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Profiles of IT Payoff Success:

An IT Capabilities and Business Environments Perspective

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Profiles of IT Payoff Success:

An IT Capabilities and Business Environments Perspective

by

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To My Family

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[1] Lee, H.-S. "Life in Austin as a Ph.T.," in *Writing Austin's Lives: A Community Portrait*, The Waterloo Press, Austin, TX, 2004, pp. 195-197.

Profiles of IT Payoff Success:

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Business value of information technology (IT) continues to be an enduring topic of importance to business leaders and academic scholars alike. Previous studies have shown that IT does make a positive contribution with regard to firm performance when IT investment is well-implemented and accompanied by complementary investments. In addition, several scholars have reported, albeit not directly and without much explanation, that business value gains differ rather significantly across industry boundaries and over different business environments. This paper, therefore, focuses on the question of "under what conditions do investments in IT generate above normal strategic gains or financial returns?" and examines the effects of business environmental factors on IT payoff. Grounded in resource-based view (RBV) and coalignment theory, three business environment characteristics--competitive pressure, environmental dynamism and IT

intensity (i.e., $IT as a percent of total expenses)--are identified as potential moderating factors on the linkage between firm performance and different types of IT capabilities, namely, IT that automates, IT that informates and IT that transforms.

I employ the case study method to conduct a preliminary investigation and develop testable hypotheses. With the IT announcement event study data from 1981-1995 and business environments data from archival and secondary sources such as US Industrial Outlook and US Economic Census, I test proposed hypotheses using multivariate regression techniques. I find that environmental dynamism negatively moderates the linkage between IT capabilities and firm performance (i.e., cumulative abnormal return (CAR)), while competitive pressure and IT intensity positively moderate this linkage. In other words, when environmental dynamism is high, above normal financial returns associated with IT that transforms are shown to be dampened.

For academic scholars, this study will enrich coalignment theory by specifically identifying optimal combinations of different types of IT and business environments. This study will help business managers and CIOs to make informed decisions regarding the right types of IT investments in a given business environment. The study concludes with discussions of its research contributions and implications of the study.

Table of Contents

List of Tables

List of Figures

I. Introduction

The business value of information technology (IT) continues to be an enduring topic of importance to business leaders and academic scholars alike. Previous studies have shown that IT does make a positive contribution to firm performance when IT investment is well-implemented and accompanied by complementary investments (e.g., Barua and Whinston 1998, Brynjolfsson et al. 1997). The salient question, then, is not "Do investments in IT pay off?" but rather "Under what conditions do investments in IT generate above normal strategic gains or financial returns?" In addition, several scholars have reported, albeit not directly and without much explanation, that business value gains differ rather significantly across industry boundaries and over different business environment factors. This paper, therefore, attempts to identify such business environment characteristics and offer insights on how these factors may further explain business value performance variances.

More specifically, I investigate how different business environment factors influence IT payoff. At the industry level, Farrell (2003) has already found that although most industries significantly increased their IT spending during the 90's, their rates of productivity gains varied greatly. In fact, in the US, productivity gains were concentrated in six sectors: retailing, securities brokerage, wholesaling, semiconductors, computer assembly and telecommunications. These sectors accounted for only 32% of the domestic GDP; however, they contributed more than 76% of the country's net productivity gain. Her study implies that there might be some underlying factors in a

given industry that help member firms reap better IT payoff than other companies in a different business environment. Industry, as defined in her study, is an aggregate of member companies, and therefore, Farrell's industry productivity can be understood as the "averaged" performance of all firms in a given industry. So it appears that there are underlying factors that drive variance in net productivity gains across different sectors, although little attempt has been made to explain what these factors are and why they have this effect. In this research, salient business environment factors will be identified and investigated, to see if these business environment factors have impacts on individual organization's IT payoff, drawing from the coalignment and resource-based view theories.

Throughout this paper, "business environment factors" is used instead of "industry-related characteristics" because it is hard to define industry-specific characteristics in today's ever-merging and fast-changing corporate environment. For example, the oil and refinery industry was one of the slowest changing, "old-boy" network types of business decades ago. But with several big mergers and acquisitions (e.g., ExxonMobil), this industry segment is leading the way to vertically integrating the whole value chain. Therefore, I will focus on business environment characteristics (not tied to a specific industry per se) that define environmental or external factors. This way, with a combination of business environment characteristics defined (e.g., fierce competition, technology-heavy), researchers can study multiple industries that share similar market characteristics. Notably, the term "industry" is oftentimes applied to many socio-economic sectors each with distinctive market structures, technologies, and domains (Chiasson and Davidson 2005).

In addition, to study the IT payoff implications in different business environments, I look for the combinations or profiles of success of different IT capabilities and various environment characteristics. Orlikowski and Iacono (2001) submit that IT has been treated as a "black box" when investigating organizational impact of this relatively new phenomenon. To untangle the intricacies of different IT types and investigate implications of their unique impacts, this study will provide a preliminary framework upon which different IT types can be categorized and more richly investigated. In other words, with the study's insights, different IT types can be categorized and each matched with an optimal business environment to generate optimal IT payoff. Although numerous ways exist to categorize IT types or capabilities, I adapt from Zuboff's (1988) groundbreaking article to categorize different IT capabilities as IT that automates, IT that informates and IT that transforms and search for optimal combinations of IT types and business environments that may induce significantly higher IT payoff.

For academic scholars, this research will enrich the theoretical underpinnings of coalignment theory with regard to business environment characteristics, different types of IT and business value. By specifically identifying different IT capabilities or types and linking them with uniquely defined business environment factors, this study will enrich and fine tune the coalignment perspective and add a layer of theoretical understanding to explain organizational performance variance with regard to aforementioned constructs. Here I focus on Business Environment-IT Types coalignment perspective (Venkatraman and Prescott 1990) and strive to further enrich that perspective by identifying underlying factors that may constitute optimal combinations for significantly higher IT payoff.

According to Sutton and Staw (1995), lists of variables and constructs are not theory. Therefore, my research will focus on relationships and profiles: how and why different business environment characteristics would moderate the linkage between different IT types and business value. As this study attempts to introduce specific dimensions to coalignment theory "to identify how this change affects the accepted relationships between variables," (Whetten 1989) I believe this study will make a value-added contribution to theory development in the IS field.

For business managers and CIOs who have to make efforts to identify appropriate types of IT investments in a given market environment, this study will provide practical insights on which their future judgment and decisions can be based. In a recent interview, David Barnes, CIO of the UPS company, says, "the days when a technologist could retreat into a narrow niche without taking the broader view are gone" and emphasizes the need to assess business environments when making technology investments (Lundquist 2005). According to the guidelines of this study, a company that is facing a fast-changing environment would be encouraged to invest in a certain type of IT capabilities to maximize their IT payoff. Unfortunately, in making investments for different IT capabilities, CIOs and business managers do not usually consider business environment characteristics as explanations for success or failure of IT investments, even though Li and Ye (1999) suggest that companies considering IT investment should assess their environmental contexts. By showing the salient influence of business environment characteristics on the linkage between intended IT capabilities and firm performance, this study will direct managers' attention to these important and yet underestimated factors.

This paper is organized as follows:

- II. Business Value of IT: Value Conceptualized: I review relevant prior studies, present how the construct of business value has been conceptualized, briefly review the theoretical underpinnings, and pose my research question to address a promising unexplored research area.
- III. Business Environment Characteristics: I present market-related characteristics that can be relevant to the business value of IT.
- IV. IT Types and Their Intended Capabilities: I review previous studies that categorize different types of IT and elaborate on potential ways that these can be relevant to the business value of IT.
- V. Firm Performance: My dependent variable is defined and outlined.
- VI. Pilot Case Studies: Pilot case studies are conducted to further clarify and fine tune theoretical background and hypotheses.
- VII. Research Model and Hypotheses Development: I present my research model and elaborate on hypotheses that address relationships among three aforementioned constructs: business value of IT, different types of IT, and business environment characteristics.
- VIII. Research Method: I elaborate on my research method to investigate my research question. Variables are operationalized and summarized.
- IX: Analyses and Discussion: I conduct statistical analyses and discuss findings.

- X. Contributions: Limitations of the study are first discussed. I then outline benefits of this study for practitioners and academic scholars. Future research opportunities are also briefly discussed.
- Appendix: Interview guidelines and coding scheme examples are included.

II. Business Value of IT: Value Conceptualized

The term business value of IT is often used to describe various aspects of the firm performance impact of IT, including productivity enhancement, profitability improvement, inventory reduction and other measures of performance (e.g., Kohli and Devaraj 2003, Hitt and Brynjolfsson 1996). Several researchers (e.g., Mukhopadhyay et al. 1995) define the business value of IT as the impact of IT on firm performance. The term is also interchangeably used with IT payoff (Kohli and Devaraj 2003). In addition, researchers refer to the term performance or IT payoff as both at the process level and at the organizational level. For example, Barua et al. (1995) incorporates both first-order effects on operational level variables such as inventory turnover as well as organizational level variables such as market share.

In investigating the organizational performance impacts of IT, scholars have adopted several theoretical frameworks, including microeconomics (e.g., Brynjolfsson and Hitt 1996, Bharadwaj et al. 1999), industrial organization theory (e.g., Gurbaxani and Whang 1991) and the resource-based view (RBV) (e.g., Mata et al. 1995). Among these theoretical engines, the RBV has been used to examine the efficiency *and* competitive advantage implications of specific firm resources. Barney (1991) submits that a resource is valuable if "it exploits opportunities and/or neutralizes threats in a firm's environment." Resources have also been defined as valuable "when they enable a firm to conceive of or implement strategies that improve its efficiency and effectiveness." (Bowman and Ambrosini 2000). Proposed sets of conditions for a resource to confer a sustained competitive advantage include value, rareness, inimitability and non-

substitutability (Barney 1991). This theory-base has wide appeal since it is rooted in microeconomics, focuses on resource attributes and is useful in examining the IT resource.

II-1. Literature Review

With the aforementioned theoretical engines in mind, I have identified several journal articles as representative of the current streams of research focused on business value of IT. Their dependent variable (i.e., value) spans the different realms and various levels. For example, Brynjolfsson and Hitt (1998) present firm level evidence that may refute the productivity paradox claim by Solow (i.e., increased productivity due to IT investments after a time delay), whereas Mukhopadhyay et al. (1997) advocate that IT not only improves "number" related measurement but also enhances "soft" measures such as quality and customer service. In addition, Barua et al. (1995) submit that process level benefits do not necessarily translate into aggregate levels (i.e., business units and firm levels) due to structural differences and other unrelated "noise." Overall, all value conceptualization seems to be done in two overarching manners (Melville et al. 2004): 1) business process performance: operational efficiency of specific business processes, measures of which include customer service, flexibility, information sharing and inventory management, 2) organizational performance: overall firm performance, including productivity, efficiency, profitability, market value and competitive advantage.

Table 1 summarizes how different business value of IT empirical studies conceptualize their value constructs. I focused on recent journal articles and conference proceedings from 1980 since 1) their results had been reviewed and validated by scholars

in the field and 2) they are largely accessible (vs. working papers). As one can see, studies include various process level and organizational level business value dependent variables. For example, Barua et al (1995) use capacity utilization, inventory turnover and quality as process (or intermediate) level business value dependent variables, whereas market share and return on asset (ROA) are selected to measure business value at the organizational level. Further, market performance metrics such as Tobin's q have been used to assess business value of IT (e.g., Bharadwaj et al. 1999) in addition to productivity measures such as total output and on-time output (e.g., Mukhopadhyay et al. 1997). In addition to these "hard" metrics, soft metrics such as IT diffusion/adoption and customer satisfaction have also been used to capture business value created by IT investments (e.g., Grover et al. 1998, Devaraj and Kohli 2000).

The last column in Table 1 describes how industry-related factors have been incorporated in prospective business value of IT studies. As one can see, the majority of studies rely on single-company or single-industry data to show how their independent variables (e.g., IT investments) influence their business value dependent variables such as market share and multifactor productivity (e.g., Barua and Lee 1997, Devaraj and Kohli 2000, Francalanci and Galal 1998, Mahler and Regan 2002, Menon et al. 2000, Mukhopadhyay et al. 1995, Mukhopadhyay et al. 1997, Peffers and Dos Santos 1996, Weill 1992). A few studies that utilize multi-industry data demonstrate that business value of IT implications apply across the industry sector boundaries (e.g., Barua et al. 1995, Brynjolfsson and Hitt 1998, Bharadwaj et al. 1999, Bharadwaj 2000), although little attempt has been made to compare and explain the different magnitudes of

ROI(return on investment) in different business environments. Interestingly, in one of the few studies that investigate IT payoffs across several different industries, Kohli and Devaraj (2003) notice that IT payoff seems to be higher in studies that focus on the non-profit and public sector than the ones that draw data from manufacturing and service industries. However, the authors stop short of providing a theoretically derived argument for why such differences may exist. In the later sections of this paper, I will further elaborate on this point: how different business environments may prove to be salient factors to explain variance in IT payoffs. Overall, it seems that one under-explored question in the existing business value of IT literature is that of how underlying market characteristics produce or generate different levels of IT payoffs or what role these characteristics play in shaping IT business value. This concern is echoed in one of the most recent *MIS Quarterly* review articles (Melville et al. 2004).

Table 1 Business Value of IT Conceptualization in Recent Studies

Studies	Year & Journal	Prominent Business Value Dependent Variable(s)	Key Findings & Industry Implications
(Harris and Katz 1991)	1991 OS	*Premium Income	The study finds support for its two main hypotheses that in top performing insurance firms 1) information technology costs as a proportion of total operating costs were higher, and 2) information technology costs as a proportion of premium income were lower, than in weak performance firms. Data is taken from a single industry (i.e., 40 systems

Studies	Year & Journal	Prominent Business Value Dependent Variable(s)	Key Findings & Industry Implications
			technology leaders in the life insurance industry) from 1983 – 1986.
(Weill 1992)	1992 ISR	*Sales Growth *ROA *Labor Productivity	The study finds that heavy use of transactional IT investment has a strong positive correlation with firm performance, whereas heavy use of strategic IT is associated with neutral firm performance at the best. Data is collected in a single industry (i.e., 33 value manufacturing firms) from the CEO, the controller and the production manager.
(Lubbe et al. 1995)	1995 Journal Info. Tech.	*Computerization Index *Operating Expense Ratio	The results of this study demonstrate a positive correlation between a computerization index and the financial ratios. The authors also show that the most profitable firms are more likely to spend a higher proportion of their operating expenses on IT. Data is collected from a single industry: long-term life insurance companies.
(Mukhopadhyay et al. 1995)	1995 MISQ	*Inventory Turnover *Costs *Production Volume	The study estimates the dollar benefits of improved information exchanges between Chrysler and its suppliers that result from using EDI (Electronic Data Interchange). After controlling for different variables including mix, volume and engineering

Studies	Year & Journal	Prominent Business Value Dependent Variable(s)	Key Findings & Industry Implications
			changes, savings per vehicle as a result of more efficient information exchanges are estimated to be about $60, thereby saving the company about $220 million per year. Performance data from the assembly centers of Chrysler Corporation over the past decade is used.
(Barua et al. 1995)	1995 ISR	*Capacity Utilization *Inventory Turnover *Quality *Market Share *Return on Asset	The results show significant positive impacts of IT at the intermediate level and these impacts do not necessarily translate up to a firm level. Nearly all data is collected from one industry sector: manufacturing. Industry specific variables including opportunity cost of capital and market growth are controlled for. The positive relationship between their dependent and independent variables still holds even in the presence of the control variables.
(Peffers and Dos Santos 1996)	1996 IEEE Transac. Engr. Mgmt.	*Market Share *Income Before Tax	The results indicate that the impacts of early ATM investments seem to be very small at first, but increase rapidly after a few years. In addition, the benefits obtained by the

Studies	Year & Journal	Prominent Business Value Dependent Variable(s)	Key Findings & Industry Implications
			earliest adopters were larger than those obtained by the banks that adopted later. The longitudinal data is collected from a single industry: banks in the United States.
(Mukhopadhyay et al. 1997)	1997 MS	*Total Output *On-time Output *Labor Hours	In this study, it is shown that IT investments lead to higher productivity and quality. Data is collected from a single industry (or rather a single organization): the US Postal Service. The authors use data from 46 mail processing centers over 3 years to study the IT impact.
(Barua and Lee 1997)	1997 ISR	*Labor Productivity *Profit Flow	In their interorganizational system (i.e., EDI) study, the authors collected data from one manufacturing firm and two suppliers in a vertical market. Industry factors are not controlled for per se, but supplier characteristics (e.g., IT-efficient and IT non-efficient) are a part of their analysis. The analysis results show that depending on the supplier competition structure, the EDI system may benefit a large supplier, while the opposite can be true for a small supplier.
(Brynjolfsson and Hitt	1998 CACM	*Multifactor Productivity	1,300 individual firm time-series data were used in

Studies	Year & Journal	Prominent Business Value Dependent Variable(s)	Key Findings & Industry Implications
1998)			their econometric analyses. It is found that regardless of industry sectors (i.e., manufacturing vs. service) IT has a positive and significant impact on firm's output.
(Francalanci and Galal 1998)	1998 MISQ	*Income Per employee *Ratio Total Operating Expense / Premium Income	Increases in IT expenses are associated with productivity benefits when accompanied by changes in worker compensation. Data is compiled for a 10-year period for 52 life insurance companies.
(Grover et al. 1998)	1998 Info. & Mgmt.	*IT Diffusion *Perceived Process Change *Perceived Productivity Improvement	Process redesign and IT have a complex relationship with productivity, and these can be represented by a mediating or moderating model for different technologies. Over half the sample is from the manufacturing and financial sectors. Different industry types and organizational size are controlled for.
(Lehr and Lichtenberg 1998)	1998 Journal Indust. Econo.	*Productivity *Labor Costs	Using econometric analysis, the study finds that IT intensity and productivity growth during the period of 1987-1992 are strongly correlated. Data is collected from federal and government agencies (i.e., BLS Federal Productivity Measurement Program and Computer

Studies	Year & Journal	Prominent Business Value Dependent Variable(s)	Key Findings & Industry Implications
			Intelligence Infocorp).
(Teo and Wong 1998)	1998 Omega	*Competitive Performance *Productivity *Management Performance	The results suggest that the intensity of IT investment has negligible relationships with information quality and improvement in work environment. Information quality is positively related to improvement in work environment, managerial satisfaction and organizational impact. Data is collected from a single industry (i.e., the retail industry in Singapore) via a questionnaire survey.
(Bharadwaj et al. 1999)	1999 MS	*Tobin's q	Four firm-specific and four industry-level control variables that could potentially impact a firm's Tobin's q were included in the research model. Four widely used industry control variables were industry concentration, industry capital intensity, industry average q and regulation. The positive relationship between their dependent and independent variables still holds even in the presence of the control variables.
(Devaraj and Kohli 2000)	2000 JMIS	*Hospital Revenue *Mortality *Customer Satisfaction	The authors examine monthly data collected from eight hospitals over a three-year time period in a single industry: healthcare management. Positive IT-

Studies	Year & Journal	Prominent Business Value Dependent Variable(s)	Key Findings & Industry Implications
			performance relationship is supported after time lags.
(Menon et al. 2000)	2000 ISR	*Costs	The results indicate that IT contributes positively to the production of services in the healthcare industry. The authors analyze the impact of IT in a healthcare setting using a longitudinal sample of hospital data from 1976 to 1994.
(Ho 2002)	2002 Public Admin. Review	*Inter-departmental Cooperation *Citizen Access	Based on a content analysis of the 55 largest city web sites and survey of web development officials, the article posits that the government paradigm shift is under way: from the Weberian bureaucracy (which emphasizes standardization, departmentalization, and division of labor) to e-government (which emphasizes coordinated network building, external collaboration and one-stop customer services). The author identifies two value drivers for e-government applications: interdepartmental cooperation and citizen access. Data is taken from a single industry (i.e., public sector).
(Mahler and Regan 2002)	2002 Amer. Review Public	*Provision of services *Collection of Information	The authors profile four different kinds of agencies (i.e., Social Security Administration's Online

Studies	Year & Journal	Prominent Business Value Dependent Variable(s)	Key Findings & Industry Implications
	Admin.	*Solicitation of Comments	PEBES, the Department of Education's National Student Loan Data System, the SEC's web site for Complaints of Internet Fraud, other agency sites that solicit citizen participation; all described in GAO reports) to show how the systems progressed from simple information displays to interactive systems. They identify success metrics used in assessing these applications including provision of services, collection of information and solicitation of comments. Data is collected from a single industry: federal government agencies.
(Kohli and Devaraj 2003)	2003 ISR	*ROI *Financial Metrics	Using a meta-analysis technique, this paper analyzes the 66 firm-level empirical studies between 1990 and 2000. The main purpose of the study is to uncover the structural variables that are behind many of the IT payoffs confounding results (i.e., positive or negative). The authors submits that the sample size, data source (firm-level or secondary), and industry in which the study is conducted influence the likelihood of

Studies	Year & Journal	Prominent Business Value Dependent Variable(s)	Key Findings & Industry Implications
			the outcome, although they did not find support for process-oriented measurement. The studies in the meta-analysis included data from the following industries: manufacturing, service, government, non-profit and combined. Among these, the study finds significant difference among outcomes of studies from different industries. Noticeably, studies conducted in nonprofit and government sectors show a greater degree of positive outcomes than those in financial and manufacturing sectors combined.
(Zhu and Kraemer 2005)	2005 ISR	*Impact on Sales *Impact on Internal Operation *Impact on Procurement	Using structural equation modeling on a dataset representing 624 firms across 10 countries in the retail industry, the authors find that technology competence, firm size, financial commitment, competitive pressure, and regulatory support are important antecedents of e-business use, and that this use creates e-business value. Notably their environmental context variables, competitive pressure and regulatory support, are shown to

Studies	Year & Journal	Prominent Business Value Dependent Variable(s)	Key Findings & Industry Implications
			influence e-business use positively.

In summary, my review leads us to several observations that are explained in more detail in the following section:

1. That underlying business environment factors in different industries have not been fully investigated in the previous business value of IT studies. The majority of studies that I reviewed include industry as a control factor and do not directly investigate the implications of industry on business value of IT.
2. That the question of how and why industry-related factors matter in assessing business value of IT needs to be explored further. For example, Kohli and Devaraj (2003) noticed in their meta-analysis of empirical IT payoff studies that payoff seems to be higher in studies that focused on the non-profit and public sector, but their study did not explain why that occurred (i.e., it was not the purpose of their study).

Note that past value conceptualizations are mostly centered on financial and market-based measures and at the firm level as IT is oftentimes strategic and can have a sweeping impact on the whole organization. In this study, business value is conceptualized at the firm level and my dependent value construct will be elaborated upon in the later section.

II-2. Theoretical Underpinnings

In order to study the role of business environment characteristics in business value of different types of IT, I employ two theoretical bases: coalignment theory and resource-based view (RBV), so that the internal perspective (i.e., intricacies of different types of IT and their intended capabilities) can be fully investigated along with external factors (i.e., prospective business environment characteristics).

II-2-1: Coalignment Theory

Coalignment theory emphasizes the role of "fit" between firm context and strategy in inducing a positive or negative firm performance. More specifically, the basic proposition is that organizational performance is a consequence of fit between two or more factors; such as, the fit between organizational environments and strategy (Van De Ven and Drazin 1985, Venkatraman and Prescott 1990). In this theory, the more fit or right combinations of complementary factors, the more likely the firm will reap a positive return. While the environment-strategy relationship and its performance implications have been studied in the management strategy field (e.g., Tan and Litschert 1994, Venkatraman and Prescott 1990), the coalignment between specific IT capabilities (that are the consequence of an organization's IT strategies) and contextual factors have not been thoroughly investigated. Henderson and Venkatraman (1999) notes: "…information technology has evolved from its traditional orientation of administrative support toward a more strategic role within an organization." Thus a choice to invest in certain IT capabilities increasingly carries strategic implications. Internal IS function and organization *and* external marketplace conditions need to be aligned (Henderson and

Venkatraman 1999) for better firm-level performance. By investigating this underexplored area of coalignment between business environments and intended IT capabilities, the study will be able to bolster and expand on extant coalignment theory. The fit that I am principally interested in is the alignment between IT capabilities and business environmental factors that lead to better or worse organizational performance.

Not much work has been published studying coalignment effects of environments on IT business value. In one of the few examples, Arthur (1994) studied the effect of HR systems on organizational performance. He found that industry norm practices of strong control or commitment regarding prospective HR systems positively moderate the relationship between HR systems investment and firm performance. IT co-alignment theory has a strong relevance for my research question for the following reasons: 1) the theoretical base is suitable for investigating the alignment effect of internal (i.e., IT capabilities) and external factors (i.e., business environment characteristics) on business value performance, and 2) further categorizing IT according to different capabilities (i.e., IT that automates, IT that transforms) gives me the option of untangling the intricacies of IT, not treating all IT as the same (i.e., treating IT as a "black box"). (Orlikowski and Iacono 2001).

II-2-2: Resource-based View (RBV)

The resource-based view was originally developed to understand the conditions under which firms are able to gain and sustain a competitive advantage (Rumelt 1984, Barney 1991). The value, rarity, and imitability of a resource have been shown to be important (Barney 1991). For example, RBV has been used to address why the

performance of processes within a firm may vary across a set of competitors (e.g., Henderson and Cockburn 1994). Only when valuable resources are rare and costly to imitate can they explain variance in performance across competing firms. A resource is likely to be costly to imitate in the presence of isolating mechanisms such as path dependence and team-embodied skills (Barney 1991).

In the IS literature, the RBV has been used to analyze IT capabilities (Mata et al. 1995) and to show that business value lies in the organization's skills to leverage IT capabilities (Clemons and Row 1991, Soh and Markus 1995). In other words, IT business value depends on the extent to which IT is used in the key activities in the firm's value chain. Although the individual components that go into the IT infrastructure may be commodity-like, the process of integrating and transforming to develop consistent applications is complex and imperfectly understood (Weill and Broadbent 1998). Thus, IT-enabled capabilities that integrate various resources and transform business processes cannot be easily imitated and have the potential to create business value (Bharadwaj 2000). In other words, IT that leverages more path-dependent components and skill sets and requires fundamental business process changes would more likely produce sustainable performance advantages than the ones companies can adopt using a "cook-book" approach. . In this paper, three IT capabilities, IT that automates, IT that informates and IT that IT that transforms, are juxtaposed against business environments. Since IT that transforms usually require overarching and fundamental business process changes, the capability to implement and leverage this type of IT is harder to imitate and

more path-dependent, and therefore, according to RBV, if valuable, could give sustainable advantage to a prospective firm, *ceteris paribus.*

III. Business Environment Characteristics

The well-known management scholar, Scott (1987), argues that organizations adapt to their environment and their environment influences organizational actions. He further identifies two overarching dimensions of an organization's environment that influence organizational forms and actions; namely, their material-resource environment and their institutional environment (Chiasson and Davidson 2005).

Material-resource environment:

- Demand-side factors: complexity, stability, variation in demand for product/services
- Supply-side factors: scarcity, concentration of key inputs to product/service
- Technologies: material technologies, skills, and knowledge used to produce outputs
- Market structure: alignment of suppliers, customers, competitors that influence flow of resources

Institutional environment:

- Institutional logics: organizing principles underlying practices and belief systems
- Institutional actors: individuals and organizations that create and enact institutional logics
- Governance systems: systems of regulatory and normative control

Some of these characteristics would appear to be more salient to business value of IT than others. For example, institutional logics and institutional actors are two prominent factors that influence the forming and transforming of institutions (Guler et al. 2002) and their impact on creating value through IT investments would be limited at best.

Guler et al. (2002) state that institutional logic defines the boundaries of organization (who's in and who's out) whereas institutional actors define who the members are with regard to their qualifications, ethnographic profiles and other professional and personal characteristics. These two factors are mostly concerned with forming, transforming and boundary expansions of institutions, which do not appear to be relevant to the topic of this study. Therefore, these two factors will not be included in my research model. Also, governance systems are mostly concerned with government regulations that outline "the rules of engagement" and their implications on the economic and political development of business (i.e., companies) and professional (i.e., CPA Certification Board) organizations. Based on case study interviews and literature review, I concluded that this variable may be more of a precedent to IT investment rather than a moderating factor on the linkage between different IT capabilities and business value. For example, several finance executives I interviewed all echoed the similar sentiment: "we're investing in this technology to better monitor our transactions and to meet upcoming regulation requirements." Here the regulation does not seem to give business managers much of a choice or discretion in IT investment (i.e., "get your act together or else"). Hence, it seems this regulation variable is outside the boundary of my research model, which is focused on the linkage between IT intended capabilities and firm performance. Thus I am more interested in the influence of business environments on performance *after* a certain type of IT investment is made rather than in what precedent factors may influence managers to invest in certain type of IT capabilities. Further, Zhu and Kraemer (2005) have empirically shown the precedent relationship of this specific variable to IT

investment: firms prompted by a higher regulatory support are more likely to invest in sweeping company-wide IT investments to achieve a greater extent of e-business use. As my research is focused on the IT capabilities-firm performance linkage, moderated by business environments, this variable seems to be beyond the scope of this study.

Through my literature search and interviews with academic scholars and industry practitioners, I have identified three business environment characteristics that appear to be relevant in business value of IT research, namely, competitive pressure, environmental dynamism, and IT intensity. First, competitive pressure is the degree of pressure that the company feels from competitors within the industry (Porter 1985), and is related to market structure in the material-resource environment (Chiasson and Davidson 2005). With intense competition, business value captured by a firm is more likely dissipated by its competition and surplus tends to go to consumers and not to organizations that have made investments. For example:

- ATMs: all banks connected to shared ATM network benefit, but some banks benefit more than others (Kaufman et al. 2000), while consumers enjoy the greatest benefits.
- EDI adoption: the powerful initiator benefits from the system, while the followers may be worse off (Sriram et al. 2000), since followers compete to get in to the initiator's network.

One bank executive mentioned during an interview that intense competition seems to "take away some bites out of the pie" when extensive IT investments are made to accomplish a company's specific goal. Since I need to investigate how different IT

intended IT capabilities match business environments factors that may contribute to variance in firm performance, competitive pressure will be included in my research model.

Second, environmental dynamism is the degree and instability of change in the firm's environment (Li and Ye 1999). In an environment characterized by greater dynamism, business and IT managers will have to deal with much more uncertainty and therefore are limited in their ability to correctly assess and capitalize on post IT investment opportunities. Environmental dynamism involves many facets including demand-side factors (Chiasson and Davidson 2005), customer force, threat of new entry and threat of substitute (Porter 1985), which may disrupt the stability of a given environment. Since business value may be realized with a time lag (Brynjolfsson and Hitt 1996), disruptive and frequent environmental shifts may cause current IT investments to be misaligned with their surroundings, and thereby hinder a particular IT implementation from reaching its full potential. This negating impact would be exacerbated if a prospective IT initiative has transformative implications (e.g., sweeping organizational-wide reform and fundamental shifts in business practices) as these efforts usually require much more cost and accordingly longer time. Eisenhardt (1989b) has shown that the speed of strategic decision making impacts firm performance in high-velocity environments such as the PC industry. Further, one finance vice president commented during an interview that her company is "limiting expansion of this system, so that we would not take too much risk--putting in so much and then everything changes." Since IT decisions are often strategic and implementation success or failure

can be influenced by shifting environmental changes, environmental dynamism will be included in my research model.

Third, IT intensity is the average digitization level in a given business environment (i.e., total business processes transacted online). IT intensity is a notable environment trait that would indirectly or directly influence the organizational return on prospective IT investments. For example, unless a significant level of infrastructure is in place, EDI will not be able to function properly nor reap any business value (Sriram et al. 2000). Barua et al. (2004) present strong evidence that financial performance attributable to net-enabled business value is driven by digitization level, which is the extent to which a firm accomplishes everyday business activities "online" including transactions and information exchange with partners. One IT senior consultant noted during an interview that "the finance industry has been money-spenders on IT and other supporting technologies . . . As you know, unless industry infrastructure is in place, this [transformative] kind of system will not function, let alone reap any benefits from it." Since IT intensity may influence the firm's ability to fully realize value from prospective IT investments, this factor is included in my research model.

Note these three factors are not meant to be encompassing or comprehensive with regard to depicting business environments. These three are identified as most relevant to the linkage between IT intended capabilities and firm performance as a result of case study interviews and extant literature search. Table 2 lists business environments factors and describes how these factors may be linked to institutional factors, Porter's five forces

and previously published articles. These business environments characteristics will be further elaborated upon and operationalized in later sections.

Table 2 Business Environments Construct

Business Environments Construct	**Relevant Institutional Factors and Porter's Five Forces**	**Related Articles**
Competitive pressure	• Market Structure • Competition	• (Kaufman et al. 2000) • (Sriram et al. 2000)
Environmental dynamism	• Demand-side Factors • Customer Force • Threat of New Entry • Threat of Substitute	• (Eisenhardt 1989b) • (Li and Ye 1999)
IT intensity	• Supply-side Factors • Technologies • Supplier Force	• (Barua et al. 2004) • (Sriram et al. 2000)

IV. IT Types and Their Capabilities

As mentioned previously, earlier business value of IT studies utilized microeconomic and industrial organizations framework and treated IT as a "black box." Since the economic theories are heavily focused on input and output exchanges, the frameworks tend to ignore the intricacies of different IT types and their related capabilities. As suggested in Orlikowski and Iacono (2001), it is critical to differentiate among different IT artifacts and their capabilities to correctly investigate business value of IT implications. Orlikowski and Iacono (2001) argue that often IT artifacts disappear from view in IS studies, are taken for granted, or are presumed to be unproblematic. In other words, IT is treated as a "black box" where input is somehow converted to different outputs. They posit that different types of IT applications (e.g., e-mail vs. CRM) need to be theorized differently in terms of their effects, context, and capabilities. For example, IT payoff from cost-cutting IT applications (i.e., efficiency improvement) may not be the same as that of customer value oriented initiatives (i.e., CRM). These different types of IT investments, therefore, may contribute to organizational performance with different magnitudes.

There are numerous ways to distinguish the different types of IT investments. By financial magnitude, by business functions, by vendors, just to name a few. However, as Zuboff (1988) explained in her groundbreaking work, information technology is distinguished from industrial age machines because of its dual of nature of being able to *automate* and *informate* (i.e., provide information to managers and employees across a firm). She also notes that "by ignoring the unique informating capacity of advanced

computer-based technology and ignoring the need for a new vision of work and organization, we will have forfeited the dramatic business benefits it can provide." In other words, the most meaningful way to categorize IT with regard to business benefits is to link different information technologies to their potential capabilities in terms of automating processes, providing information and transforming business practices. In that regard, I adopt the categorization that is utilized by Dehning et al. (2003), in work that built upon the original work of Zuboff (1988) and added an additional dimension, *transform,* to capture dramatic transformative capabilities of IT in today's business world. In their article, they show abnormal positive returns to announcements of IT investments by firms making transformative IT investments, and with membership in industries with transformative IT strategic roles. Borrowing from the IT strategic role construct, they conceptualize different types of IT investments as the following:

- Automate: replace a human labor in automating business processes
- Informate: provide information about business activities. This can be further divided into Informate-up (i.e., to senior management) and Informate-down (i.e., to employees across the firm)
- Transform: fundamentally redefine business and industry processes and relationships

Companies use IT to automate human labor in order to improve the efficiency of existing business processes. This practice may not be expected to produce large increases in profits or value because automation is easy to imitate. According to resource-based theory, the gains would be short-lived at best as a result. The same logic may apply to

the informate option since competitors are able to implement imitable applications. In contrast, companies that use IT in a transform IT strategic role introduce radical business models that disrupt industry practices and market structures (e.g., creation of new market space). The intended changes are disruptive rather than incremental, which may not be easy to imitate, and therefore, produce high and sustainable returns if they are successful. As Zuboff (1988) suggested in her work, there may be varying degrees of complexity to implement different IT capabilities. She notes, "Informating derives from and builds upon automation. Automation is a necessary but not sufficient condition for informating." In this study, I plan to adopt a coding scheme developed by Dehning et al. (2003) to separate Transform (i.e., fundamental business changes) from Automate/Informate (i.e., distinctive characteristics of IT from industrial age machines) in order to distinguish different types. For example, as the definition states, IT that transforms fundamentally redefines business and industry processes and relationships. Therefore, major business process improvement/reengineering efforts should accompany IT that Transforms. By asking managers, to what extent (i.e., more than 70 percent etc.) business process changes are planned along with a given IT implementation, we can separate IT that transforms from the other two.

V. Firm Performance

The dependent variable for this study is firm financial performance. In business value of IT studies, value conceptualization usually reflects a facet of firm financial performance or an immediate predecessor for such. In addition, coalignment theory specifically targets the interaction between a firm's internal strategy which may include whether and what IT investments should be made and environments within which the organization operates. Following suggestions from Standard & Poor reports, proper financial metrics can be chosen for different industries. The following table gives examples of such metrics in different industries.

Metal Production	Specialty Retail	Financial Services
Earnings per share Gross margin Inventory turnover Operating margin before taxes Return on assets	Earnings per share Gross margin Inventory turnover Operating margin Return on assets Return on equity Return on investments Sales per property, plant & equipment* *Proxy for sales per ft^2	Earnings per share Operating margin Operating margin before taxes Return on assets Return on equity

VI. Pilot Case Studies

In order to further clarify and fine tune my hypotheses, I conducted pilot case studies. Using exploratory case studies to define and present testable hypotheses is a frequently used approach in the field of management and information systems (e.g., Eisenhardt 1989a, Chircu and Lee 2005). I chose case sites that display polar opposite business environment characteristics such as high competitive pressure and low competitive pressure. Extreme situations and polar opposites help make the process of interest "transparently observable" (Eisenhardt 1989a, Yin 1984). For example, it has been shown that the finance industry spends far more on IT than the public sector does (MomentumResearchGroup 2000). These two sectors, therefore, can be selected to demonstrate opposing characteristics with regard to their IT intensity.

In conducting and writing pilot case studies, I used personal interviews, project deliverables and archival data. Since I might be biased in interpreting raw case data collected, I adopted the "resident devil's advocate" technique (e.g., Sutton and Callahan 1987) where a team member intentionally brought up alternative explanations and opposite perspectives in translating case data into patterns and findings. One of my Ph.D. colleagues served this role. Due to security measures and the sensitive nature of the data, having multiple investigators was not feasible. During the interviews, questions were asked using interview guidelines (See Appendix A) and notes were taken. In order to preserve the accuracy of data, case notes were typed and transcribed from hand-written notes immediately after each interview or at least on the same day.

VI-1: Pilot Cast Study 1: Northeast Bank Securities Lending Application[2]

In September 2000, a prominent northeast bank was embarking on a dramatic journey that would catapult it into the future of the securities lending business. It was believed that the bank's planned securities lending application (from this point on, it will be referred to as SLA for short) would bolster the bank's leadership position in the marketplace. This transformative project would take approximately 2 years to complete, involve nearly one hundred internal staff resources and outside experts, and alter the ways traders conduct securities lending transactions tremendously.

The bank dominated the global securities lending marketplace - a highly profitable and rapidly growing business. But this business was built upon a fragile and deteriorating information technology infrastructure. Defending and extending the bank's market dominance require the establishment of a new generation of SLA. Seeing this need, the executives of the company hired a prominent business and technology consulting firm to help them leapfrog the fierce competition. The table below shows a list of my interviewees. The interviewees were chosen based on their experience, project involvement and ability to respond to certain questions (i.e., in order to understand business environment characteristics and implications, one needs to be able to see the "big picture"). Each interview lasted between 30 ~ 45 minutes and was conducted over the phone.

[2] Due to the sensitive nature of data, company name, real application name and interviewee names are not disclosed.

Table 3 Securities Lending Bank Interviewees

Name	Position	Role in SLA
Graham	Senior VP, Securities Lending Operations	SLA client project lead. All use cases, business process improvements and technology implement plans need his final approval.
Karen	VP, Securities Lending Operations	SLA client functional team lead. Played the role of expert who provides feedback on business requirements and securities lending.
Maryclare	Senior Consultant	SLA consulting functional team lead. Responsible for developing all use cases and business requirements for the application with client team members.
Mike	CIO, Securities Lending Operations	SLA client technology team lead. Responsible for developing and validating IT implementation plans and object models for the application.

VI-1-1: Background

The industry: The securities lending business and the finance sector in general are known to have extremely high competitive pressure as indicated by Porter and Millar (1985). Also, the industry boasts the highest IT $ spending per employee (MomentumResearchGroup 2000). As evidenced by numerous mergers and acquisitions, the finance industry is usually associated with high speed of change (Zmud et al. 2005).

Securities Lending[3]: Knowingly or unknowingly, owners of securities frequently lend those securities to other parties who may sell them short or deliver them to another party to satisfy some other obligation. Securities may be loaned for a fixed period of time, or the loans may be open-ended. In return for lending its securities, the

[3] Available at: http://www.riskglossary.com/link/securities_lending.htm

lender receives a fee, which is quoted as basis points per annum of the original market value of loaned securities. The fee depends upon how scarce a loaned security is in the marketplace. A securities loan is typically collateralized. This reduces the lender's credit exposure to the borrower. The collateral permitted may be cash, other securities or a letter of credit. The lender retains the market risk of loaned securities. This is because the borrower is obligated to ultimately return the securities—not the original market value of the securities—to the lender. If the loaned securities pay dividends, coupons or partial redemptions during the loan, these are returned to the lending party. If cash is used as collateral, interest is credited at the repossession rate. The securities lending fee is then deducted as a "rebate" from the interest.

Many custodians run securities lending programs for their custody clients. Under such programs, the custodian earns income for the client by lending out the securities the custodian is holding for the client. The bank in this case study is a custodian that runs a highly profitable securities lending business.

The Bank: The company was founded nearly 200 years ago. Headquartered in the northeast region of the United States, the bank is a world leader in financial services with almost $9.5 trillion in assets under custody and approximately $1.5 trillion under management. The company employs more than 20,000 employees in 25 countries.

SLA: SLA is a web-based securities lending application with processing and data centralized in a metropolitan city in the northeast region. Private connections are used for high security and performance, but customers have self-service access to SLA services via the public Internet. Less critical processing capabilities located at remote sites ensure

an easy to use and easy to support work environment. High availability is engineered into the architecture for reliability and around-the-clock operation. The bank disaster recovery sites host a hot backup of data and system applications to ensure non-stop business operations.

Many new capabilities are included in SLA. Simple access to third party custody extends lendable inventory and makes the bank the securities "lender of choice". A flexible, rules-driven structure makes the bank a quick, agile player in the business with the ability to lend any security, secured by any collateral, in any marketplace in the world. Integrated accounting, including full general ledger, accounts payable, and accounts receivable, provides unprecedented control and accountability. Seamless integration into the existing legacy systems and internal information feeds establishes a modern, service-based architecture with separation of responsibilities and minimum overlap between organizations.

VI-1-2: IT Types and Business Environment Characteristics

The bank experiences numerous benefits because of SLA. First, since the application allows traders to have access to securities that were previously not accessible, the bank enjoys increased customer satisfaction and more clientele. Second, since SLA's agile features helped employees to assist traders faster and more efficiently, revenue generated per employee more than doubled. This application, therefore, was touted as a positive image-maker for the bank. According to RBV, their remarkable results were "expected" as SLA and its capabilities are quite transformative, hard-to-imitate and rare.

However, through interviews with executives involved in the initiative, I learned that the business value they captured could have been much higher if business environments had had a better fit with their "IT that transforms" application. Competitive pressures "took away some bites out of the pie" as one executive observed. Graham said:

> See, our customers, traders, have multiple securities lending accounts, one with us and the other with another custodian bank. And they compare services. Although SLA is quite remarkable and they rave about our system, the fact of the matter is that we didn't get full benefits from it, because our major competitor came up with a better system for international securities lending niche. So those comparisons, I think, would somehow spread over the overall assessment of SLA, international and domestic, though I think we have an edge on domestic transactions.

In addition, a dynamic and fast-changing business environment hindered the company from fully capturing the business value of SLA. Karen mentioned:

> One concern I have is that this industry changes so fast. Short-selling is illegal in Europe and Asia, and restrictions in the US have been increasing. In addition, frequent changes in customer demand for different types of collateral complicate our further expanding this system. Otherwise, we could be the be-all, have-all,

> providers of all securities lending. We are limiting expansion of this system, so that we would not take too much risk--putting in so much and then everything changes. It's a risk.

Graham echoed her concern: "Sometimes when things are going too fast, I think we are better off to move carefully and possibly miss out on some opportunities than venture too much and fall into a big hole, like we did with a prior bank regulation change." When probed further, he said:

> Often banks need to change things dramatically because of regulatory changes. SLA was in part initiated because of a federal regulation change with regard to securities lending. I believe if you know that things will shake up again, I'd rather change just what's required, like making a process real-time etc., than going a whole ten yards with it. I want to wait and see.

These comments reflect executive insights regarding how business environment characteristics may influence an organization's best-intentioned transformative IT efforts. If IT transformation goes too far, future market changes may require the organization that embarked on a bold journey to step back and transform yet again in a different direction, which is quite risky.

On the other hand, other business environment characteristics seem to be well aligned with the bank's IT transformative initiative. Mike responded to my question regarding IT intensity:

> Yes. This kind of system will not and cannot function without substantial IT infrastructure already in-place in the business. For example, all traders request real time securities lending, which is quite difficult if the involved stocks are international. However, with Hong Kong Exchange signing up with SLA, now it's doable for a limited number of international stocks.

Maryclare agreed:

> The finance industry has been money-spenders on IT and other supporting technologies. That's why [the consulting company] has their biggest contracts with banks and financial institutions. As you know, unless industry infrastructure is in place, this kind of system will not function, let alone reap any benefits from it.

VI-2: Pilot Cast Study 2: Northwest State Port Authority Moorage Reservation System

In the summer of 2000, a northwestern state's port authority wanted to replace its manual moorage reservation process with an automated web-based moorage reservation system (MRS). At the time, the system for processing transient moorage (i.e., boat

parking space for recreational boaters and owners) was very manual, time consuming and consisted of repetitive tasks for the marina staff. A customer would have to either call or stop by the marina during business hours to reserve a slip. This resulted in customers' having to wait in long lines especially during the peak season (e.g., July 4th) and the waits during those times would be quite significant.

The leadership at the port authority decided to pursue the option of automating this reservation process in order for the staff members to focus on more complicated and critical tasks such as customer service and port security surveillance. The effort took approximately six months and the system was tested and ready for the next peak season. The implementation's focus was on replacing the majority of the manual processes with more efficient web-based application, so use cases were used to capture existing procedures and mirror them in MRS. Customers would interact with the application in a way that was similar to the way in which they had interacted with the marina staff; therefore, process change for customers was minimal and since the procedure was fairly simple, significant business process reengineering was not warranted. For marina staff, some work was eliminated, but overall processes remained the same. As such, MRS would fall into the category of IT that automates.

The table below shows the list of my interviewees. The interviewees were chosen based on their experience, project involvement and ability to answer certain questions (i.e., in order to understand business environment characteristics and implications, one needs to be able to see the "big picture"). Each interview lasted between 30 ~ 45 minutes and was conducted over the phone.

Table 4 Moorage Reservation System Interviewees

Name	Position	Role in MRS
David	Director & Client Project Sponsor	Provided vision and thought leadership for the MRS and the role of e-government. Signed the consulting contract and approved the budget for the MRS project.
Jonerik	Customer Service Director & Client Project Lead	Managed day-to-day marina operations and provided "business user" insights to consultants.
Tony	Senior IT Architect & Consulting Team Lead	Managed day-to-day responsibilities for the MRS project. Had more than 20 years of IT consulting experience.
Monique	Consulting Principal	Owned the MRS contract (profit and loss) and was responsible for initiating and staffing the MRS project. Kept close and direct contact with the Port Authority Director to manage issues and challenges.

VI-2-1: Background

Public Sector: Partly due to the Clinger-Cohen Act of 1996, public sector agencies are gradually focusing more on the importance of sound business cases for IT investments. Recently, electronic government, or e-government for short, is getting tremendous attention. On signing the E-Government Act of 2002, the President emphasized the need for "a citizen-centered, results-oriented and market-based" e-government initiative. While a market-based approach would imply the existence of competition, most government agencies face none. In addition, although e-government spending is on the rise, e-government initiatives are still in their infancy, with only 1% of

all government interactions being conducted online (Kaylor et al. 2001). Dynamic changes are not usually associated with the government sector. Bureaucracy and resistance to change oftentimes are identified as challenges to government transformation (Gant and Gant 2001, Chircu and Lee 2003).

Port Authority and Transient Moorage Reservations: The Port Authority is divided into three operating divisions, Aviation Division, Economic Development Division, and Seaport Division, plus other departments that support the divisions and the broad mission of the Port. The business providing services at the port-owned marine terminals and an international airport received $320.9 million in 2003. The Seaport Division operates the marine terminals and related maintenance and MRS is designed to improve the moorage reservation process, which generates sizable seaport revenue. According to a Port Authority study, web-reservation usage was forecasted to exceed phone reservation by 2005. The following chart demonstrates this trend.

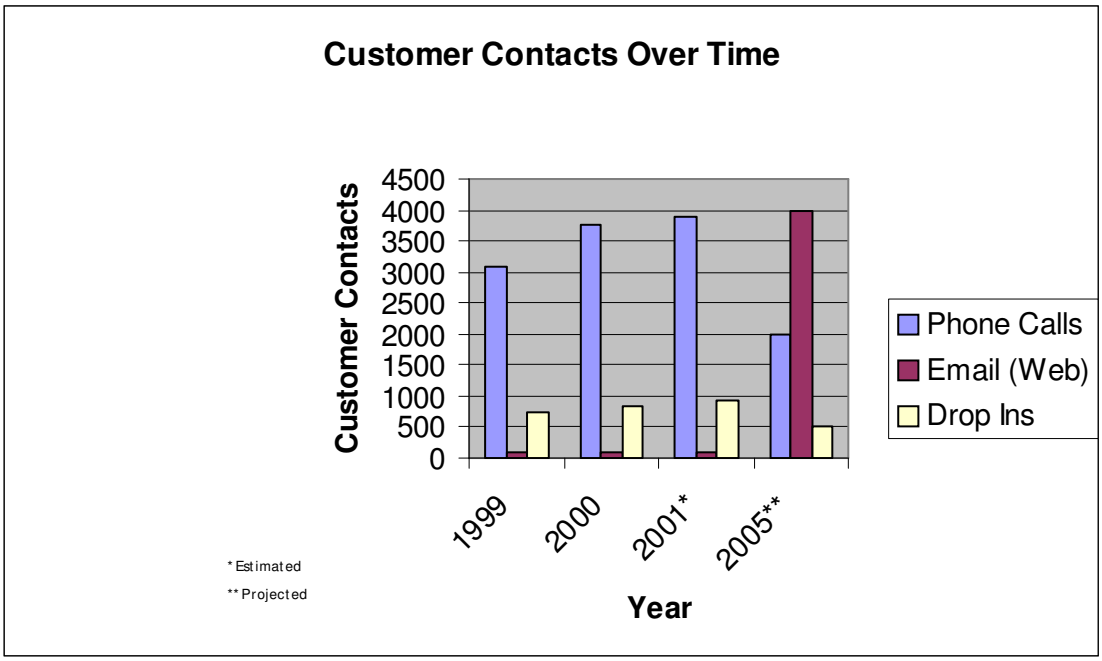


Figure 1 MRS Customer Contacts Over Time

MRS: The main purpose of the project was two-fold: 1) to design and implement a web-based transient moorage reservation system for the marina, and 2) to allow recreational boaters to make a reservation and provide online payment options for a moorage slip via the web. Prior to the project, about 80 percent of reservations were made over the phone, while the rest of them were done either in person or through e-mails (i.e., not interactive and usually taking more marina staff time than a phone conversation). Information was stored in one physical master book. Reliance on this physical master book for reservation prevented different port employees from taking reservations at the same time, and all staff members had to reference the same book for information. In addition, customers often could not get in touch with the marina, as the

phone lines were busy during the peak season. To automate this very manual process, MRS was implemented and served the following three user groups:

Table 5 MRS Purposes for Different Stakeholders

Category of User	Purpose
Individual Recreational Boaters	To reserve and pay for a moorage slip
Harbor Master	To book a moorage reservation for a customer To book a moorage reservation for Group Boaters To book a moorage reservation for Charter Vessels
Admin	To administer the application

VI-2-2: IT Types and Business Environment Characteristics

The MRS was positively received by both users and marine staff members alike. Customers were very satisfied and additional revenue was generated by capturing would-have-been-lost income due to the huge inconvenience of having to wait "in line". The results seem to present a boundary condition for RBV: unless capabilities are quite transformative, hard-to-imitate and rare, the positive impact would not be significant and sustainable. However, given environmental munificence (i.e., virtually no competition), IT that automates produced significantly positive results in accordance with IT coalignment theory.

Through interviews with executives involved in the efforts, I learned that the business value they captured could have been lost had there been intense competition. Jonerik notes:

> It's hard to see hidden demand. What I mean is that many people would have used the marina if service had been more customer-friendly, but they didn't because of huge inconvenience. The comments such as 'it was such a pain to wait in line or on hold for a long time; so we didn't even bother' were common. Lucky for us, because if there were competitors out there, this hidden demand would have gone to them. We try to instill more business-mind and customer-friendliness into our culture.

In addition, David comments:

> It seems our MRS investment paid off—every dollar we spent. We are exercising fiduciary stewardship, although I'm not sure whether or not we would see this kind of return with fierce competition. Probably not.

Their comments seem to indicate that their MRS investment (i.e., IT that automates) generated abnormal returns largely due to the lack of competition. In other words, fierce competition would have prevented the government organization from capturing the full business value of its IT investments, since IT payoff would have been dissipated among competitors.

However, the Port Authority might have missed out on opportunities that could have fundamentally changed and optimized their business processes and culture in the organization, without assuming the risk that is associated with the majority of

transformative efforts. The opportunities are born out of environmental munificence or low environmental dynamism and disruption. David notes:

> Marina operations have stayed pretty much the same from the 1970s. So in a way, we had a fixed target and could have scored a bulls-eye. We didn't, because of budget issues. In an operations research perspective, we aimed for partial optimization rather than going for ultimate optimization.

Monique echoed David's comments:

> In the field of IT, there is a common adage: 'If you automate inefficient processes, they will become more inefficient.' Old marina business processes were designed at the time there were virtually no PCs and IT. So probably some of the procedures were unnecessary in today's web environment. However, instead of transforming the whole business processes—reservation, accounting, and marketing—the port authority took a piecemeal approach and simply automated their manual processes. In my mind, opportunities are lost.

To sum up, low environmental dynamism afforded the Port Authority an opportunity to transform the whole organization, possibly by using IT that transforms, without assuming much change or disruption risk. However, the organization settled for

IT that automates (vs. IT that transforms) and captured "partial optimum" business value rather than "ultimate optimum" IT payoff.

At the same time, low IT intensity might have prevented the Port Authority from dreaming big and leaping far. Tony notes:

> There was talk about integrating the whole marine process, using MRS as a centerpiece. It never materialized. For example, to integrate accounting and marketing, we would have to do some legacy systems re-alignment and the task seemed too complicated and too risky.

He also added:

> [Our consulting company] can do legacy systems stuff, but maybe the Port Authority was correct in recognizing that integrating the whole legacy systems would incur huge costs with moderate return… at least at this time.

His comment underscores that IT that transforms and associated benefits will not happen unless the proper supporting IT infrastructure is in place. Jonerik agreed:

> I guess MRS could have been used to capture more customer information and do better marketing. But we were not quite ready. I think other investments have to be made first.

Customers still have to call in for refunds or to resolve problems due to the aforementioned integration issues. To sum up, IT that transforms will not happen (let alone generating any benefits) unless the right level of IT intensity exists to support transformative efforts. The following table summarizes the findings of the two pilot case studies.

Table 6 Pilot Case Study Summaries

Case	IT Capabili.	Comp. Pressure	IT Intensity	Environ. Dynamism	Performance Implications
1. NE Bank SLA	IT that transforms	High	High	High	Although the bank experiences numerous benefits (e.g., increase in clientele, $ per employee doubled), the business value they captured could have been much higher if the business environment characteristics provided a better fit with their "IT that transforms" application. High competitive pressure seems to "take away some bites out of the pie" in general. Rapid change seems to keep the company from fully absorbing the business value of SLA, while high IT intensity enables "IT that transforms" functions.
2. NW Port Authori	IT that automates	Low	Low	Low	Due to virtually no competition, the Port Authority was able to

Case	IT Capabili.	Comp. Pressure	IT Intensity	Environ. Dynamism	Performance Implications
ty MRS					reap sizable business value out of IT that automates; fierce competition would have made that value dissipate. Also, low environmental dynamism gave the organization an opportunity to reap significant business value without assuming much change risk; however, the Port Authority settled for "partial optimum" with MRS rather than going for "ultimate optimum" with IT that transforms. Further, low IT intensity level prevented the Port Authority from dreaming big and leaping far. Partly due to legacy systems integration issues, IT that transforms did not materialize and IT that automates generated moderate returns.

VII. Research Model and Hypotheses Development

As mentioned previously, IT capabilities will be characterized as IT that automates, IT that informates and IT that transforms. According to Zuboff (1988), automate and informate are the dual natures of IT, while transform is more focused on fundamentally redefining business and industry processes and relationships using IT capabilities. Therefore, I expect the first two intended capabilities to behave in a similar way in relation to business value or IT payoff, while the third type, transform, would have a different relationship with the dependent variable. Since IT that transforms requires more path-dependent, rare and hard-to-imitate resources, the IT capability would generate abnormal returns, *ceteris paribus*, according to RBV. Also, I argue that the capabilities-performance linkage will be moderated, at times significantly, by the aforementioned business environment characteristics. This phenomenon is in accordance with IT coalignment theory because the theory emphasizes the fit between a certain type of IT investment and business environment. Although IT that transforms usually demonstrates abnormal returns (vs. IT that automates/informates), the capability may not be best aligned with a highly dynamic business environment. In the following paragraphs, I elaborate on these hypotheses.

First, in a highly competitive environment, business value gained out of IT investments would quickly be dissipated (Kaufman et al. 2000), and only capabilities with rare, hard-to-imitate and path dependent resources will generate sustainable and abnormal returns (Ray et al. 2005). Examples of this value dissipation can be found in the banking industry where the ATMs advantages were short-lived due to intense

competition and did not give abnormal returns to adopting organizations (Kaufman et al. 2000). One manager noted during an interview that his organization's investment in IT that automates produced sizable returns partly because of lack of competition, and added "because if there were competitors out there, this hidden demand [unmet needs of customers] would have gone to them." In other words, IT capabilities that are not valuable, rare and hard-to-imitate (as outlined in RBV) will not generate abnormal returns in a highly competitive environment; it may produce moderate returns in a monopolistic, munificent or less than competitive environment as indicated in one of my pilot case studies. Therefore, IT that transforms, which is usually associated with hard-to-imitate, rare and path-dependent capabilities, would produce significantly higher IT payoff than IT that automates or IT that informates (which competitors can quickly imitate) would when competitive pressure is high.

More formally stated:

H1: High competitive pressure positively moderates the linkage between IT capability and firm performance.

Second, in a highly dynamic environment, IT that transforms, which capitalizes on the certain types of rare, hard-to-imitate, and path-dependent resources, may not produce higher than average returns, at least not for a sustained time period, since what constitutes valuable resources may change before the transformative application accumulates sizable IT payoff. For example, during the internet boom of the 1990s, two dramatically different online reservation systems emerged: Priceline.com and Orbitz.com. Priceline.com promoted its patented business model with the motto of

"Name Your Own Price", while Orbitz.com focused on more efficient ways to search, find and book air travel reservations. Their business models and IT capabilities were significantly different. Priceline.com lets customers bid on fare prices through the web and when their bidding prices match or exceed a seller's asking price, fare tickets are sold at a heavily discounted price. Customers could not indicate their preferences when purchasing through Priceline.com, since the focus was on finding the cheapest possible price. Orbitz.com, in comparison, listed fares according to customer preferences (i.e., by the maximum number of connections, by price, by airlines). As such, Priceline.com employed IT that transforms as its IT applications fundamentally shifted business processes and altered the rules, while Orbitz.com basically mirrored a telephone fare reservation process minus booking agents, thereby utilizing IT that automates and IT that informates. Priceline.com was wildly successful in the beginning, while Orbitz.com struggled to gain momentum. Then business environments quickly changed: 9/11 happened, and "left-over" air tickets were no longer available. As Priceline.com's transformative IT applications relied on the continuous and undisruptive supply of "unused" air fares, with this sudden change in business environments the company suffered and eventually filed for bankruptcy. In other words, the disruption placed too much risk and burden on their IT that transforms, because after an abrupt change, the IT application was no longer aligned with post-change valuable resources (i.e., air tickets) and business environments. Metaphorically, Priceline.com's IT that transforms was an "overshoot." In contrast, Orbitz.com which focused on improving reservation efficiency rather than changing the whole business process, ultimately won the race, since the post-

change valuable resources (i.e., valuable air tickets and frequent travelers with preferences) were better aligned with their IT that automates/informates system. Porter (1985) notes also that in a fast-changing industry, successful firms tend to make investments out of strategic necessity (i.e., efficiency improvement) than for strategic advantage (i.e., focusing on effectiveness and fundamentally changing business processes). Accordingly, in a dynamic environment, IT that automates or IT that informates may produce higher than average returns than IT that transforms, since IT that transforms usually takes much longer to implement, involves significant changes, incurs the risk of a changed environment before the transformative application is able to reap significant business benefits, and is even presently misaligned with abruptly changed business environments. In other words, using a baseball metaphor, continuously hitting singles with small and efficient swings would be more desirable than hitting homeruns once in a blue moon, if a game environment is about to change or one is uncertain when the game will end. The opposite may be true if the game environment is stable.

According to IT coalignment theory, IT strategic moves should be aligned with business environments. Therefore, IT that transforms that is installed and about to take advantage of capabilities with rare, hard-to-imitate and path dependent resources may not realize its full business value because the definition of valuable resources often changes in a dynamic environment. During an interview, one executive mentioned the risks that IT that transforms has to assume and that may outweigh potential benefits: "We are limiting expansion of this system [to make it into IT that transforms], so that we would not take too much risk--putting in so much and then everything changes. It's a risk." By

the same token, IT that transforms may produce significantly higher IT payoff than IT that automates or IT that informates when environmental dynamism is low. One manager noted during a pilot case study interview, "[Our] operations have stayed pretty much the same from the 1970s. So in a way, we had a fixed target and could have scored a bulls-eye [with IT that transforms]." His comment highlights that in a stable environment a company can score big with a transformative IT application without assuming the risk that is often associated with the majority of transformation efforts, thereby reaping abnormal returns over IT that automates or IT that informates.

More formally stated:

H2: High environmental dynamism negatively moderates the linkage between IT capability and firm performance.

Third, IT intensity, which is defined as the average digitization level in a given business environment (e.g., total business processes transacted online), has been shown to be a positive complimentary factor to many e-business endeavors (Barua et al. 2004). Many interviewees during my pilot case studies agreed that without proper IT infrastructure and the right level of IT intensity in business environments, IT that transforms would not happen, let alone reap any business value benefits. This is especially true because by definition IT that transforms "fundamentally changes business processes and relationships", and in order to achieve holistic business process changes effectively, an adopting organization needs the cooperation of its partners, in terms of the digitization level, to support the transformative application. In other words, IT that transforms would not be able to accomplish its "mission" unless IT intensity is high

enough to support its mandates. Accordingly, IT that transforms most likely will produce significant business value when IT intensity is high (i.e., supporting infrastructure is in place). To say it another way, if IT intensity is low, then IT that transforms applications may not reach their full potential and may not generate abnormal IT payoff. This observation is in accordance with the IT coalignment theory, where it is predicted that IT that transforms may need to be aligned with a high IT intensity business environment to be successful. Since IT that transforms usually requires more effort and resources to implement, the return will not justify the cost if the application is developed or implemented in an environment characterized as a low IT intensity environment. Therefore, in a low IT intensity environment, if one focuses on "bang for the buck", then IT that automates or IT that informates may produce higher returns given the same size of investments and the level of effort.

More formally stated:

H3: High IT intensity positively moderates the linkage between IT capability and firm performance.

The following table summarizes hypotheses and presents their supporting rationale and references.

Table 7 Hypotheses Summary and Rationale

Hypotheses	Supporting rationale for the relationship	Relevant References
H1: High competitive pressure positively moderates the linkage between IT capability and firm performance.	IT capabilities that are not valuable, rare and hard-to-imitate (as outlined in RBV) will not generate abnormal returns in a highly competitive environment; they may produce moderate returns in a monopolistic, munificent or less then competitive environment as indicated in one of my pilot case studies. Therefore, IT that transforms, which is usually associated with hard-to-imitate, rare and path-dependent capabilities, would produce significantly higher IT payoff than IT that automates or IT that informates (which competitors can quickly imitate) would when competitive pressure is high.	(Kaufman et al. 2000) (Ray et al. 2005)
H2: When environmental dynamism is high, IT that automates or IT that informates displays more positive correlation to firm performance than IT that transforms does and vice versa.	In a dynamic environment, IT that automates or IT that informates (while usually focuses on small improvements at a time vs. IT that transforms) may produce higher than average returns than IT that transforms would, since IT that transforms usually takes much longer to implement and involves significant changes in organizations. Things can change too quickly before the transformative application is able to reap significant business benefits. The reverse can hold true for IT that transforms when environmental dynamism is low.	(Porter 1985)
H3: When IT intensity is high, IT that transforms displays more positive correlation to firm performance than IT that automates or IT that informates does and vice versa.	Since IT that transforms usually requires more effort and resources to implement, the return will not justify the cost if the application is aligned with a low IT intensity environment. Therefore, in a low IT intensity environment, if one focuses on "bang for the buck," IT that automates or IT that informates may produce higher returns given the same size of investments and the level of effort. Vice versa can hold true for IT that transforms when IT intensity is high.	(Barua et al. 2004)

The following two figures present my research model at the conceptual level and at the construct level.

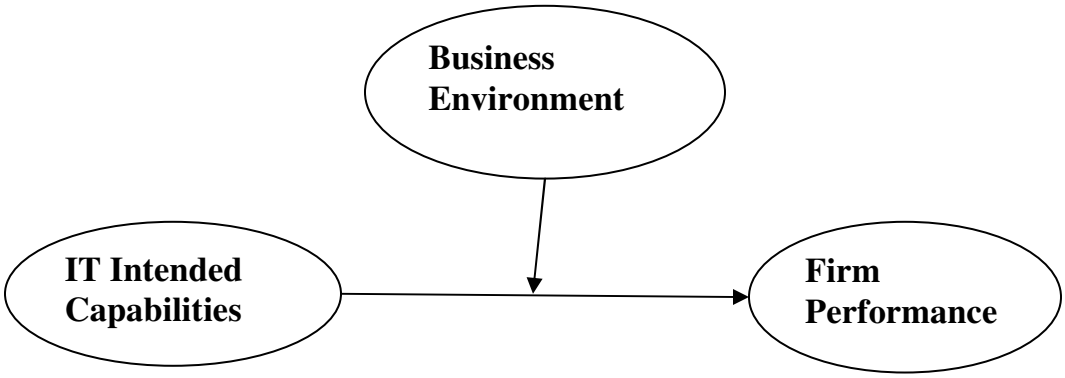


Figure 2 Conceptual Research Model

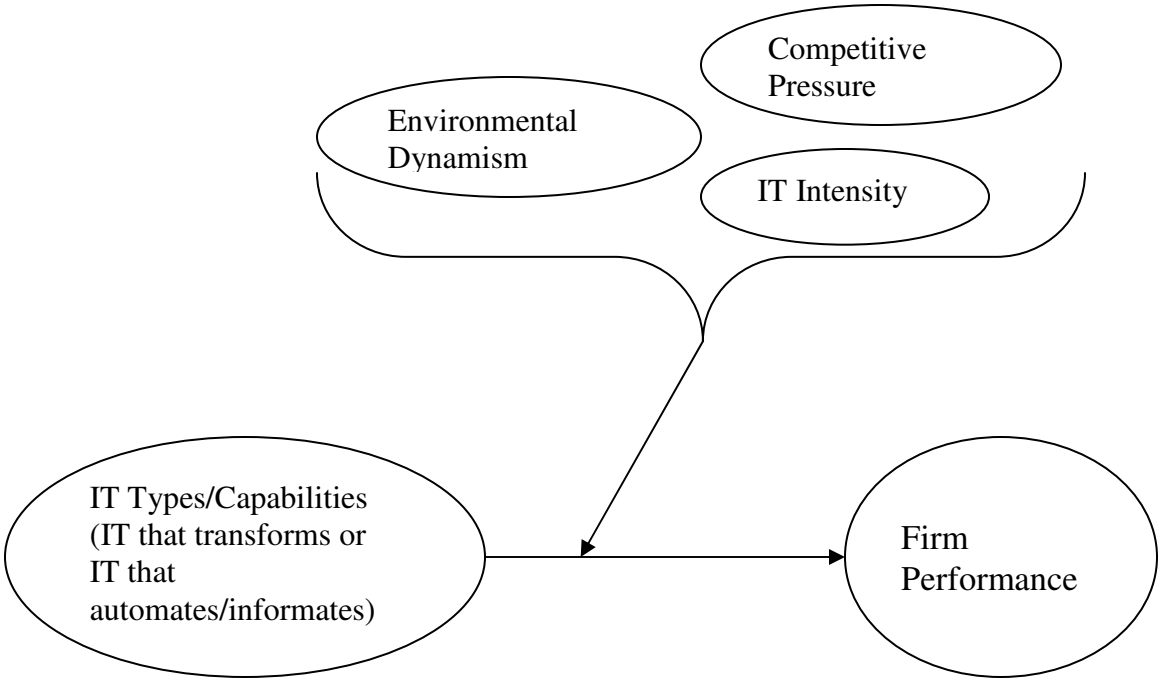


Figure 3 Constructs-Level Research Model

VIII. Research Method

This research involves firm-level analyses and employs firm IT investment announcement data and industry archival data to investigate how different IT capabilities generate business value under various business environments. As outlined previously, business value is defined rather broadly including market-related measures or financial performance.

VIII-1. Operationalization of the Variables

Operationalization of the variables is achieved in two ways: 1) as much as possible, previously used measures are used, as long as they satisfy acceptable measurement quality and validity tests, and 2) for those variables that are unique to this study, I develop new operational measures and confirm their content validity through interviews and discussions with business and academic experts in the field.

IT that automates, IT that informates, and IT that transforms: This categorical variable pertains to IT capabilities with regard to an organization's business processes and strategic goals. While automate and informate are the dual nature of IT that distinguishes IT from industrial age machines, transform goes a step further to utilize IT to fundamentally redefine business processes and industry relationships (Dehning et al. 2003). As such, major business process improvement/reengineering efforts should accompany IT that transforms. By asking managers how much business process changes (i.e., more than 70 percent etc.) are planned along with a given IT implementation, we can separate IT that transforms from the other two. A more detailed coding scheme is presented in Appendix B, taken almost verbatim from Dehning et al. (2003).

Competitive Pressure: This variable is defined as the degree of pressure that the company feels from competitors within the industry. Some survey items exist (e.g., Tan and Litschert (1994)); however, the variable will be measured using Herfindahl-Hirshmann Index (HHI) for preliminary analyses and concentration ratios (C4) for multivariate analysis. HHI and C4 are obtained from an archival source.

Environmental dynamism: This variable is defined as the degree and instability of change in the firm's environment (Li and Ye 1999). Using archival data such as COMPUSTAT, it is measured as the standardized variation in industry-level sales revenue over the last five years (Li and Ye 1999).

IT intensity: This variable is defined as the average digitization level in a given institutional environment (i.e., total business processes transacted online). This can be measured as industry average spending per employee or IT investment as a percentage of revenue or expense. In this study, data taken from a study at MIT[4] is used to assign IT expenditure as a percentage of the total cost per different SIC industry groups.

Firm performance: In this study, cumulative abnormal returns (CAR) is employed to isolate the impact of a specific IT implementation initiation or announcement from a company's other strategic moves. CAR measures stock price reactions above and beyond the average returns of all publicly traded firms in the market. The event study methodology focuses on a short time window surrounding the IT announcement or initiation date to eliminate all other confounding factors such as M&A, bankruptcy or other announcements.

[4] Prof. Peter Weill, CISR at MIT Sloan, provided me with the data.

Table 8 defines and summarizes previously described constructs and variables in this study.

Table 8 Constructs and Variables Definitions

Concept	Constructs	Operational Examples	Reference Examples
IT Capability: Pertains to a company's or functional unit's primary goal of IT investment in terms of different IT capabilities.	IT that Automates: This focuses on replacing human labor by automating business processes. Virtually no IT-driven transformation efforts. IT that Informates: This focuses on providing new data/information to empower management, employees, or customers. An intermediate level of IT-driven transformation efforts. IT that transforms: This focuses on fundamentally altering traditional ways of doing business by redefining business capabilities and/or internal or external business processes and relationships. Can include strategic acquisition to acquire new capabilities or to enter a new marketplace.	Automate (coded 0) -Replace human labor by automating business processes? -Virtually no IT-driven transformation efforts? Informate (coded 0) -Provide new data/information to empower management, employees, or customers? -An intermediate level of IT-driven transformation efforts? Transform (coded 1) -Fundamentally alter traditional ways of doing business by redefining business capabilities and/or (internal or external) business processes and relationships? -Strategic acquisition to acquire new capabilities	• (Dehning et al. 2003) • (Zuboff 1988)

Concept	Constructs	Operational Examples	Reference Examples
		or to enter a new marketplace? -Use of IT to dramatically change how tasks are carried out? -Is the move recognized as being important in enabling firm to operate in different markets, serve different customers?	
Business Environment Characteristics: Pertains to external institutional factors under which companies or functional units operate.	Competitive Pressure: the degree of pressure that the company feels from competitors within the industry. Environmental Dynamism: the degree and instability of change in the firm's environment. IT Intensity: the average digitization level in a given institutional environment (i.e., total business processes transacted online)	• Competitive pressure: HHI, C4 • Environmental dynamism: standard variance of industry total revenues over the past decade • IT intensity: IT spending as a percentage of total expenditure	• (de Figueiredo and Kyle 2006; Tan and Litschert 1994) • (de Figueiredo and Kyle 2006) • (Barua et al. 2004)

Concept	Constructs	Operational Examples	Reference Examples
Performance: Pertains to an organization's financial performance.	Firm performance:	CAR	(Zmud et al. 2005) (Dehning et al. 2003)

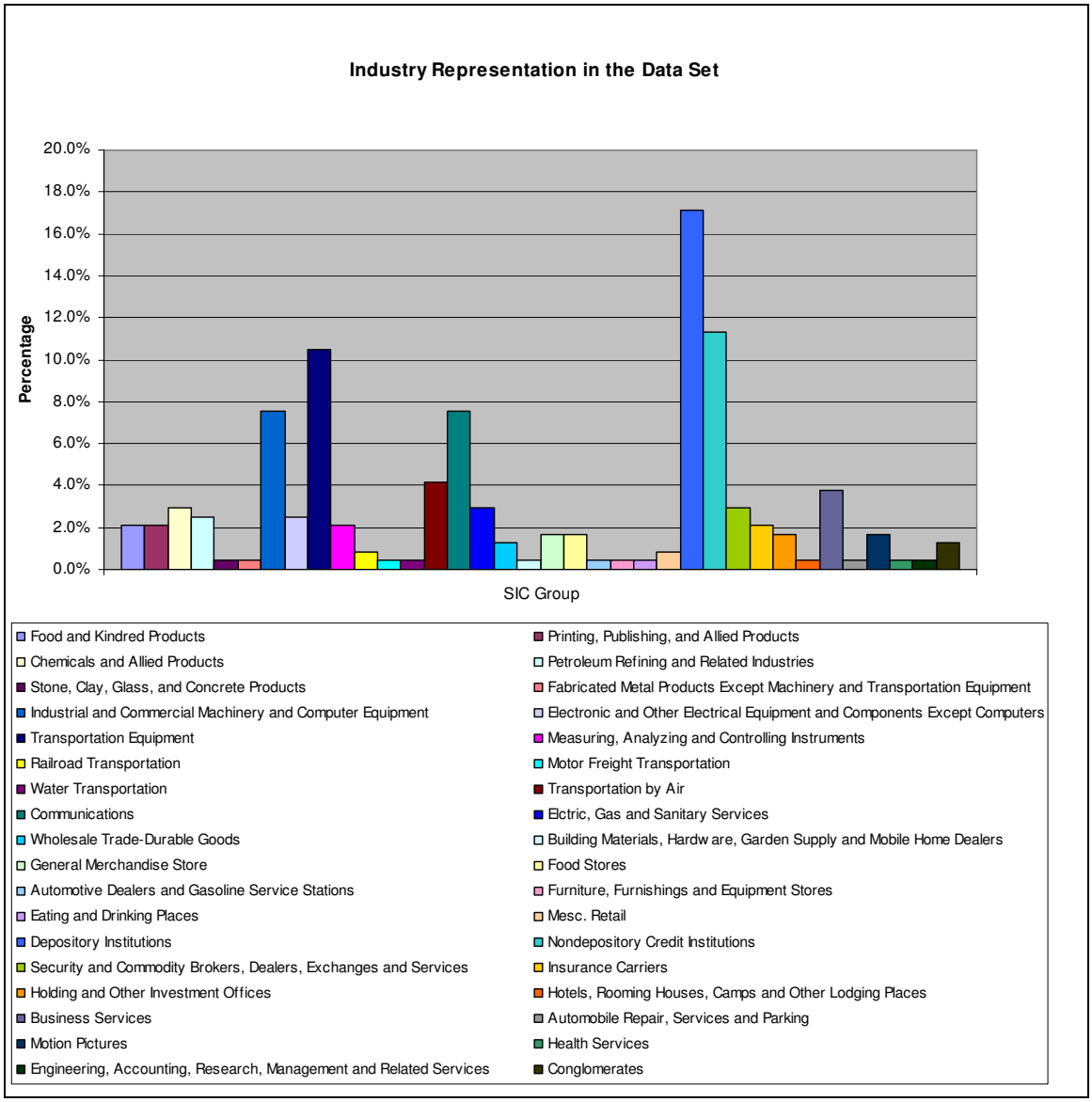
IX. Analyses and Discussion

IX-1. Data Set

The firms and IT capabilities data set was obtained from the second author of Dehning et al. (2003). The original data set contained 353 distinct data records that include company names, codes that indicate IT capabilities such as IT that automates, informates or transforms and dates of IT announcements. The data spans 15 years from 1981 to 1996. Among the 353 data records, some companies merged almost immediately after starting on specific IT implementations, were bought out by a competitor or went bankrupt. These companies were not included for my analyses because mergers and acquisitions usually have far reaching financial consequences for organizational performance, and any IT capabilities impact would be almost impossible to sort out and specify. Others were excluded because they were private companies without public financial information. After exclusions for the aforementioned reasons, 139 useful data points were retained.

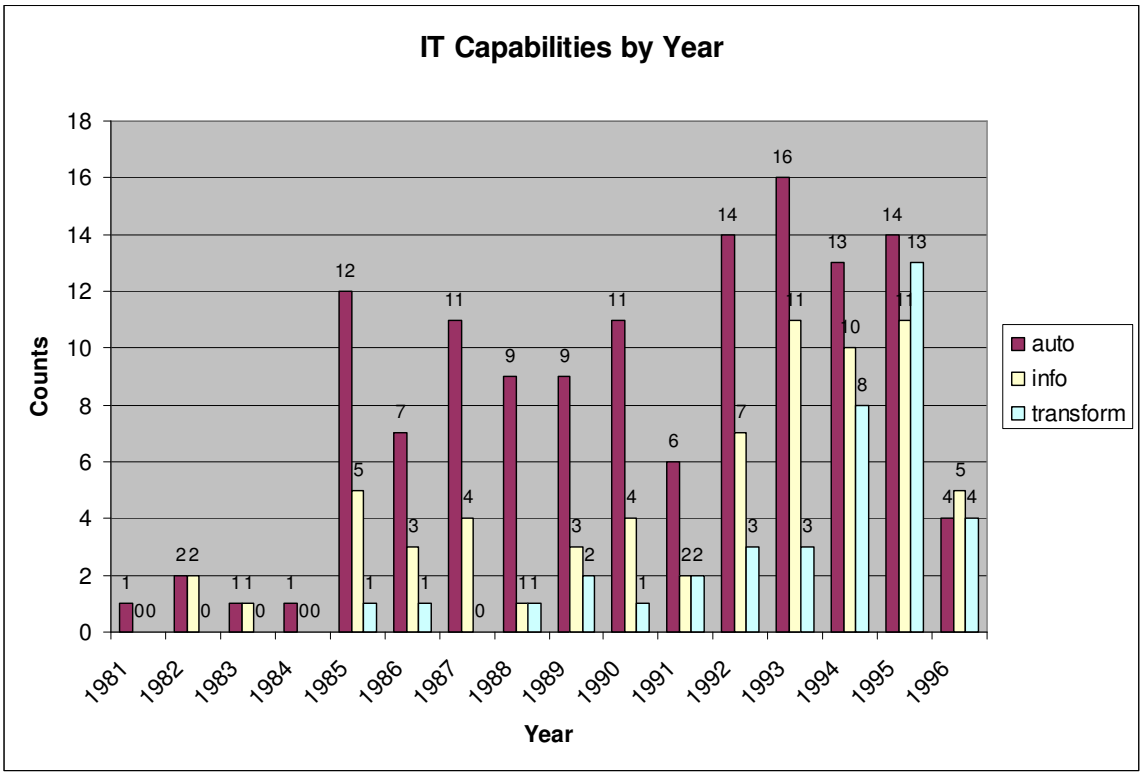
To logically group companies according to their business environments, I manually associated the Industry Classification Code (a.k.a. DNUM in COMPUSTAT) to each "usable" company in the data set. The Industry Classification Code is based on a four-digit SIC (Standard Industrial Classification) code that identifies a company's primary operation. SPC (Statistical Process Control) assigns these codes by analyzing the sales breakdown from a company's 10K and annual report. Therefore, even if a company operates in multiple industries, the company's main line of business in terms of sales and

revenue will be used to identify its industry code. For example, GM is assigned 3711 (Motor Vehicles and Passenger Car Bodies) and Ford Motors is also assigned 3711, which indicates they are in direct competition against one another, although they both operate in other industries. The codes are based on the U.S. SIC (Standard Industrial Classification), which is the predecessor to the NAICS (North American Industry Classification System). Since NAICS was adopted in the late 1990s, SIC was more appropriate to use for my data in the given time period, 1981-1996. The codes in the data set range from 2000 to 9997, covering almost the entire spectrum of the SIC code range. After entering all codes manually to individual data points, I grouped them according to the higher order families. For example, while 2731 covers Books: Publishing or Publishing & Printing, and 2721 refers to Periodicals: Publishing or Publishing & Printing, both groups would be categorized under the higher order family, 2700 Printing, Publishing and Allied Industries. Overall, there were 36 2-digit industry groups ranging from Food and Kindred Products to General Merchandise Store to Health Services. The largest membership in the dataset consists of Depository Institutions (17.2%), followed by Non-depository Credit Institutions (11.3%), Transportation Equipment (10.5%), Communications (7.5%), and Industrial and Commercial Machinery and Computer Equipment (7.5%). The following graph portrays how different industry groups are represented within the data set.



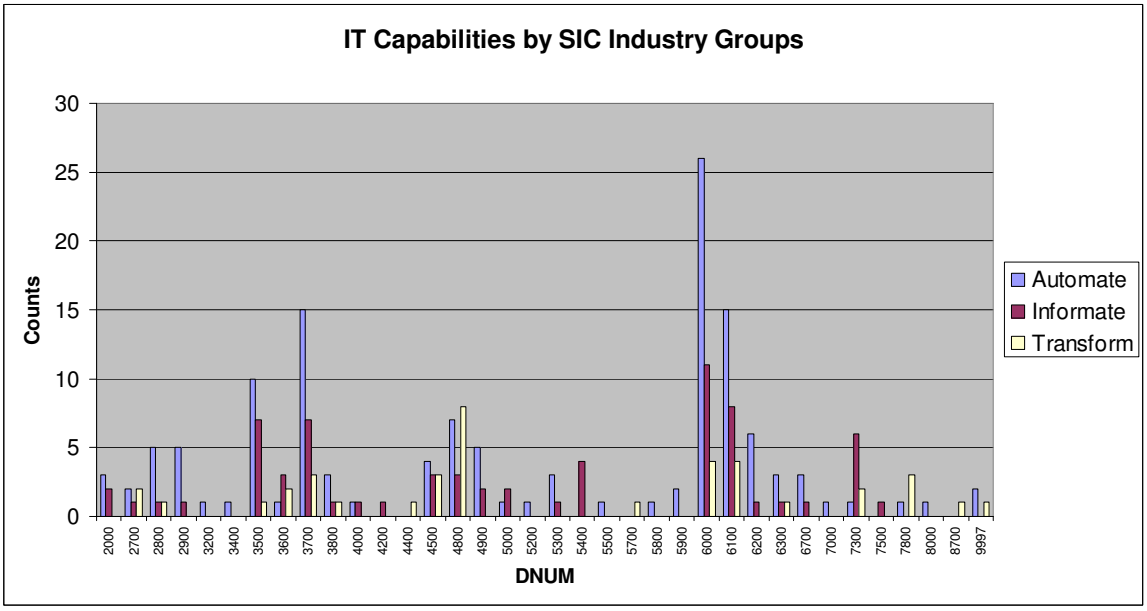
Different types of IT capabilities were announced at these firms throughout the period of 1981~1996. The majority of IT capabilities implemented were IT that

automates (55%) followed by IT that informates (29%) and IT that transforms (16%). The following graph depicts IT capabilities implemented by each year.



In addition, different SIC groups seem to adopt different IT capabilities. The majority of industry groups seem to implement more IT that automates or IT that informates than do IT that transforms. For example, in the Depository Institutions (DNUM=6000) group, commercial banks implemented 26 IT that automates and 11 IT that informates applications in comparison to just 4 IT that transforms systems. While the data set is not comprehensive enough to draw a complete assessment, some industry groups did invest more often in IT that transforms capabilities than they did in either IT

that automates or IT that informates technologies. Communications (DNUM=4800) is such an example. Possibly due to the group's extensive innovations during the given time period, companies in the group invested more in IT that transforms (8 times) versus IT that informates (3 times) or IT that automates (7 times). The following graph depicts a pattern in IT capabilities implementation among different SIC groups.



DNUM	Groups
2000	Food and Kindred Products
2700	Printing, Publishing, and Allied Products
2800	Chemicals and Allied Products
2900	Petroleum Refining and Related Industries
3200	Stone, Clay, Glass, and Concrete Products
3400	Fabricated Metal Products Except Machinery and Transportation Equipment
3500	Industrial and Commercial Machinery and Computer Equipment
3600	Electronic and Other Electrical Equipment and Components Except Computers
3700	Transportation Equipment
3800	Measuring, Analyzing and Controlling Instruments
4000	Railroad Transportation
4200	Motor Freight Transportation
4400	Water Transportation
4500	Transportation by Air

4800	Communications
4900	Electric, Gas and Sanitary Services
5000	Wholesale Trade-Durable Goods
5200	Building Materials, Hardware, Garden Supply and Mobile Home Dealers
5300	General Merchandise Store
5400	Food Stores
5500	Automotive Dealers and Gasoline Service Stations
5700	Furniture, Furnishings and Equipment Stores
5800	Eating and Drinking Places
5900	Misc. Retail
6000	Depository Institutions
6100	Nondepository Credit Institutions
6200	Security and Commodity Brokers, Dealers, Exchanges and Services
6300	Insurance Carriers
6700	Holding and Other Investment Offices
7000	Hotels, Rooming Houses, Camps and Other Lodging Places
7300	Business Services
7500	Automobile Repair, Services and Parking
7800	Motion Pictures
8000	Health Services
8700	Engineering, Accounting, Research, Management and Related Services
9997	Conglomerates

IX-2. Statistical Analyses

To support my research model, I use univariate and multivariate regression analyses where the dependent variable (i.e., CAR) is regressed on IT capabilities along with interacting business environment variables.

IX-2.1 Preliminary Regression

To assess general viability of my hypotheses, the dependent variable is first regressed on IT capabilities without control variables. The purpose of the preliminary analyses is two-fold: 1) without strong support in a simple regression, going forward with additional analyses and control variables would be futile. In other words, the

preliminary regression is conducted to assess the general viability of further analyses, and 2) RBV has been supported in different IT capability studies (e.g., Ray et al. 2005) and I want to verify if RBV generally holds in my research model as well.

For these analyses, I adopt the CAR data from Dehning et al. (2003). In their study, CAR (cumulative abnormal returns) is used to demonstrate the immediate impact of IT strategic signaling in order to filter out any subsequent projects or business/technology initiatives that might confound relevant correlation effects. I measure, more specifically, CAR for each type of IT capability around the date of the IT implementation announcement (day -1, 0, +1), following from Dehning et al. (2003). The following table presents descriptive statistics of these measures.

Table 9: Preliminary Analysis: CAR for Different IT Capabilities

CAR (%)	Automate	Informate	Transform
Average	0.183%	0.072%	**1.478%**
Max	6.252%	11.859%	25.335%
Min	6.230%	15.330%	6.572%
Std. Deviation	2.458%	3.325%	4.960%

Note that average CAR (%) for IT that transforms is significantly higher than those of IT that automates or IT that informates (1.478% vs. 0.183% and 0.072%). As CAR is a forward-looking measure, the market reacted to the announcement or initiation of different IT capabilities implementation differently: analysts perceive IT that automates and IT that informates capabilities as the ones that most likely will not produce

net benefits against implementation and managerial costs. According to RBV, the reason for these low CAR figures is clear: since only resources or capabilities that are hard to imitate, rare and path-dependent would give adopting firms sustainable advantages, those IT capabilities that do not have those RBV characteristics would not yield abnormal returns and would most likely be competed away. In other words, while everything else remains constant (i.e., ceteris paribus), the aforementioned capabilities will likely contribute to creating consumer surplus without giving noticeable benefits to adopting companies. On the other hand, since IT that transforms capabilities are perceived as path-dependent and hard-to-imitate, the market favorably reacts to such project initiation or announcements.

Next, the dependent variable, CAR, is regressed on independent variable--different IT capabilities (i.e., IT that automates, IT that informates and IT that transforms). As mentioned before, from the original data set from Dehning et al. (2003), I excluded companies that shortly acquired other firms, were merged with others , were bought out or went bankrupt within the next 2 years, since these business events (or rumors thereof) can significantly alter a prospective organization's CAR. For example, in a popular investment column, *Inside Wall Street,* Gene Marcial predicted that Gillette, a household name for oral-care and male-grooming products, would be a take-over target in 2002. When Procter & Gamble officially announced the acquisition of their once-rival Gillette in late 2004, Gillette's share had gone up almost 20%. The following table displays the results of this preliminary univariate regression:

Table 10 Results of DV-IV Preliminary Regression Analysis

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.358392407
R Square	0.128445118
Adjusted R Square	0.122083403
Standard Error	0.008054585
Observations	139

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	0.001309875	0.001309875	20.1903305	0.00001
Residual	137	0.008888058	6.48763E-05		
Total	138	0.010197933			

	Coefficients	*Standard Error*	*t Stat*	*P-value*
Intercept	0.000957474	0.001577349	0.607014388	0.54485
X Variable 1	0.004188567	0.000932167	4.493365164	0.00001

Note that the coefficient (r=0.0042) is positive and significant at p<.001, which seems to indicate that there is a strong positive correlation between IT capabilities and CAR. In other words, the more path-dependent and hard-to-imitate IT capabilities are (i.e., IT that transforms), the more positive CAR will be. The preliminary finding is consistent with RBV as mentioned earlier. Although R-square and Adjusted R-square are fairly low (R^2 = 0.128; Adjusted R^2= 0.122), indicating a less than perfect model fit, this is expected possibly due to the fact that the independent variable is coded (i.e., dummy variable) and the number scales show a large discrepancy (i.e., environmental dynamism varies from 183 to 77899 whereas CAR goes from -0.0533810 to 0.0683340). However, these values seem to be acceptable as indicated in Tanriverdi and Uysal (2006).

IX-2.2 Preliminary Univariate Analysis and Testing of the Hypotheses

Treating business environmental characteristics as moderating factors in the linkage between IT capabilities and firm performance, I tested my hypotheses using regression techniques. The testing of hypotheses consists of two parts: 1) measuring business environments characteristics—competitive pressure, environmental dynamism and IT intensity—using archival data for each included groups/SIC codes, and 2) running separate multivariate regression analyses with the dependent variable (i.e., CAR), the independent variable (i.e., IT intended capabilities), and the interaction variable (i.e., IT intended capabilities times each of the business environmental variables). This univariate phase is a preliminary analysis.

IX-2.2.1 Hypothesis 1: Competitive Pressure Effect

I obtain my competitive pressure measure from the 1997 U.S. Economic Census. An advantage of using the census data is that the numbers are constructed using sales data for both public and private firms. These numbers should more accurately reflect industry competitiveness than would ratios constructed with data from only the COMPUSTAT database, which is comprised almost entirely of publicly-traded firms. More specifically, I employed Herfindahl-Hirschman Index (HHI) to measure competitive pressure per different SIC groups. HHI is a commonly accepted measure of market concentration and competitiveness. It is calculated by squaring the market share of each firm competing in a market, and then summing the resulting numbers. Theoretically, the HHI number can range from close to zero to 10,000. The U.S. Department of Justice considers a market with a result of less than 1,000 to be a

competitive marketplace; a result of 1,000-1,800 to be a moderately concentrated marketplace; and a result of 1,800 or greater to be a highly concentrated marketplace. So the lower the HHI is, the more competitive pressure prospective companies would face. As a general rule, mergers that increase the HHI by more than 100 points in concentrated markets raise antitrust concerns.

I choose HHI over concentration ratios (e.g., C4) because the index conveys more information. For example, C4 does not change value if the largest firm gains 10 percent share at the expense of the second largest firm, while HHI does increase under such circumstances. The census data indicates that some industries are more competitive than others. For example, the members of the Newspapers: Publishing or Publishing and Printing group (SIC 2711) have to compete in a highly competitive environment (HHI=241), while the competitive pressure for the Calculating and Accounting Machines, Except Electronic Computers (SIC 3578) group is moderate (HHI=1260).

To be statistically representative, I did not include data 1) when only one company represented a type of IT intended capabilities in a four-digit SIC group and 2) when companies were either merged or bought out immediately after IT implementation initiation or announcement. Since my hypotheses draw comparisons between IT that automates/informates and IT that transforms, capabilities were coded as 1s and 2s for the regression analyses. The following tables present ANOVA and parameter estimates. All statistical analyses were conducted using SAS 8e.

Table 11 Preliminary ANOVA: Competitive Pressure

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.00410	0.00205	2.56	0.0875
Error	51	0.04094	0.00080271		
Corrected Total	53	0.04504			

Root MSE	0.02833	R-Square	0.0911
Dependent Mean	-0.00376	Adj R-Sq	0.0755
Coeff Var	-753.63465		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	-0.02267	0.01392	-1.63	0.1095
firmcode	firmcode	1	0.02527	0.01347	1.88	0.0664
codexpres	codexpres	1	-0.00000648	0.00000315	-2.06	0.0448

As expected, the interaction term has a negative coefficient (r = -0.00000648) since HHI is an "inverse" measure (i.e., the lower HHI, the more competitive the business environment is), while the IT that transforms capability in general is positively correlated to firm performance (r = 0.02527). This indicates that the interaction term, codexpres, negatively moderates the linkage between firm performance and IT intended capabilities. In other words, in a highly competitive environment (i.e., HHI is low), IT that transforms is shown to be more positively correlated to firm performance at $p<0.05$ than IT that automates/informates. While the model fit is not ideal (R^2=0.0911), this is expected due to the presence of coded variables. Therefore, H1 is supported at α=0.05 level (two-tailed test).

IX-2.2.2 Hypotheses 2: Environmental Dynamism

In order to measure environmental dynamism, I employed a previously validated measure from Li and Ye (1999). In their study, the authors used the variance of an industry's yearly revenues as a proxy for environmental dynamism for a given industry group. For example, if we have the Year and Industry Sales Revenue (ISR) for each industry, then we can run the following regression:

$$ISR = \alpha + \beta * Year + \varepsilon$$

After running the regression, the standard error will then become a proxy of a given industry's environmental dynamism.

I collected ISR data for eight years, 1987-1994, since the majority of my data spans over 1985-1995 and some earlier data were not available. I hard-coded ISR (sometimes called *Shipment Volumes)* from *US Industrial Outlook,* published annually by the US Department of Commerce. The Food and Kindred Products industry (SIC: 2000) was one of the "stable" industries (i.e., low standard deviation in its annual sales revenues), while Depository Institutions (SIC: 6020) was highly dynamic. Some industries such as Information Services were in their infancy during this time period, so their ISR numbers were not published. I again did not include data when 1) only one company represented a type of IT intended capabilities in a four-digit SIC group and 2) companies had either merged or been bought out immediately after IT implementation initiation or announcement. Since my hypotheses draw comparison between IT that automates/informates and IT that

transforms, the announcements were coded as 1s and 2s for this regression analyses. The following tables present ANOVA and parameter estimates.

Table 12 Preliminary ANOVA: Environmental Dynamism

The REG Procedure
Model: MODEL1
Dependent Variable: CAR CAR

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.00255	0.00128	1.44	0.2410
Error	113	0.10011	0.00088589		
Corrected Total	115	0.10266			

Root MSE	0.02976	R-Square	0.0549
Dependent Mean	-0.00398	Adj R-Sq	0.0476
Coeff Var	-748.31926		

Parameter Estimates

Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	-0.00381	0.00288	-1.32	0.1879
firmcode	1	0.01174	0.01321	0.89	0.3758
codexenv	1	-0.00048071	0.00028527	-1.69	0.0947

While the model fit is not ideal (R^2=0.0249), this is expected due to the presence of dummy variables. In Parameter Estimates, one will note that IT that transforms has a generally positive impact on the firm performance (i.e., 0.01174), while the capability has a negative implication in a highly dynamic environment (i.e., -.00048071). In other words, the interaction term, codexenv, negatively influences the linkage between IT that transforms and firm performance in a highly dynamic environment. Therefore, H2 is supported at $p<0.1$ level (two-tailed test).

IX-2.2.3 Hypotheses 3: IT Intensity

To measure IT intensity in a given business environment, I employ an aggregate measure of firm-wide $ IT investment as a percent of expenses. This data is based on an MIT Center for Information Systems Research (CISR) SeeIT survey with data from 640 firms[5]. All firms included in the survey spent 5.3% of their total expense on IT-related investments from 2004-2005 on the average. Financial services led the spending at 7.5%, while Wholesale, Retail, Transport spent only 3.6% of their total cost on IT. While the earlier spending data is not available, the MIT report indicates that IT investment/revenues over the last 10 years has been fairly flat; thereby making these numbers appropriate for my statistical analyses.

First, I manually match SIC codes with the data given in the MIT report. Second, using hard-coded $IT as a percent of expenses as a proxy for IT intensity, I run multivariate analyses with CAR, IT intended capabilities, and an interaction term (i.e., IT intensity*IT intended capabilities). The following table summarizes the results:

[5] This data is obtained from Prof. Peter Weill, Director & Senior Research Scientist, MIT Center for Information Systems Research. He can be reached at pweill@mit.edu.

Table 13 Preliminary ANOVA: IT Intensity

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	2	0.00006261	0.00003130	0.03	0.9736
Error	33	0.03861	0.00117		
Corrected Total	35	0.03867			

Root MSE	0.03420	R-Square	0.0616
Dependent Mean	0.00280	Adj R-Sq	0.0589
Coeff Var	1223.29513		

Parameter Estimates

Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	Intercept	1	0.00256	0.00624	0.41	0.6848
firmcode	firmcode	1	0.03497	0.17277	0.20	0.8408
codexinten	codexinten	1	0.00895	0.04232	0.21	0.8338

While the signs of the coefficients are "right" (i.e., positive: r=0.03497 and r=0.00895, indicating that in a highly IT intense environment, the IT that transforms capability displays more positive correlation to firm performance than does IT that automates/informates), the t-value is so small that the results of this analysis are inconclusive. There may be several reasons for this. First, the MIT study is conducted at such a high level (i.e., two-digit SIC code) that too many sub-SIC groups are lumped into one. For example, Wholesale, Retail, Transport are all averaged to spend approximately 3.6% of their total expense on IT; however, in my prior analyses these three groups have distinctly different business environment characteristics in terms of competitive pressure and environmental dynamism.

Second, IT intensity level may need to be measured with a hard dollar amount rather than with a percentage of total expense. For example, while not included in my statistical analyses, the government sector is shown to have spent 7.4% of its total expense on IT, second only to Financial Services. However, the government total expense may be much smaller than that of financial services (e.g., 7.5% of $1.5B vs. 7.4% of $100M). Therefore, these percentage numbers may not have accurately captured what I was trying to measure. Again, the report that contains the exact information may be available, but due to resource and financial constraints, I decided to use "available" data vs. "best" data.

IX-2.2.4 Other Financial Metrics

Regression analyses with interaction (i.e., moderating relationship) are used to support proposed hypotheses with other financial metrics such as Return on total Assets (ROA) as well. ROA is defined as a measure of profitability that assesses the relative effectiveness of a company in using available resources to generate net income and it is calculated as net income divided by average total assets. To each of the usable data points, ROAs (i.e., ROA+1, ROA+2, ROA+3) were manually entered from COMPUSTAT through WRDS (Wharton Resource Database System).

The regression analyses, however, did not show any significant support. There may be several reasons for the lack of support. First, ROA is a "backward" looking measure and can easily be confounded by numerous factors. For example, Citi Group announced multiple IT initiation implementations that includes all IT capabilities (i.e., IT that transforms, IT that automates/informates) over the span of six months. Therefore, it

would be almost impossible to isolate the impact of one implementation (e.g., IT that transforms) from the others if I employed annual ROA numbers as my financial metrics. Also, total assets can also include physical assets such as manufacturing plants in addition to IT-related resources. Therefore, while IT is now a strategic asset with significant monetary implications for many companies, its impact on ROA would be limited at best since the denominator includes other things. For the above reasons, CAR seems to be the best financial metric because it is a forward looking measure and averages over 3 days around IT implementation initiation or announcement to isolate the impact of a specific IT capability.

IX-2.3 Validity Issues

Multicollinearity refers to the extent to which a variable can be explained by the other variables in the analysis. While some degree of multicollinearity is acceptable, one needs to be aware of this issue to ensure all variables included contribute to add sizable explanatory power to proposed relationships. I used the condition index (CI) to assess if there was a multicollinearity problem with the variables. The following three tables present CI numbers for the three multivariate regression analyses I conducted.

Table 14 Multicollinearity Testing Results

Competitive Pressure:

Collinearity Diagnostics

Number	Eigenvalue	Condition Index	Proportion of Variation: Intercept	firmcode	codexpres
1	2.65118	1.00000	0.00993	0.00804	0.03910
2	0.31467	2.90261	0.05914	0.01354	0.76359
3	0.03415	**8.81123**	0.93093	0.97842	0.19731

Environmental Dynamism:

Collinearity Diagnostics

Number	Eigenvalue	Condition Index	Proportion of Variation: Intercept	firmcode	codexenv
1	1.77374	1.00000	0.07765	0.14101	0.13604
2	0.87372	1.42482	0.88170	0.02159	0.08908
3	0.35254	**2.24305**	0.04065	0.83740	0.77488

IT intensity:

Collinearity Diagnostics

Number	Eigenvalue	Condition Index	Proportion of Variation: Intercept	firmcode	codexinten
1	2.26034	1.00000	0.06377	0.00120	0.00120
2	0.73639	1.75200	0.93590	0.00076295	0.00077262
3	0.00327	**26.27175**	0.00033029	0.99804	0.99803

Notice the largest CI numbers (in bold) are all under 30, which is the often used threshold value for multicollinearity problems. Therefore, multicollinearity is not a big concern in my analyses.

Further, DNUM has been used in numerous places (e.g., de Figueiredo and Kyle 2006) to categorize a company into an appropriate SIC group. Some issues may emerge, though, if a company participates in multiple industries as a major player. For example, GE participates in multiple industries ranging from aircraft engines to financial services.

To reduce these confounding effects, I did not include data from conglomerate (SIC=9000 and above) companies.

Lastly, to see if my analyses have been influenced by any outliers, I ran Cook's D Influence Statistics test. The following graphs depict the test results for my three statistical analyses.

Table 15 Cook's D for Competitive Pressure

```
The REG Procedure

                                        Model: MODEL1
                              Dependent Variable: CAR CAR

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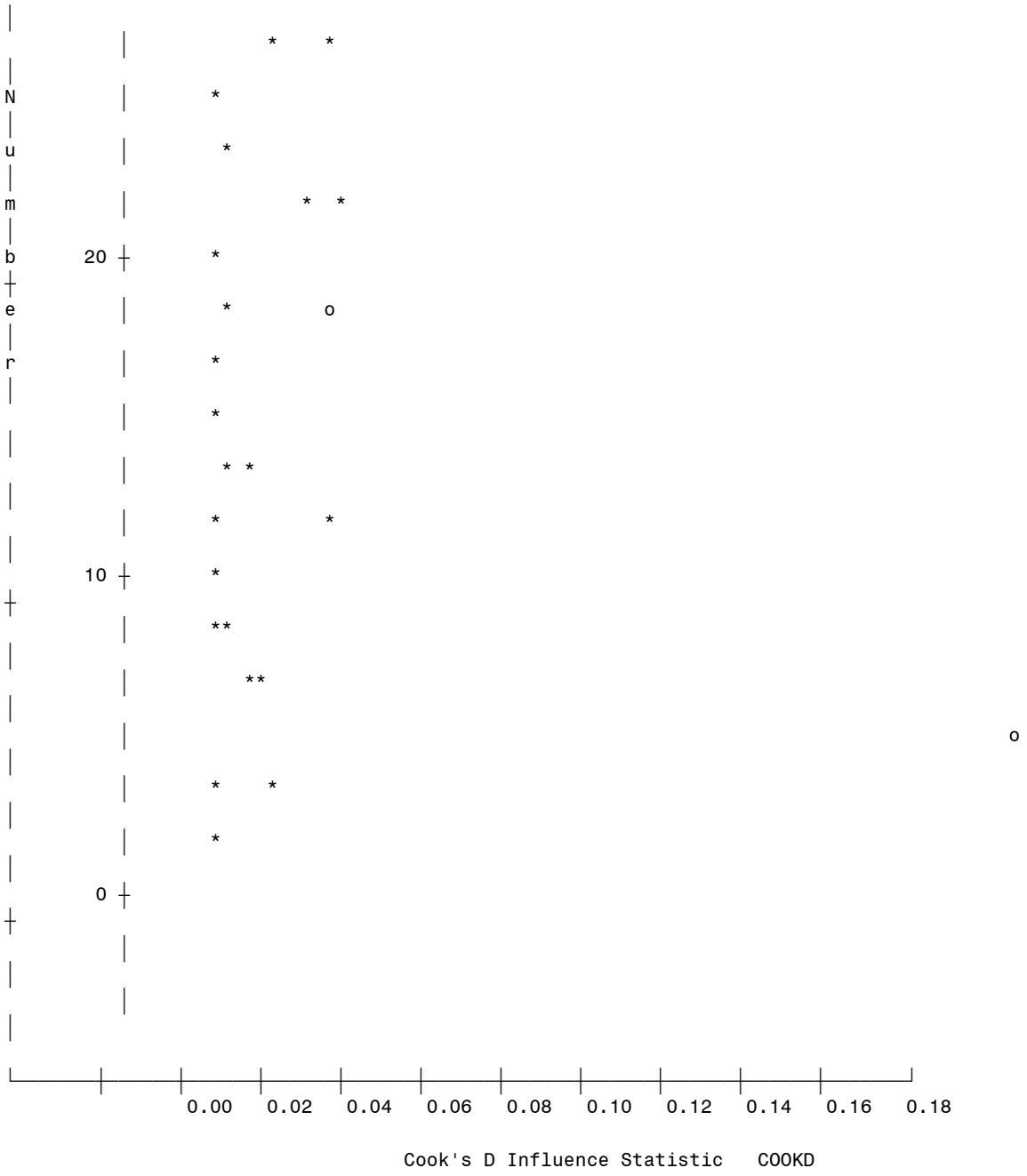
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0.18
Cook's D Influence Statistic COOKD

Table 16 Cook's D for Environmental Dynamism

```
The REG Procedure
                                    Model: MODEL1
                          Dependent Variable: CAR CAR

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a       |      **
t       |      *
i       |      *
o    60 +      *
n       |      *
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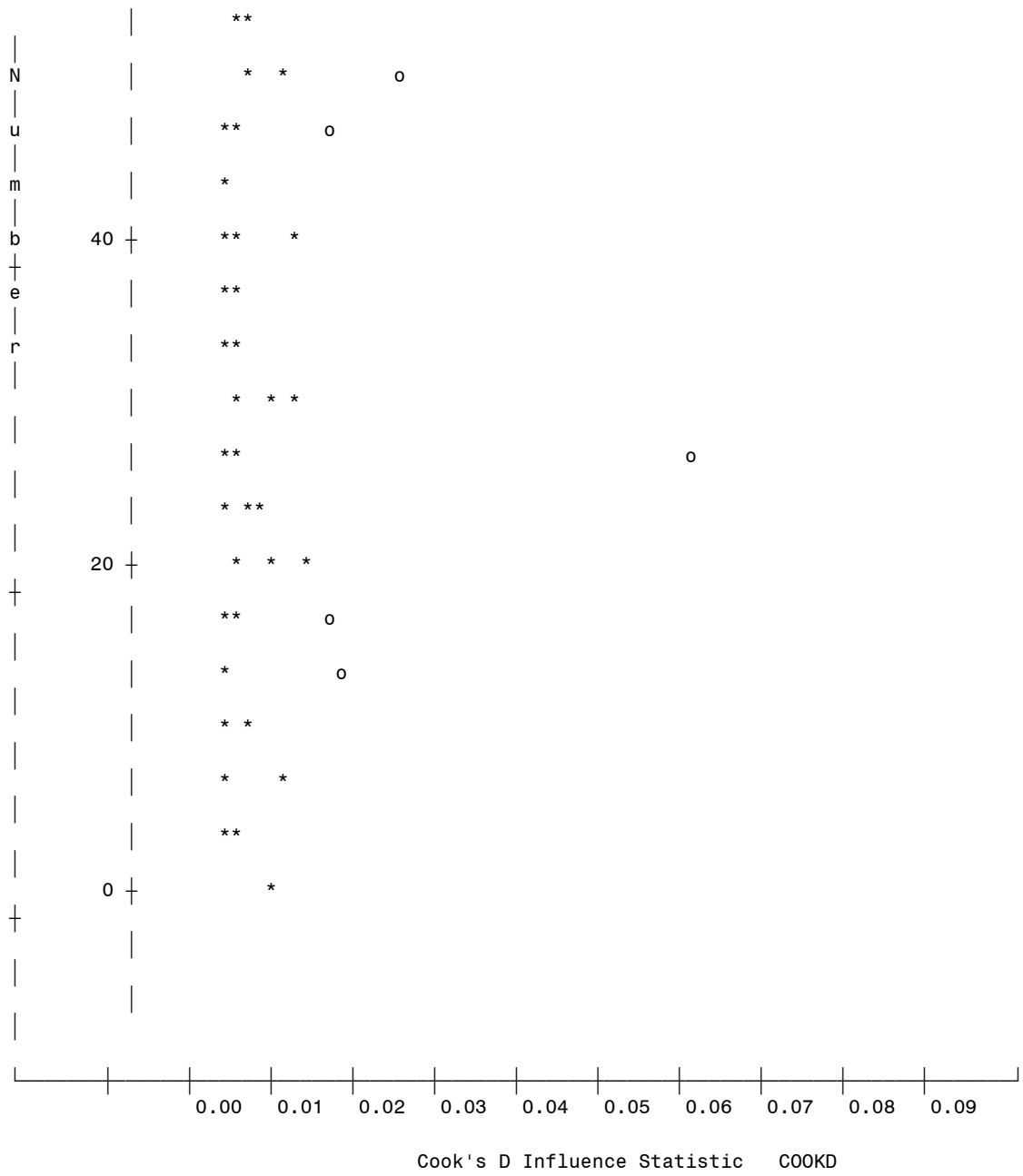
Number
40
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Cook's D Influence Statistic COOKD

Table 17 Cook's D for IT Intensity

```
                                        The REG Procedure
                                          Model: MODEL1
                               Dependent Variable: CAR CAR


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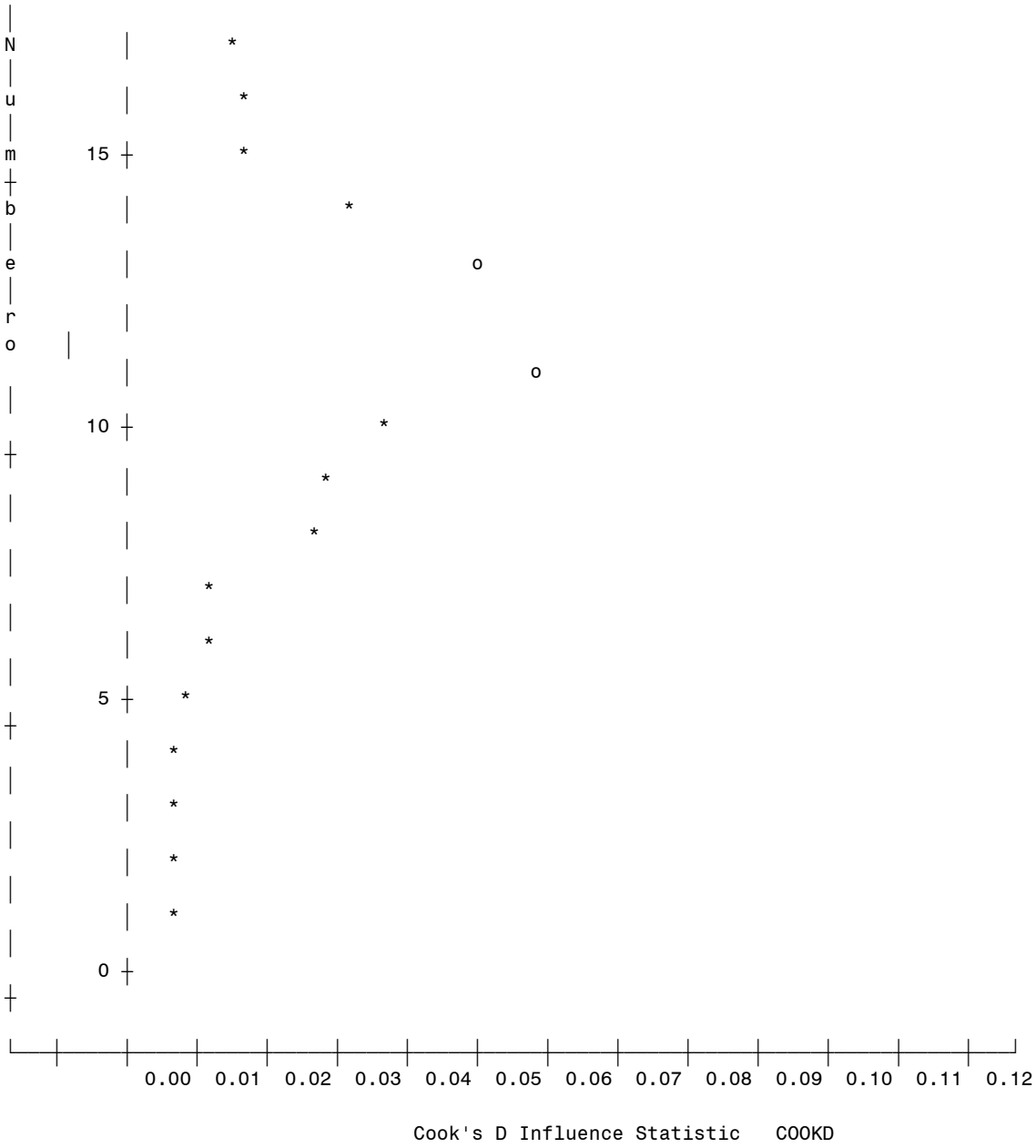


As one can see, none of the outliers (graphed with the symbol “o”) has a significant influence on my statistical results. All “o”s are much lower than a big influence threshold reference of 1. This indicates that the results come from the patterns of collective data not just from one or two influential data points.

In addition, one of the basic assumptions regarding regression analyses is normality. To test for the normality of data, I employed different test techniques and the results indicate the regression residuals are normally distributed. For example, the p-value for the Shapiro-Wilk test is 0.8146, which is much higher than 0.05. In that case, we should retain the null hypothesis (Ho: Residuals are normal). The following table presents the normality test results.

Table 18 Normality Testing Results

```
The UNIVARIATE Procedure
  Variable:  residuals  (Residual)

                    Moments

N                        126    Sum Weights               126
Mean                       0    Sum Observations            0
Std Deviation      0.00960834    Variance            0.00009232
Skewness           0.02868304    Kurtosis            -0.2928779
Uncorrected SS     0.01154002    Corrected SS        0.01154002
Coeff Variation             .    Std Error Mean      0.00085598


            Basic Statistical Measures

     Location                    Variability

  Mean      0.00000     Std Deviation            0.00961
  Median   -0.00010     Variance               0.0000923
  Mode       .         Range                    0.04616
                       Interquartile Range      0.01335

            Tests for Location: Mu0=0

     Test           -Statistic-    -----p Value------

     Student's t    t         0    Pr > |t|    1.0000
     Sign           M         0    Pr >= |M|   1.0000
     Signed Rank    S      -9.5    Pr >= |S|   0.9817

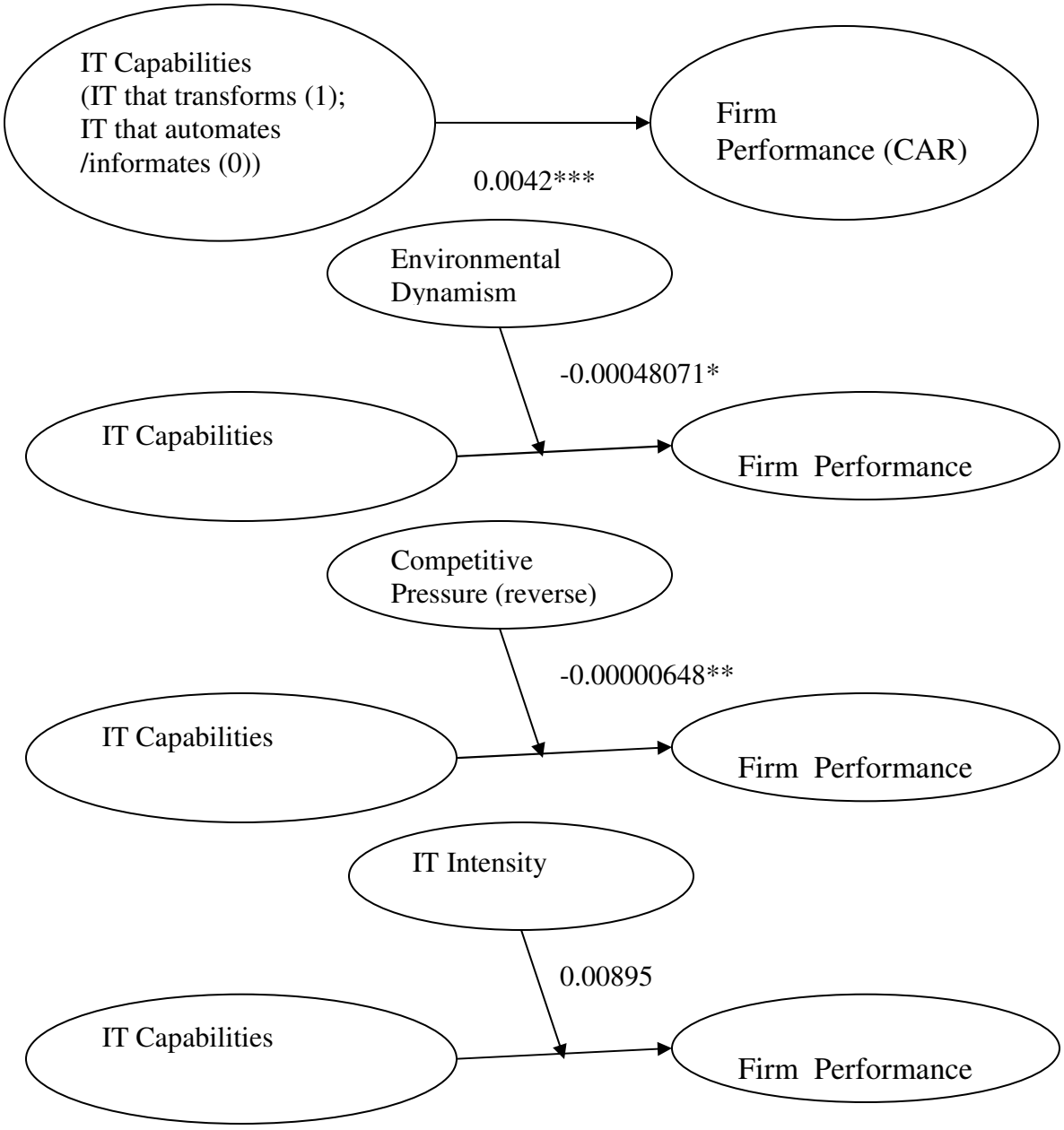
                 Tests for Normality

  Test                  --Statistic---    -----p Value------

  Shapiro-Wilk          W     0.993306    Pr < W      0.8146
```

```
Kolmogorov-Smirnov    D     0.055253    Pr > D     >0.1500
Cramer-von Mises      W-Sq  0.034105    Pr > W-Sq  >0.2500
Anderson-Darling      A-Sq  0.215268    Pr > A-Sq  >0.2500
```

I also ran the Durbin-Watson test and found that autocorrelation is not a significant issue (i.e., Durbin-Watson D = 1.816). To summarize, the following figure summarizes the univariate analyses findings:



*p< 0.1; ** p<0.05; *** p< 0.01

Figure 4 Preliminary Univariate Analyses

IX-2.4 Multivariate Analysis and Testing of the Hypotheses

Having tested the impact of moderating factors separately, I now will include control factors and assess the impact of my proposed business environmental variables over and beyond the variances previously explained.

Control Variables: First, since my original data set is obtained from Dehning et al. (2003), I include all their variables in my base model. These variables include:

- Assets: Total assets in the year of the IT investment announcement ($M)
- Time: Number of days from the first IT investment announcement in the full sample to the date of each announcement
- Financial Firm: 1 if firm is a financial firm (SIC code 6000-6299)
- Transform Industry IT Strategic Role: 1 if the firm has membership in an industry characterized as having a transform industry IT strategic role; 0 otherwise
- Lead: 1 if IT investment strategic role transforms or leads the industry IT strategic role
- Lag: 1 if IT investment lags the industry IT strategic role

Assets is included to control for organizational size. Others may warrant some explanations. Time is included to see if the earlier announcements would result in more positive CAR results than later ones due to the "first-mover advantage". Dehning et al. (2003) find statistically significant support only for their Transform Industry IT Strategic Role, Transform IT Investment Strategic Role and Lead variables. Since my study aims to identify underlying business environment characteristics that may moderate the

relationship between IT capability and firm performance, these original factors are included as my control variables.

Second, prior financial performance is included as a control variable in order to examine the possibility that a company's ex post performance is simply a carry-over effect of ex ante performance. In other words, previously successful firms may continue to deliver good financial results regardless of IT capabilities. Prior ROAs (i.e., investment related measure) averaged over the past three years were used to control for this carry-over effect.

Note that for competitive pressure, I use concentration ratios instead of HHI. Although HHI is a more accurate reflection of competitive pressure than concentration ratios are (Besanko et al. 2000), the lack of availability of HHI for all SIC groups prevents me from using the index for significance purposes. While imperfect, many strategy studies still employ concentration ratios (commonly known as C4) as their way of measuring competitive pressure (e.g., de Figueiredo and Kyle 2006, Simon 2005). Also, for IT intensity, I include previously excluded industries from the aforementioned MIT study for the same reason. Newly added industries include utilities and wholesales; they were previously left out because they were all lumped together under the miscellaneous category. After excluding unusable data due to one or more missing values (e.g., no IT intensity data available for a specific SIC group), the data set for the whole regression now contains 139 data points.

The following tables present descriptive statistics and correlations among the factors.

Table 19 Descriptive Statistics

The MEANS Procedure

Variable	Label	N	Mean	Std Dev	Minimum	Maximum
Assets	Assets	139	70177.90	73131.66	59.3520000	250489.00
Time	Time	139	3562.23	1402.30	425.0000000	5723.00
Financial	Financial	139	0.5214286	0.5013343	0	1.0000000
Indtran	Indtran	139	0.1000000	0.3010772	0	1.0000000
Firmtran	Firmtran	139	0.1285714	0.3359269	0	1.0000000
Lead	Lead	139	0.1000000	0.3010772	0	1.0000000
Lag	Lag	139	0.1214286	0.3277975	0	1.0000000
CAR	CAR	139	0.000900864	0.0179879	-0.0353530	0.0666940
preROA	preROA	139	-0.0021402	0.0256179	-0.0740910	0.1096050
EnvDyn	EnvDyn	139	41962.34	34799.66	183.0300522	77899.32
C4	C4	139	36.6171429	20.0717595	15.8000000	84.0000000
Itintense	Itintense	139	6.0021429	1.6583978	3.0000000	7.5000000

As one can see, cumulative abnormal returns (CAR) vary widely (min=-0.0353, max=0.0667, SD=0.01799) and center around zero (mean=0.0009). CAR (-1, 1) is chosen for this analysis since the news of IT announcement may leak to the media earlier and analysts may need time to analyze and react to the news or announcements (Tanriverdi and Uysal 2006). IT capability displays a positive correlation with CAR (r=0.03904), but the correlation is not significant. Organization size (Assets) has a positive and moderately significant correlation to CAR (r=0.14637, p<.1), while another control variable, prior financial performance (preROA) has a significant and positive correlation with CAR (r=0.72934, p<.01). As shown in Dehning et al. (2003), Lead, Transform Industry IT Strategic Role (Indtran), and Transform IT Investment Strategic Role (Firmtran) all display positive correlations with CAR.

Table 20 Correlation Statistics

	Assets	Time	Financial	Indtran	Firmtran	Lead	Lag	CAR	preROA	EnvDyn	C4	Itintense
Assets	1											
Time	-0.19824	1										
	0.0189											
Financial	0.5017	-0.16687	1									
	<.0001	0.0488										
Indtran	-0.12594	0.39341	-0.0143	1								
	0.1382	<.0001	0.8668									
Firmtran	0.14637	0.23288	-0.0592	0.15649	1							
	0.0844	0.0056	0.4872	0.0648								
Lead	0.15171	0.12519	-0.06196	-0.11111	0.86781	1						
	0.0736	0.1405	0.4671	0.1912	<.0001							
Lag	-0.2518	0.16917	-0.16917	0.31345	-0.1428	-0.12392	1					
	0.0027	0.0457	0.0457	0.0002	0.0924	0.1446						
CAR	-0.11258	0.05739	-0.00276	0.01113	-0.03904	-0.02306	0.03759	1				
	0.1854	0.5006	0.9741	0.8962	0.647	0.7868	0.6593					
preROA	-0.0684	0.08324	0.01898	-0.01824	-0.02475	-0.02362	0.03226	0.72934	1			
	0.422	0.3282	0.8239	0.8306	0.7716	0.7818	0.7051	<.0001				
EnvDyn	0.51946	-0.1064	0.83419	-0.01313	-0.04905	-0.05006	-0.13336	-0.07181	-0.01814	1		
	<.0001	0.2108	<.0001	0.8776	0.5649	0.5569	0.1162	0.3992	0.8315			
C4	-0.07461	-0.12929	-0.59895	-0.03136	0.08183	0.09293	-0.03017	0.00294	-0.0899	-0.1173	1	
	0.381	0.1279	<.0001	0.713	0.3365	0.2748	0.7235	0.9725	0.2908	<.0001		
Itintense	0.47724	-0.09544	0.87866	0.05432	0.01887	-0.01052	-0.2506	-0.06365	-0.02407	0.78254	-0.54502	1
	<.0001	0.262	<.0001	0.5238	0.8248	0.9018	0.0028	0.455	0.7777	<.0001	<.0001	

Table 20 reports coefficient estimates and standard errors of the OLS regressions. As mentioned before, autocorrelation is not a big concern, so GLS regression is not really necessary. In the Base Model through Model 3, I introduce control variables in Dehning et al. (2003), my own control variable (preROA), the precedent variable (Firmtran or IT capability), and the moderating variables (i.e., interactions of IT capability with each of the business environment factors).

The base model enters the control variables in Dehning et al (2003). As indicated in their own study, Lead ($r=0.17$, $p<0.05$) and Transform Industry IT Strategic Role ($r=0.107$, $p<0.05$) show a significant and positive impact on CAR. In summary, their study found that in some industries that are categorized as "Transform" by experts, IT that transforms announcements tend to produce above average financial returns. However, the authors did not elaborate on what may constitute "Transform" industry characteristics. As mentioned before, uncovering underlying business environment factors that may moderate the linkage between IT capability and firm performance is one of the purposes of this study.

Model 1 adds my control variable--Prior ROA. Prior ROA displays a moderately positive relationship to CAR ($r=0.00042$, $p<0.1$). This shows that firms that have been successful in managing different investments (i.e., higher ROA numbers) tend to continue in their successful run (Tanriverdi and Uysal 2006). Partly due to the addition of the prior performance control variables, the model fit improved ($R^2_{base} = 0.041 \rightarrow R^2_{model1} = 0.121$).

Model 2 adds the precedent variable (Firmcode or IT capability) that has been tested by itself in the preliminary analysis and business environment factors (i.e., main effect). While in the prior analysis, IT capability displayed a positive and significant impact on CAR ($r=0.0042$, $p<0.01$), in Model 2, the relationship is also supported albeit not as significantly ($r=0.00139$, $p<0.05$) in the presence of other control variables. Only competitive pressure displays a moderately significant relationship to CAR ($r= -0.0000208$, $p<0.1$). This lack of main effect seems to suggest that the combination of IT capabilities and business environment factors is more influential on firm performance than are business environmental characteristics themselves.

Model 3 introduces moderating factors that are introduced in this study on top of control variables and the precedent factor. Overall, all three interaction factors display "correct" signs—negative for IT Capability x Environmental Dynamism ($r = -0.00157$, $p<0.05$) and IT Capability x Competitive Pressure (reverse) ($r=-0.00379$, $p<0.05$) and positive for IT Capability x IT Intensity ($r=0.000495$, $p<0.1$). Only two interactions (with Environmental Dynamism and Competitive Pressure) receive significant support, while IT Intensity shows only moderate support. The weak support may stem from the fact that IT intensity is measured as a percent of total expenditure, which may work against large corporations (i.e., large dollar amount spent, but small percentage of the total expenditure).

As one can note, the proposed interaction factors bring in additional explanatory power to explain variances in CAR. As recommended in Carte and Russell (2003), I used ΔR^2 to assess the impact of moderators in terms of model fit and explanatory power.

Not only is the model fit improved ($\Delta R^2 = 0.0491$), but also it was a moderately significant improvement ($p<0.1$). While increasing the R^2 values has been accomplished by adding more predictors in my model, the purpose of this study is not to maximize the overall variance explained. Rather, this study takes the first step in identifying salient and underlying business environment factors that moderate the relationship between IT capability and firm performance.

Table 21 Multivariate Regression Analysis Results

Dependent Variable: CAR (0,1)	Parameter Estimates (Standard Errors)			
	Dehning et al. Base Model	Model 1	Model 2	Model 3
Control Variables				
Assets	-0.032	-0.00186	-0.00821	-0.002894
	(0.00228)	(0.000287)	(0.000245)	(0.000624)
Time	0.003	-0.00049	0.000944	0.0000623
	(0.00136)	(0.0000755)	(0.000012)	(0.00000202)
Financial Firm	0.022	0.000149	0.0003774	0.00853
	(0.00415)	(0.00435)	(0.00126)	(0.00234)
Transform Industry	0.107**	0.00384*	0.00875	0.00311
IT Strategic Role	(0.00535)	(0.00267)	(0.00129)	(0.00401)
Lead	0.17**	0.00132	0.00339	0.00781*
	(0.00592)	(0.00811)	(0.00803)	(0.00114)
Lag	0.067	-0.00332	-0.0021*	0.00457
	(0.0048)	(0.00692)	(0.00132)	(0.00712)
Prior ROA		0.00042*	0.000506*	0.000471*
		(0.000371)	(0.000416)	(0.000286)
Precedent Variable				
IT Capability (0=IT that automate/informate; 1=IT that transforms)			0.00139**	0.000242*
			(0.00532)	(0.00885)

Main Effects				
Environmental Dynamism			-0.000434	
			(0.000211)	
Competitive Pressure			-0.0000208*	
			(0.000088)	
IT Intensity			0.000592	
			(0.0000181)	
Moderating Factors				
IT Capability x Environmental Dynamism				-0.00157**
				(0.000221)
IT Capability x Competitive Pressure				-0.00379**
				(0.00011)
IT Capability x IT Intensity				0.000495*
				(0.000488)
Model Statistics				
N (number of observations)	353	139	139	139
Model R2	0.041	0.121	0.149	0.197
Adjusted R2	0.033	0.108	0.1372	0.1863
Delta R2			0.0292*	0.0491*

*p<0.1; **p<0.05

The following figure summarizes the multivariate analyses findings:

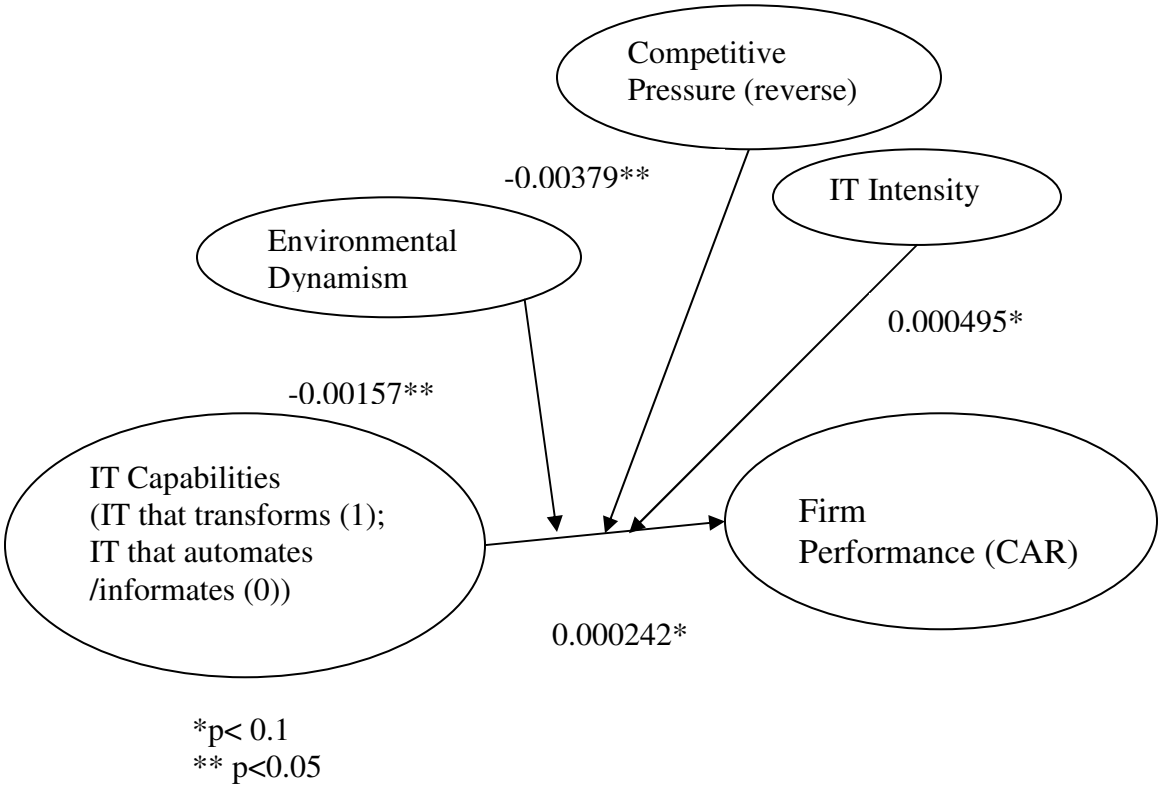


Figure 5 Multivariate Analyses: Hypotheses Supported

The following figure displays the same model with normalized coefficients.

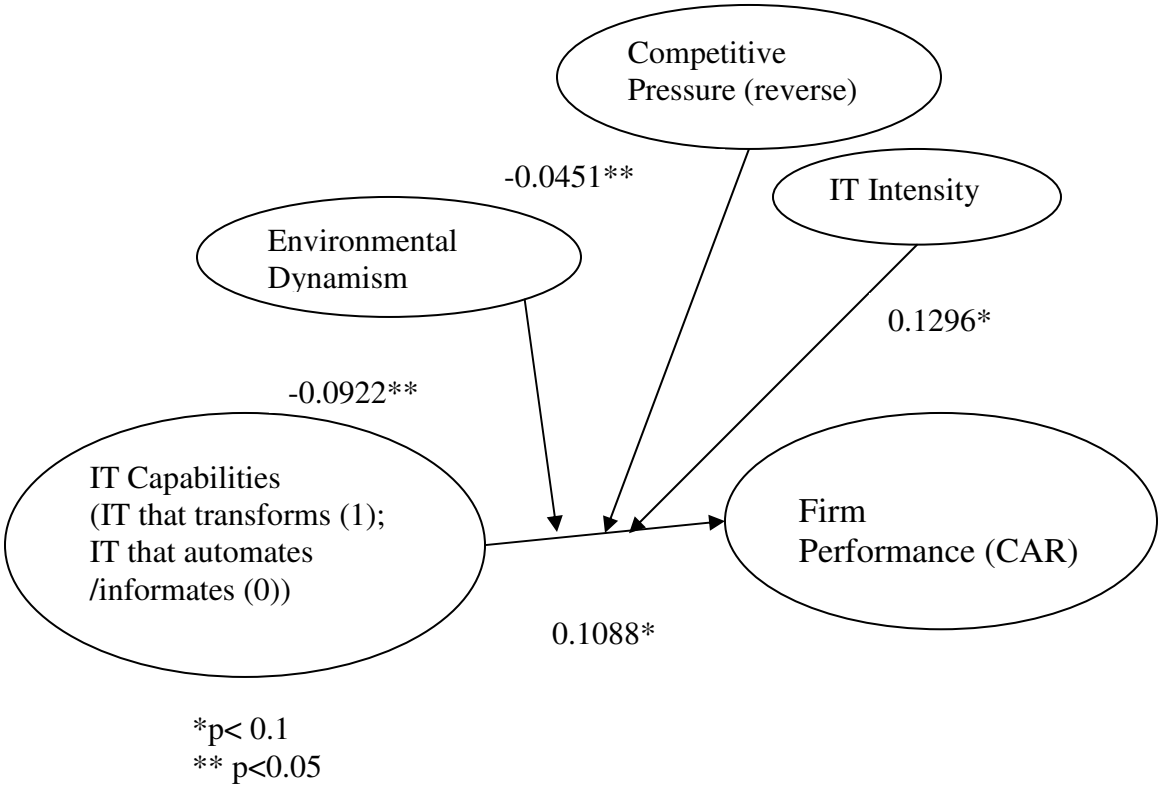


Figure 6 Multivariate Analyses: Hypotheses Supported (Normalized Coefficients)

X. Discussions and Contributions

This study is an initial step toward defining the role of business environments in moderating the linkage between different IT capabilities and firm performance. While many mistakenly believe the most grand IT capability (i.e., IT that transforms) would universally produce higher IT payoff, this study preliminarily has shown that in a highly dynamic environment, IT that transforms may not produce better returns than do IT that automates/informates, while all others remain constant. However, in a highly competitive environment, IT that transforms would most likely generate higher business value than do other IT capabilities. The positive role that IT intensity plays on the linkage between IT capabilities and firm performance is also shown to be supported.

Limitations and Future Opportunities: While this study takes the first step in exploring the moderating impact of business environment factors on the linkage between IT capability and firm performance, further studies may be needed to further support the findings. For example, the data set was limited in a couple of ways: 1) the sample was taken from an event study conducted from 1980 to 1995, and 2) many data points were eliminated due to the missing attributes of the prospective observations. Complementary work with more extensive and direct data may be necessary to improve statistical support and further validate hypotheses.

In addition, regression analyses by design cannot confirm or disconfirm the direction of causality. In other words, some can argue that instead of moderating the relationship between IT capability and firm performance, business environment factors can be precedents for making investment in different IT capabilities. For example, it

seems that business decision makers somehow instinctively knew that sophisticated IT infrastructure (i.e., high IT intensity) was a necessary and precedent condition for the successful IT payoff of IT that transforms. As mentioned earlier, my data sample contains fewer IT that transforms announcements than those of IT that automates or IT that informates when the importance of IT infrastructure investments was only beginning to emerge. In order to test for this "staged" causality (business environment factors → different IT capabilities → firm performance), structural equation modeling (SEM) may need to be employed and it requires far more data points with no missing attributes per observation.

In addition, the issue of endogeneity has not been fully addressed in this study. For example, one of the moderating factors in my study may in fact influence both independent variable and dependent variable simultaneously. The endogeneity concerns should be addressed by identifying and controlling for those prospective variables.

Finally, IT announcements may be an imperfect measure for IT capabilities. Further studies may be warranted to measure directly and more accurately pinpoint IT capabilities. Also, a company's announcement regarding its IT that transforms capability does not necessarily mean that the organization *will* acquire that capability. Some even may make a "fake announcement" to play the market. These issues have to be considered and addressed in subsequent studies.

Contributions: The "so what?" of this research is twofold: First, for scholars, this research will advance the field of business value of IT by answering a fundamental question of what the role of business environment characteristics are in creating IT

business value. By specifying underlying business environment factors, the study adds an additional dimension to IT coalignment theory. As the title of the study suggests, there may be an optimal profile or alignment between internal IT capabilities and external business environments (i.e., IT that transforms in a stable environment). This study has taken a first step into elaborating and enriching this under-explored research area. While some studies have studied the interaction effect between firm capabilities and external environments (e.g., Dehning et al. 2003, Kohli and Devaraj 2003), the majority of them did not offer the logic behind the environmental influence and/or identify underlying variables that may help explain the role and impact of environmental factors on the linkage between IT capability and firm performance. This study has taken the first step. More specifically, in reference to Melville et al's (2004) integrated IT Business Value Model, this study will be the first stepping stone to address the competitive environment "box" that influences the IT business value generation process.

For practitioners, the findings will provide a necessary platform to evaluate IT investment returns in different sectors or markets. For example, executives in highly dynamic industries should be aware of the value issues when they are making significant IT investment decisions. Taking insights from this study, they would be cautious before investing heavily in grand IT efforts if business environments are unstable and apt to change. At the same time, practitioners will benefit from the insight that a simple cross-industry comparison of IT investment returns in the forms of financial ratios and economic productivity and other metrics should be done with caution since business environment characteristics play a vital role in determining the amount of returns.

Finally, while not underscored throughout, this study builds on and further expands the work of Dehning et al. (2003). Not only do identified and validated business environment factors in this study help explain what "Industry with IT Transform Strategic Role" means, but also this research provides managers with the necessary tools to properly exercise "signaling" techniques to better reap above normal market returns. Assuming financial analysts have a deep knowledge about the industries and technologies they cover, prudent managers will benefit by sending right signals (i.e. what types of IT and in what business environment) to the market with their IT announcements.

Appendices

Appendix A: Interview Guidelines

Profiles of IT Payoff Success:
An IT Capabilities and Business Environments Perspective

Interview Guidelines

Inform participants about the scope of the study:
I am interested in your agency's experience in implementing [name of IT applications] and business value implications of such. All your responses will be confidential and the sources of data will not be revealed.

1. General Questions:

When did your agency first become interested in [name of IT applications]?

What was your role in your organization's [name of IT applications] efforts?
Who else was involved in this effort?

2. IT Type and Intended Capabilities

What and how much business process improvement/reengineering accompanied [name of IT applications] project?

What was the purpose of [name of IT applications]?

What benefits and positive changes did [name of IT applications] bring to your organization?

3. Business Value

In your assessment, how has [name of IT applications] contributed to your organization's business bottom line?

	Business Value Generated
Financial (i.e., stock price, return on asset, return on investment, earnings per share etc.)	
Process (i.e., customer satisfaction, processing time shortened)	
Others	

4. Business Environment Characteristics

Does any of the following business environment characteristics either decrease or increase your chance of capturing business value of [name of IT applications]? If so, how?

- Competitive pressure

- IT intensity

- Speed of change

- Regulatory support

5. Other Comments:

Appendix B: IT Capabilities Coding Scheme (taken verbatim from Dehning et al. (2003))

Coding rules

- Do not code information about IT that is embedded in industrial technology.

Automate Rules

- Replace human labor by automating business processes.
- Virtually no IT-driven transformation efforts.
- **Goals:** Improving, applying and refining firm capabilities, substitute labor with computers.
- **Outcome:** Clearly definable benefits, e.g., cost reduction, process consistency, process efficiency.

Informate Up/Down Rules

- Provide new data/information to empower management, employees, or customers.
- An intermediate level of IT-driven transformation efforts.
- **Goals:** Better decision making, better coordination and collaboration.
- **Outcomes:** "Soft" benefits, difficult to evaluate in advance, e.g., better decisions shared understanding, clearer picture of cause-effect relationships, greater understanding of operating environment.

Transform Rules

- Fundamentally alter traditional ways of doing business by redefining business capabilities and/or (internal or external) business processes and relationships.
- Strategic acquisition to acquire new capabilities or to enter a new marketplace.
- Use of IT to dramatically change how tasks are carried out… is the move recognized as being important in enabling firm to operate in different markets, serve different customers… gain considerable competitive advantage by doing things differently.

Examples of Coded IT Investment Announcements

Automate Example

September 26, 1985

Headline: Exxon Unveils Point-of-Sale System; MCorp to Be First Bank Participant
Byline: Special to the American Banker
Body:
Exxon Co. USA has developed its own communications network to support the acceptance of debit cards at its gas stations around the country.

MCorp, which operates the MPact Electronic Banking Network through its subsidiary MTech, will the first banking company to participate in Exxon's point-of-sale system.

The system will allow bank customers to purchase gasoline and other products at Exxon stations with MPact cards.

Exxon Co. USA, a subsidiary of the Exxon Corp., is initiating service with the system in Austin and San Antonio, where it will be available to MPact customers by early December at about 100 stations.

Also, late this year, the system will become available at 275 to 300 stations in the Dallas-Fort Worth area. Next year, Exxon's system will be expanded to about 350 Houston-area stations and to other major markets.

Exxon also plans to start operating the system at up to 275 facilities throughout Florida later this year. Eventually, Exxon is expected to have the payments system available in 17,000 stations throughout the nation.

An oil company spokesman said Exxon is negotiating with other banks to accept their cards in the point-of-sale system.

Exxon is also testing its own debit card at stations in the Phoenix area. "The test is still under way," an oil company spokesman said. "We're still looking at that entire area."

Other major oil companies, such as Mobil Oil Corp. and Shell Oil Co., are installing similar systems at their retail stations. Mobil, which also accepts MPact cards, has committed about $30 million to a point-of-sale program to link all its service stations in 25 states.

An Exxon spokesman said the system is designed to speed transactions and increase the methods of payments available to customers. Some customers may be charged a transaction fee similar to those for using a bank's automatic teller machine.
The gasoline station systems work in a manner similar to automated teller machine transactions. Participating Exxon stations will have card readers that will allow customers to enter their secret codes to complete a transaction.

"Customers authorize transactions using secret code, the same one used at MPact teller machines," said Darwin Deason, chairman of MTech.

Once the purchase has been electronically authorized and completed, the funds are automatically transferred from the customer's bank account to the of the oil company. "The MPact debit card gives customers a quick and easy means of paying for purchases from their checking accounts without having to write a check," said Ray Hansen, Exxon's western regional sales manager.

Exxon said purchases made with MPact cards will qualify for the four-cent-a-gallon discount given to customers who pay with case. The oil company said it will continue to accept Exxon credit cards as well as MasterCard and Visa cards.

Informate Example

Spectrum awarded contract by Grainger worth 2.5 million dollars for technology implementation to automate sales force
28 April 1993
Business Wire

Dallas—(Business Wire)—Grainger, a division of W.W. Grainger Inc., has awarded Spectrum Information Technologies (Spectrum)(NASDAQ: NMS: SPCL) a contract to provide part of its sales force with a computerized sales support tool that will improve responsiveness to customer needs and enhance the effectiveness of its account executives.

Under the agreement worth 2.5 million dollars, Spectrum's subsidiary DATA ONE, is providing Grainger with portable computer hardware, project integration services, and technical support services for sales personnel. The program will be rolled out during the end of the second quarter.

Spectrum Information Technologies, Inc. is headquartered in Manhasset, N.Y., with facilities nationwide.

Spectrum develops and licenses wireless data transmission technologies through its subsidiary Spectrum Cellular Corp. The company designs, markets and services portable communications and computing systems as a systems integrator through its subsidiary DATA ONE. Spectrum is a distributor of portable computers through its subsidiary Computer Bay, which has the resources of 270 franchise locations.

Transform Example

American Greetings to Sell Cards Using the Internet
2 May 1995
The Wall Street Journal

Cleveland—American Greetings Corp. said it will sell greeting cards on the Internet World Wide in an alliance with Oakton, VA-based PC Flowers & Gifts Inc.

For $3.99 each, customers can pick out a card, personalize it and type it in the name and address of the recipient. Then the card is mailed by American Greetings. Consumers pay by entering their credit-card numbers.

American Greetings said the service is the first of its kind on the Internet World Wide Web. "While the sale of greeting cards in these on-line and electronic channels of distribution is minimal now, we realize that this is an emerging market," the company said. "By informing alliances with key players on the information highway, we are in a position to generate incremental sales and growth for the company in the future when on-line services begin attracting more significant consumer usage."

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