	Telecommunications Services
Communications World International	05/31/96	External	T	Telecommunications Services
General Motors	06/20/96	External	I	Automotive Manufacturing
Aspect Telecommunications	07/15/96	External	T	Computer Software Products and Services
Sumitomo Bank	08/13/96	External	T	Banking
Tribune Company	08/26/96	External	T	Media — Diversified
Procter & Gamble	09/10/96	Internal	I	Cleaning Products—Manufacturing
Spyglass	10/09/96	External	T	Computer Software Products and Services
Dean Foods	11/04/96	Internal	I	Diversified Foods Manufacturer
Mercantile Stores	12/06/96	Internal	I	Department Stores and Discount/Variety Stores
Bowne & Co. Inc.	12/16/96	External	I	Printing, Photocopying and Graphic Design
Alcoa	12/20/96	External	A	Metals (Aluminum, Steel) Manufacturing

Company	Announcement Date	External/Internal	IT-Driven Transformation Score	Industry
Enhance Financial Services Group	01/07/97	Internal	I	Reinsurance
Central Newspapers Inc.	01/08/97	External	T	Publishing—News Services, Newspapers and Periodicals
Ag-Chem Equipment Co.	02/03/97	Internal	I	Agricultural Machinery Manufacturing
Adobe Systems	03/03/97	External	T	Computer Software Products and Services
Ford Motor Company	03/06/97	Internal	I	Automotive Manufacturing
Donnelly Corp.	03/14/97	External	I	Automotive Parts and Service
Pacific Scientific Company	03/18/97	External	I	Electric Equipment, Electronic/Scientific Test/Measurement Instruments Manufacturing
Western Staff Services	04/07/97	External	T	Staffing, Outsourcing and Other Human Resources
Cylink	06/03/97	External	T	Computer Software Products and Services
Electroglas	06/26/97	External	I	Semiconductor Equipment and Materials Manufacturing
Siebels Bruce Group	07/31/97	External	A	Surety, Title and Miscellaneous Insurance
Birmingham Steel Corp.	08/21/97	Internal	A	Metals (Aluminum, Steel) Manufacturing
Echlin, Inc.	08/25/97	External	I	Automotive Parts and Service
Vencor	09/15/97	External	I	Long Term Care Facilities
Telespectrum Worldwide	09/24/97	External	T	Telemarketing, Call Centers and Other Direct Marketing
CSX Corporation	11/04/97	Internal	A	Transportation—Ground and Railroad
LTV Corp	11/10/97	Internal	A	Metals (Aluminum, Steel) Manufacturing
Profit Recovery Group	11/12/97	External	T	Accounting, Bookkeeping, Collection and Credit Reporting
Blount International, Inc.	11/25/97	Internal	I	Agricultural Machinery Manufacturing
PNC Bank Corp	12/11/97	Internal	T	Banking
Gymboree	01/28/98	External	I	Retail—Apparel/Accessories and Specialty Products
Human Genome Sciences	02/24/98	Internal	I	Biotechnology Products/Services
Playboy Enterprises, Inc.	04/27/98	External	T	Publishing—News Services, Newspapers and Periodicals
e.spire	04/29/98	External	T	Telecommunications Services

Company	Announcement Date	External/ Internal	IT-Driven Transformation Score	Industry
CompUSA Inc.	05/07/98	Internal	I	Retail—Apparel/Accessories and Specialty Products
Wisconsin Electric	06/05/98	External	A	Utilities—Electric
Advanced Energy Industries	06/12/98	Internal	I	Semiconductor Equipment and Materials Manufacturing
General Cable	07/28/98	External	I	Wire and Cable Manufacturing
Concentric Network	08/05/98	Internal	T	Internet and Online Service Providers
USG Corporation	08/17/98	External	I	Diversified Building Materials Manufacturing
Seagate Technology	08/25/98	Internal	A	Computer Manufacturing
Nabi	08/31/98	External	I	Pharmaceuticals Manufacturing
Midas	09/22/98	External	I	Automotive Parts and Service
AMD	09/25/98	Internal	I	Semiconductor Equipment and Materials Manufacturing
Nash Finch	10/05/98	External	T	Wholesaler—Floral Products and Groceries
Reuters Group, Pic	10/05/98	Internal	T	Information Collection and Delivery Services
Consolidated Delivery and Logistics	10/13/98	External	T	Air Delivery, Freight and Parcel Services
USA Floral Products	10/15/98	Internal	T	Wholesaler—Floral Products and Groceries
Etec	10/22/98	External	I	Semiconductor Equipment and Materials Manufacturing
Tele globe	10/27/98	Internal	T	Telecommunications Services
Paper Warehouse	11/18/98	External	I	Retail – Apparel/Accessories and Specialty Products
Bellsouth	11/24/98	External	T	Telecommunications Services
America West Holdings	11/30/98	External	T	Airlines
24/7 Media, Inc.	12/14/98	External	T	Advertising

Appendix C

Outlier and Matched Pairs Analyses

We performed two analyses to examine the effects of outliers. In the first analysis, observations outside the range of the mean plus and minus three standard deviations were extracted from the data set. This eliminated three observations: two to the right and one to the left of the mean. The cumulative abnormal return without these outliers is 1.02% and is significantly greater than zero at the 0.01 level. Similar tests performed on each of the possible event periods produced results comparable to those reported in Table 2. In the second analysis, we truncated our sample by two, three, and four observations from both tails and continued to find significantly positive cumulative abnormal returns. Finally, it should be noted that non-parametric testing (as shown in Table 3) does control for the possible effects of outliers (as it considers the sign and the rank of the cumulative abnormal returns as opposed to the magnitude of the abnormal returns). We conclude that outliers are not driving the results of our study.

To control for the possibility of firm size and industry effects, we also employ a matched-pairs analysis where each announcing firm has a matched control firm. Control firms are firms in the same SIC code (four-digit, where possible) and of approximately the same total assets and net income in the fiscal year prior to the CIO announcement. The sample size is reduced to 90 firms due to the unavailability of total assets and profitability levels from S&P Compustat for six firms. Table C1 reports the results of the matched-pairs analysis.

Descriptive statistics are shown for the size of the announcing firms and the control firms. Tests of significance suggest that despite our efforts to control for the size and profitability, the CIO announcing firms are more profitable than the control firms.³ However, the Wilcoxon signed rank test finds no significant difference in profitability. In both the *t*-tests and the Wilcoxon signed rank tests, we find announcing firms have significantly higher cumulative abnormal returns around the CIO announcements.

To allow for the possibility that the difference in event-period returns is due to differences in total assets and profitability, a multivariate regression is run that allows firm size and profitability to be covariates (similar to Carlson et al. 1998). Each firm's three-day market model adjusted return ($t = -1$ to $t = 1$) is the dependent variable in this cross-sectional regression. To differentiate between the experimental firms and the control firms, a newly created CIO position indicator variable is used. As shown in Panel B of Table C1, regression results suggest that the difference in market-model adjusted returns can be explained by whether the firm is announcing a newly created CIO position or is a control firm. Note that the model F-statistic is significant only in the model in which the CIO indicator is used. In the model in which total assets and earnings are included as covariates, the model F-statistic is not significant. In addition, the *t*-statistic on the coefficient of total assets and earnings is not significant. This matched-pairs analysis lends further support to the hypothesis that firms announcing newly created CIO positions have significantly higher returns than their matched firms.

³An analysis of the earnings of experimental and control firms suggests a few outliers. It was difficult to find a match for Sears and AT&T, which have much higher total assets and earnings than their matching firms (Kmart and Bellsouth, respectively). As a test of sensitivity, we also removed Sears and AT&T and their control firms and found no significant differences between assets and earnings. However, even without Sears and AT&T, we continue to find significant differences between the market model adjusted returns.

Table C1. Matched Pairs Analysis (N = 90)

Each firm announcing a CIO position is matched with a control firm of approximately the same size (total assets), profitability and same industry (four-digit SIC code, where possible) at the time of the event. Sample size is reduced to 90 firms due to unavailability of total assets and net income data from S&P Compustat.

Panel A: Descriptive Statistics of Experimental and Control Firms

	Average Total Assets (\$ Millions)	Average Net Income (\$ Millions)	Market-Model Adjusted Return (CAR) (Day -1, Day 0)	Market-Model Adjusted Return (CAR) (Day -1, Day 0, Day +1)
Firms making CIO announcements (experimental firms)	\$13,207.00	\$435.55	0.935%	1.255%
Control firms	\$10,951.56	\$303.82	-0.147%	-0.028%
Paired samples <i>t</i> -test of differences	1.23	1.75*	2.30**	1.83*
Wilcoxon Signed Rank <i>z</i> -test	0.54	0.06	2.19**	2.37**

Panel B: Matched Pair Regression Analysis

Dependent Variable is the market-model adjusted cumulative abnormal returns (CARs) over three-day event period (Day -1, Day 0, Day +1).

Independent Variables	Coefficient (<i>t</i> -statistic in parentheses)	
Constant	-0.0002 (-0.05)	0.00015 (0.031)
CIO Indicator	0.0128 (1.95)**	0.0128 (1.94)*
Total Assets		-6.94E-08 (-0.40)
Net Income		1.19E-06 (0.18)
Adjusted R ²	1.5%	0.6%
F-Statistic	3.81**	1.36

CIO Indicator = 1 if the firm is announcing a newly created CIO position; 0 if it is a control firm

*Significant at the .10 level.

**Significant at the .05 level.