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How Do Investors Value IT? An Empirical Investigation of the Value Relevance of IT Capability and IT Spending Across Industries

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ABSTRACT: Drawing on the resource-based theory of the firm and using Ohlson's (1995) residual income valuation framework, this paper investigates the relationships between IT capability and IT spending, and market value. We also assess whether these relationships differ based on the industry type (i.e., high-tech). Using publicly available ratings, and after controlling for firm-specific determinants as well as industry fixed-effects, we find that IT capability is value relevant (i.e., the stock market values of firms with superior IT capability are both economically and statistically higher than the values of a control sample), whereas the level of IT spending did not explain variation in market values. The results are shown to hold using two unique archival data sets representing the immediate pre-Internet (1992–1994) and the post-Internet commercialization (1999–2006) eras and are remarkably robust to variations in the control sample, sampling method, and model specifications. Consistent with these results, we also find that IT capability is associated with actual future earnings. Additionally, we find that IT capability is more value relevant for firms in high-tech industries in the post-Internet period. Overall, our analysis suggests that, on average, investors reward firms with superior IT capabilities through higher market values, consistent with the notion that IT capability contributes to the firm's future prospects (the size and risk associated with the firm's future income stream), and that market performance differential from IT rests less on IT spending, per se, and more on the firm's IT capability. The implications of these findings for practice and research are discussed.

Keywords: business value of IT; IT capability; IT spending; resource-based theory; market valuation.

Data Availability: Data used in this study are available from sources identified in the body of the paper.

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I. INTRODUCTION

Understanding the impact of information technology (IT) on firm performance is a central theme in contemporary Information Systems (IS) and Accounting Information Systems (AIS) research. While much progress has been made, significant gaps in our understanding remain. For example, while studies document an association between IT spending and increased firm output, empirical studies examining the contemporaneous relationship between IT spending/capital and measures of financial performance report mixed findings (Dehning and Richardson [2002], Dedrick et al. [2003], and Melville et al. [2004] provide excellent reviews). Commentators have also recently questioned the strategic importance of IT (Carr 2003). Yet anecdotal evidence and numerous case studies suggest that some firms are able to gain competitive advantages through IT (see, for example, Porter and Millar 1985; Quinn and Baily 1994; Kraemer et al. 2000; McAfee et al. 2004).

As an alternative to the focus on IT spending, prior research has advanced the notion of IT capability as a key potential differentiator (Feeny and Willcocks 1998; Bharadwaj 2000; Santhanam and Hartono 2003; Wade and Hulland 2004). A firm's IT capability refers to *the firm's capacity to leverage the potential of information technology by effectively deploying IT resources in combination or co-present with other resources in the organization* (Bharadwaj 2000); it focuses on *how* IT is used rather than on how much the firm spends on IT. Interestingly, firm-level studies examining the question of payoff from IT capability are surprisingly limited and far from being conclusive. In particular, using appearance on the list of "leaders" in the *InformationWeek* (*IW*) 500 as a proxy for IT capability, Bharadwaj's (2000) univariate analysis suggests a link between IT capability and contemporaneous accounting-based measures of firm performance. However, subsequent analysis by Santhanam and Hartono (2003) that controlled for prior financial performance found no association between many (21 out of 24, in one case) performance measures and IT capability, and, in some cases, the effects on some performance measures were opposite of expectations.

In this paper, we attempt to reconcile these seemingly conflicting results and advance our understanding of the link between IT and firm performance by proposing and testing a model that focuses on whether, and if so how, investors in the market impound firm-specific IT-related information into stock prices. A key distinguishing feature of our study is the inclusion of a comparative analysis; we *simultaneously* examine differential effects (value relevance) of IT capability and IT spending on market value. Prior studies have focused on examining the effects of each of these two IT-related factors in isolation from the other. More specifically, much of the prior work, including Bharadwaj et al. (1999), Anderson et al. (2006) and Kobelsky et al. (2008), focuses only on the impact of IT spending/budgets, whereas Bharadwaj (2000) and Santhanam and Hartono (2003) consider IT capability exclusively. As we show in this paper, omitting one of those factors from the analysis can significantly bias the results and interpretation. Additionally, with only a few notable exceptions (Brynjolfsson and Yang 1997; Bharadwaj et al. 1999; Anderson et al. 2006; Wang and Alam 2007), prior studies employed accounting-based measures for firm performance. A principal limitation of relying on accounting-based measures is that those measures look only at past performance, are not risk adjusted, and only capture tangible value component of IT resources/capabilities. These measures do not capture their intangible contributions, namely, the potential effects on the size and risk associated with the firm's future income stream (Bharadwaj et al. 1999; Anderson et al. 2006).

The most similar work to ours is a recent paper by Wang and Alam (2007) that examined the value relevance of "IT capability" using the *IW* 500 ranking index as a proxy for "IT capability." While Wang and Alam's (2007) study has much to recommend it, the definition and proxy measure it uses for "IT capability" combines both the quantity of a company's technology or service investments and the quality of the company's innovative use of IT resources. This proxy for IT capability potentially confounds the effects of IT spending and IT capability as defined in this paper and other related studies (Bharadwaj 2000; Santhanam and Hartono 2003). As Wang and Alam (2007) acknowledge, a significant concern about using the rank order as proxy for IT capability is that methodology of *IW* 500 ranking varied from year to year during their sample period (1991, 1992, 1995–2002). For example, the ranking in some years was based solely on the size of IT installation, while in others it was based on "biggest and best users" of IT or the extent of usage of eight predefined IT categories. For the purpose of this study, we adopt measures that allow us to disentangle the effects of the two factors of interest, IT spending and IT capability.

We examine the links between IT capability and IT spending on firm performance by conducting three related sets of analyses using two archival data sets representing the immediate pre-Internet (1992–1994) and the post-Internet commercialization (1999–2006) eras. First, using Ohlson's (1995) residual income valuation framework and publicly available ratings, we investigate the relationship between IT capability and the firm's market value, which is a forward-looking, risk-adjusted measure of firm performance and reflects market *expectations* of the firm's future earnings. After controlling for book value, earnings, net dividends, advertising expense, R&D expense, prior accounting performance, and industry fixed-effects, we find that IT capability is indeed value relevant—the market values of firms with high IT capability are (statistically and economically) higher than the values of a control sample of firms without IT capability. This relationship is maintained even when the level of IT spending is included in the model. By contrast, the association between IT spending and market value is found to be statistically significant only when IT capability is not included in the model. This finding is contrary to prior empirical studies (Brynjolfsson and Yang 1997; Bharadwaj et al. 1999; Anderson et al. 2006) that examine the value of IT spending in isolation and infer a positive association between the size of IT investments and market-based measures of firm performance. Our findings suggest that it is IT capability, rather than IT spending, that is the source of IT-enabled intangible value. A series of tests show that this result is remarkably robust to variations in the control sample, sampling method, and model specifications.

Our main finding regarding the value relevance of IT capability gives rise to two additional research questions. First, does industry matter: Does the degree of value relevance hold homogeneously across industries or vary with industry type? We examine this question by focusing on high-tech industries. Following Francis and Schipper (1999), high-tech industries are those in which firms are likely to have significant unrecorded intangible assets. Such firms also operate in rapidly changing environments that make their future performance relatively more uncertain. We find that IT capability is more value relevant for firms operating in high-tech industries, albeit only in the sample covering the post-Internet period. A second question we investigate is whether IT capability is linked to *actual* future earnings, not just current market value which reflects market *expectations* of future earnings. Consistent with our value relevance results, we find that IT capability is associated with future earnings, while the level of IT spending is not.

Our study contributes to the literature across multiple disciplines in several ways. First, prior studies in accounting provide evidence that certain intangible resources, such as research and development (R&D) expenditures and patents, are valued by the market (Lev 2001; Lev and Sougiannis 1996; Hall 1993). Our study contributes to this body of literature by investigating the relation between both IT capability and IT spending, and market value of equity. However, unlike expenditure items such as advertising and R&D, separate disclosure of IT spending or IT capability is not required by GAAP, and this has clear implications for managers, investors, and financial accounting standards setters. Moreover, our study also contributes to the earnings prediction literature in accounting by examining whether IT capability is associated with future earnings.

Second, while a few conceptual papers and case studies have drawn on resource-based theory to address the question of competitive advantage from IT, we believe that, along with Powell and Dent-Micallef (1997), Bharadwaj (2000), Santhanam and Hartono (2003), Ravichandran and Lertwongsatien (2005), and Ray et al. (2005), this study represents one of the few studies that empirically tests the resource-based theory in the IT domain.

Third, our study further contributes to the literature by advancing a contingency perspective to the question of IT capability's intangible value, and by empirically examining the moderating effect of industry type on the relationship between IT capability and market value. In doing so, our study responds to the exhortations by Wade and Hulland (2004) regarding the need to consider the role of potential moderating factors that influence the IS resources/firm performance relationship in general, and Chiasson and Davidson's (2005) call to consider the role of industry, in particular, as an important contextual factor when developing and testing theory regarding IT's impact.

The rest of the paper is organized as follows. In the next section, the theoretical framework and hypotheses are developed. The model and research method used to test the hypotheses are discussed in section three. Section four describes the data and the data analysis. Section five concludes with a discussion of the results and implications for future research.

II. THEORY AND HYPOTHESES

The research reported here investigates whether investors reward firms with higher IT spending or superior IT capability through increased market valuations. To accomplish this, we draw on the resource-based theory of the firm as the primary theoretical framework. The resource-based view (RBV) (Wernerfelt 1984; Barney 1986, 1991) is the contemporary theory of competition in the strategy literature, and it seeks to explain sources of competitive advantage, sustained or otherwise. The theory ascribes competitive advantage to a firm's idiosyncratic resources—the tangible and intangible assets and capabilities that are used to implement firm strategies. According to resource-based logic, resources that are valuable but common can only be a source of competitive parity; resources that are valuable and rare can be a source of temporary competitive advantage; and resources that are valuable, rare, and costly to imitate can be a source of competitive advantage (Barney 1991). A resource can be imperfectly imitable in the presence of isolating mechanisms, such as path dependence, causal ambiguity, social complexity, or team-embodied skills (Barney 1991).

The resource-based view of the firm has been used to investigate potential sources of distinctive advantage from other intangibles, including culture (Barney 1986), total quality management (Powell 1995), and R&D capability (Yeoh and Roth 1999). Recently, IS scholars have turned to the RBV to reason about and seek better answers to the question of IT business value and competitive advantage from IT (see, for example, Mata et al. 1995; Powell and Dent-Micallef 1997; Bharadwaj 2000; Wade and Hulland 2004; Ray et al. 2005). RBV theory, therefore, seems well positioned to inform examinations of the relationship between IT capability and market value.

A firm's IT capability tends to be tacit, firm-specific, and developed over a long period of time, and it is often path-dependent and socially complex. To the extent that the tacit skills related to IT are valuable and heterogeneously distributed across firms, RBV logic suggests that these skills can be a source of a distinctive advantage which would be reflected in the firm's market value (Barney 1991). Companies with superior IT capabilities are much better at conceiving and deploying innovative firm-specific applications and managing the technical and market risks associated with the development and use of these applications. Such firms are better able to make the right IT investment, deployment, and use decisions and translate those investments into truly distinct value in terms of enhanced efficiency, improved customer service, enhanced product quality, increased agility, and improved production, logistics, and marketing decisions (Santhanam and Hartono 2003). The net result is enhanced growth and improved earnings potential. Investors may learn about a firm's IT capability through many channels (e.g., directly from the organization in the form of press releases or filings, from reports of analysts who follow the firm and compare strategies and abilities with competitors, from suppliers/consumers who have direct interaction with the organizations and may identify how a firm's IT capability has aided the organization, and through industry and trade group meetings and publications) and revise their expectation of the firm's future prospects. This knowledge, in turn, should be reflected in the firm's market value relative to competitors. The above observations lead to the following hypothesis:

H1a: IT capability is value relevant (i.e., positively associated with market value).

A higher market value because of superior IT capability reflects higher market *expectation* of future earnings. If IT capability is value relevant and the market fully and correctly impounds the IT capability, then improved performance should be reflected in *actual* future earnings. In other words, IT capability is likely to be a good predictor of future earnings, which leads to the following hypothesis:

H1b: IT capability is positively associated with future earnings.

By contrast, RBV suggests that IT spending, per se, is not likely to be value relevant. Underlying most of the studies examining the link between IT spending and firm performance is the (implicit) assumption that IT investments will necessarily lead to outcomes intended by managers (Bharadwaj et al. 1999). We believe that, while IT spending is important, there is little theoretical justification to assume that IT spending, in and of itself, will necessarily lead to intended outcomes or provide spenders a competitive advantage. For example, Nicolaou (2004) indicates that it is the management and implementation choices which are significant factors in a firm's realization of performance benefits with ERP adoption. Certainly, most managers are likely to make IT investments because they think such investments are likely to improve firm performance. But managers can be wrong and ample anecdotal evidence shows that IT project implementations can and do fail.[1] Also, there can be important agency problems resulting in technology investments that may not benefit the firm.

The arguments above are consistent with resource-based logic which suggests that raw spending on IT (in terms of hardware and software), while important, is not likely, *by itself*, to be a source of distinctive advantage (Ray et al. 2005). This is because firms typically have access to the same hardware and off-the-shelf application software, and purely technical IT labor is widely available in the factors market to all firms (i.e., by hiring employees or consultants with those skills). This is not to suggest that IT spending is not important; failure to invest in IT hardware, software, and labor, can put a firm at a competitive disadvantage. However, as Hitt and Brynjolfsson (1996) argue, to the extent that IT assets are equally available to all the participants, in a competitive market all firms will spend at a level they consider optimal in equilibrium, and no firm will gain an advantage from its spending alone Consistent with Hitt and Brynjolfsson's (1996) beliefs about a competitive market, Bharadwaj et al. (1999) find that the impact of IT investments on Tobin's q value decreases in the later years of their study; they indicate that this decrease may

[1] For a comprehensive review of IT project failure rates which are estimated to have ranged between 18–40 percent between 1994–2004, see the "CHAOS Report 2007" published by Standish Group International (2007), an independent IT research organization. Its most recent (Standish Group International 2009) global survey of IT executives found that 24 percent of projects failed outright (i.e., were either cancelled prior to completion or delivered and never used), 44 percent were challenged (i.e., were over time, over budget, and/or with fewer features than promised), and only 32 percent succeeded (delivered on time, on budget, and with stated deliverables).

result from rapid technological changes and rival firms quickly copying IT investments.[2] In short, availability of IT has become more common and IT spending in itself is not likely to explain variation in market values across firms and is not likely to predict future earnings. Thus, we do not expect to be able to reject the following *null* hypotheses:

H2a: IT spending is not value relevant (i.e., not associated with market value).

H2b: IT spending is not associated with future earnings.

Given the above hypotheses, a natural question to ask is whether investors value superior IT capability differently across industries. As noted before, prior studies have tended to ignore industry differences that may confound the results, and the few studies that control for industry fixed-effects have largely focused on the average impact across industries. At the same time, event studies examining the shareholder wealth effects of IT-related announcements suggest that the nature and significance of the impact of such announcements may differ across industries depending on the dominant role IT plays within each industry (Chatterjee et al. 2001; Im et al. 2001; Dehning et al. 2003). These findings are consistent with the resource-based view: the relative importance and value of a resource/capability depend on the competitive environment in which the firm operates. As Barney (1995, 52) observes, "Firm resources are not valuable in a vacuum, but rather are valuable only when they exploit opportunities and/or neutralize threats" in the environment in which the firm competes. It follows, therefore, that the market's recognition of the ultimate value of IT capability is contingent on industry conditions.

A setting in which we expect IT capability to be more value relevant is in high-tech industries, where firms tend to make large investments in intangibles, including IT, and the disparity between what is value relevant to investors and what is included in financial statements is potentially the widest (Amir and Lev 1996; Francis and Schipper 1999). Such firms also comparatively operate in rapidly changing environments that make their future performance relatively more uncertain. To the extent that organizational agility is vital for success in dynamic environments (Brown and Eisenhardt 1997), and consistent with the view that IT capability can generate real options and strategic flexibility (Sambamurthy et al. 2003), superior IT capability is likely to be more valuable in dynamic high-tech industries and to be perceived as such by investors. This leads to our final hypothesis:

H3: The value relevance of IT capability will be greater when the firm is in a high-tech industry.

III. RESEARCH METHODOLOGY

Measurement of IT Capability

Following the pioneering work of Bharadwaj (2000) and Santhanam and Hartono (2003), the rankings provided by *InformationWeek* in their annual *IW* 500 special issue were used in this study to identify firms with superior IT capability. Specifically, we use IT spending data as well as rankings data from two time periods, 1992–1994 and 1999–2006, representing the pre- and post-Internet eras. The use of the *IW* 500 as a data source sets the focus of our analysis on public firms with revenues greater than $250 million.

[2] The analysis reported in the Bharadwaj et al. (1999) study, which is based on separate OLS runs for each year, finds that although the coefficient on IT spending ratio is positive and significant (based on one-tailed tests) across all five years examined (1989–1993), its magnitude and statistical significance drop substantially in the last three years (from 1991 onwards). In fact, the results for the last two years (1992–1993), which partially overlap with the first period (1992–1994) examined in our study, would not be statistically significant had a two-tailed test of significance been used.

During a three year period from 1992 to 1994, *IW*[3] identified 40–60 firms (out of the 500) each year as "IT Leaders" in their respective industries. In developing those rankings, *IW* asked IT executives, together with a select group of industry analysts and IS researchers, to nominate firms that they considered to be the "most efficient and effective" in use of IT. We believe this characterization of "IT leaders" captures the soundness of the investments and the effectiveness and innovativeness with which IT assets are mobilized and deployed and is therefore an appropriate proxy for the firm's IT capability. The primary reason for limiting the data set to before 1995 is that *IW*'s criteria and methodology used to designate leaders changed starting in 1995. In 1995, *IW* developed two sets of technology leaders. The first set was developed by *IW*'s staff without explicitly identifying the criteria. The second set was selected based on financial results—using this set in our analysis would make demonstrating a link between IT leadership and market performance tautological. Therefore, for the purpose of our main analysis, and in order to facilitate comparison with prior published work, we focused on the 1992–1994 data.[4] During this period, *IW* also provided information on IT spending as a percentage of revenue; we use this information to examine the differential impact of IT capability and IT spending.

The 1992–1994 period predates the commercialization of the Internet, and so a natural question is whether the posited relationships hold in the post-Internet era. To address this question, we test our hypotheses regarding the value relevance of IT capability and IT spending using a more recent data set from *IW* covering the period 1999–2006.[5] In 1995, *IW* ceased publishing a list of "IT leaders" based on peer ratings. In 1998, however, *IW* developed a ranking based on the quality of a company's IT innovations.[6] Thus, for the 1999–2006 period, we use the rankings based on "IT innovations" as a proxy for IT capability. In 2004, *IW* modified its listing to rank only the top 100 innovators and identified these as "leaders;" *IW* named an additional 400 other companies as "challengers" to complete its listing of the top 500 IT innovators. We follow *IW*'s designation, and for the years 1999–2006, we classify companies ranked in the top 100 as IT "leaders."[7]

Thus, in both periods, we identify a firm as having superior IT capability if it appears in *IW*'s list of "leaders." In using appearance on the *IW* list as a proxy for superior IT capability, we are assuming that firms not included in *IW*'s list of leaders do not have superior IT capability. To the extent that this assumption is invalid, we decrease our ability to reject the null hypothesis (i.e., it would be more difficult to find significant difference in market value on account of differences in IT capability).

Market Valuation Model

Our main research question centers on the association between both IT capability and IT spending on the one hand and market valuation on the other. Therefore, we require a model

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[3] *InformationWeek* 500 articles published on September 21, 1992; September 27, 1993; and October 10, 1994. Nominations of efficient and effective users of IT were collected during the summer immediately prior to the publication.

[4] Bharadwaj (2000) also starts with 1992 *IW* data and includes 1995 *IW* data. She uses performance data from the last completed fiscal year and therefore refers to the data as 1991–1994. Our analysis finds similar results if we include the 1995 leaders identified by *IW*'s staff; however, given the change in methodology, we do not include the 1995 data in our primary analysis.

[5] We thank *InformationWeek* for providing us with the data on IT spending, which was not reported in the *IW* 500 issues during those years.

[6] *InformationWeek* describes the rankings as follows, "The *InformationWeek* 500 is determined by how IT organizations innovate in their use of IT" and "InformationWeek editors sought to identify and reward companies that demonstrate a pattern of technological, procedural, and organizational innovation." Information about the methodology for the *IW 500* is provided in "Where To Find Innovators," *InformationWeek*, September 14, 1998, available at: http://www.informationweek.com/700/method.htm.

[7] *IW* started its "innovation" rankings in 1998; however, IT spending data was not available for 1998. Therefore, we start our data sample with 1999 rankings.

focused on explaining the determinants of market value. We selected Ohlson's (1995) residual income valuation (RIV) framework because it has a theoretical basis and has been widely used and accepted in capital markets literature. Examples of the use of Ohlson's (1995) RIV model for examining the value relevance of non-financial components include: brand strength (Barth et al. 1998), disclosure of non-financial information (Shevlin 1996), wireless networks (Amir and Lev 1996), network traffic in e-commerce firms (Rajgopal et al. 2003), and more recently in IT contexts (Anderson et al. 2006; Wang and Alam 2007).

The RIV model starts from the basic premise that asset prices represent the present value of all future expected dividends, with investors trading current value for a future stream of expected income. The model then replaces the expected value of future dividends with the book value of equity and current earnings. This change is based on the accounting concept of clean surplus, which holds that the change in book value of equity will be equal to earnings less paid out dividends and other changes in capital contributions (Ohlson 1995). These standard assumptions produce the following model (Ohlson 1995; Rajgopal et al. 2003):

$$MVE_{jt} = \text{b}_0 + \text{b}_1 BVE_{jt} + \text{b}_2 Earnings_{jt} + \text{b}_3 Net\_Dividends_{jt} + \text{b}_4 Value\_relevant\_information + \varepsilon_{jt}, \quad (1)$$

where MVE_{jt} is the fiscal year-end market valuation for firm j for year t, BVE_{jt} is the fiscal year-end book value of equity, $Earnings_{jt}$ is net income, and $NetDividends_{jt}$ is dividends paid less changes in contributed capital (measured as sales of common and preferred stock minus purchases of common and preferred stock). Other information is said to be value relevant if it explains variation in market values beyond that captured by the book value and earnings. Our primary value-relevant variables of interest are: $IT\_Capability_{jt}$, a dummy variable taking the value of 1 if the firm is identified by *IW* as an IT "leader" in year t and taking the value of 0 otherwise; and IT_Spend_{jt}, the ratio of IT expenditures to sales for firm j in year t. We also include year dummies to control for fixed year-effects (e.g., effects of macroeconomic factors on stock prices). If correlated with the independent variables, these effects may bias the regression coefficients. Similarly, we include one-digit industry dummies to control for fixed industry-effects that may explain variation in market values across industries. To test H1a and H2a, we therefore estimate the following multiple regression model, consistent with prior research assessing the value relevance of information beyond earnings (e.g., Amir and Lev 1996; Barth et al. 1998; Rajgopal et al. 2003):

$$MVE_{jt} = \text{b}_0 + \text{b}_1 BVE_{jt} + \text{b}_2 Earnings_{jt} + \text{b}_3 Net\_Dividends_{jt} + \text{b}_4 IT\_Capability_{jt} + \text{b}_5 IT\_Spend_{jt} + industry\ dummies + year\ dummies + \varepsilon_{jt}. \quad (2)$$

To provide a stronger test, we also include advertising (*ADV*) and research and development (*R&D)* expenditures to control for potentially value-relevant intangible assets not included on the balance sheet. Furthermore, prior work using the *IW* 500 data has raised the concern that *IW* leadership designations may be influenced by an organizational halo effect (Bharadwaj 2000; Santhanam and Hartono 2003). A *performance halo effect* is said to exist when well-performing firms are selected as IT leaders based on their performance rather than on their capabilities. Bharadwaj (2000) tested for potential performance halo effects, found none, and proceeded to conduct her (univariate) analysis assuming there was no halo effect. Santhanam and Hartono (2003, 128) argue that "a more conservative approach to addressing the halo effect is to assume that a halo effect does exist, and then determine the impact of IT capability on financial performance, after adjusting for the halo effect." We follow this approach in our analysis. Specifically, consistent with Wang and Alam (2007), we include return-on-asset of prior year (ROA_{jt-1}) to control for the possible halo effect of prior performance; we also include Sales (*S*) to control for firm size. Additionally, we include the one-year sales growth rate (*SG*) as a proxy for future earnings growth and book-to-market value ratio (*BM*) as an additional control for future growth potential. Thus, our final model is as follows:

$$MVE_{jt} = b_0 + b_1 BVE_{jt} + b_2 Earnings_{jt} + b_3 Net\_Dividends_{jt} + b_4 IT\_Capability_{jt} + b_5 IT\_Spend_{jt} + b_6 ADV_{jt} + b_7 R\&D_{jt} + b_8 ROA_{jt-1} + b_9 S_{jt} + b_{10} SG_{jt} + b_{11} BM_{jt} + industry\ dummies + year\ dummies + \varepsilon_{jt}. \quad (3)$$

Accounting Earnings Models

To test H1b and H2b regarding the association of IT capability and IT spending with actual future earnings, we estimate an earnings prediction model that combines the elements of two earnings prediction approaches used in the literature. One prior approach models future earnings as a linear function of tangible and intangible assets and a measure of growth/risk (e.g., book-to-market) (Lev and Sougiannis 1996; Rajgopal et al. 2003). An alternative approach, which is based on examinations of the time-series properties of annual earnings, suggests that earnings follow a random walk (or random walk with drift) process (Albrecht et al. 1977; Watts and Leftwich 1977). By combining these two approaches, our model for future earnings accounts for firm assets as well as the historical earnings of those assets, consistent with recent work (Kobelsky et al. 2008):

$$FutureEarnings_{jt} = b_0 + b_1 ADV_{jt} + b_2 R\&D_{jt} + b_3 BM_{jt} + b_4 ROA_{jt-1} + b_5 S_{jt} + b_6 SG_{jt} + b_7 IT\_Capability_{jt} + b_8 IT\_Spend_{jt} + industry\ dummies + year\ dummies + \varepsilon_{jt}. \quad (4)$$

We use the average of return on assets (*ROA*) over three years as the measure of future earnings.[8] The consideration of multiple years into the future allows for a possible lag between investments in IT or IT capability and realization of potential value. Advertising and R&D are included in the model to account for intangible assets, and both measures are scaled by sales, as is the IT spending variable. In order to test H2a and H2b, our two variables of interest (*IT_Capability* and *IT_Spend*) are included as predictors in the model. Finally, as in Equation (3), sales (*S*), book-to-market (*BM*), and sales growth (*SG*) are included as proxies for size and growth and additional controls for possible halo effects.

Sample Selection and Data

As explained earlier, we test our hypotheses using two data samples covering two distinct periods: 1992–1994 and 1999–2006. For each sample, a firm is included as an observation each year that it appears on the *IW* 500 annual list during the corresponding period.[9] The Compustat database is used to collect financial information for those *IW* 500 firms (both "leaders" and "non-leaders"), for a final total of 654 firm-year observations in the pre-Internet (1992–1994) sample and 2,252 firm-year observations for the post-Internet (1999–2006) sample.

Table 1, Panels A and B, provide descriptive statistics and show the bivariate correlations between variables included in our analysis for each of the two periods. The bivariate correlations are consistent with prior literature in that we find in both time periods that the theoretical control

[8] We use the average of reported ROA over three years as the dependent variable. Given that our data sample for the second period extends to 2006, there are some firms that may have less than three years of reported future earnings. If we reduce the data set to firms with three future years of reported ROA, we obtain qualitatively similar results.

[9] As discussed later in the robustness testing section, the results did not change when the observations pertaining to "leader" firms are limited to the year a firm is *first* designated as leader.

TABLE 1
Sample Descriptive Statistics

Panel A: Descriptive Statistics and Correlation Table for the First Period (1992–1994)

	Mean	Std. Dev.	MVE	BVE	Earnings	Net_Dividends	ADV	R&D	BM	ROA_{t-1}	S	SG	IT_Capability
MVE	6283.6	8905.2	1.00										
BVE	2865.4	3335.3	0.774*	1.00									
Earnings	204.2	742.1	0.214*	0.043	1.00								
Net_Dividends	−165.8	384.9	0.697*	0.655*	0.227*	1.00							
ADV	.011	.025	0.196*	0.012	0.072***	0.063	1.00						
R&D	.017	.033	0.236*	0.124*	−0.041	0.189*	0.212*	1.00					
BM	.591	.326	−0.292*	0.015	−0.129*	−0.181*	−0.208*	−0.143*	1.00				
ROA_{t-1}	.031	.080	0.128*	0.003	0.119*	0.144*	0.177*	0.087**	−0.123*	1.00			
S	7447.1	9444.3	0.718*	0.835*	−0.092*	−0.480*	0.075***	0.110*	−0.020	−0.033	1.00		
SG	1.04	.146	0.038	−0.081**	0.095**	−0.105*	0.067	0.077***	−0.261*	−0.083**	−0.097**	1.00	
IT_Capability	.143	.351	0.327*	0.305*	0.064	0.186*	0.001	0.115*	−0.044	0.023	0.286*	0.066***	1.00
IT_Spend	.023	.017	0.165*	0.243*	0.010	0.128*	−0.076***	0.175*	0.058	−0.063	0.132*	−0.001	0.224*

Sample size: 654

Panel B: Descriptive Statistics and Correlation Table for the Second Period (1999–2006)

	Mean	Std. Dev.	MVE	BVE	Earnings	Net_Dividends	ADV	R&D	BM	ROA_{t-1}	S	SG	IT_Capability
MVE	15260	36107	1.00										
BVE	4381	7776	0.752*	1.00									
Earnings	584.7	1680	0.645*	0.646*	1.00								
Net_Dividends	344.9	961.1	0.603*	0.599*	0.612*	1.00							
ADV	0.009	0.027	0.066*	−0.002	0.039***	0.103*	1.00						
R&D	0.026	0.094	0.114*	0.047**	0.008	0.037***	−0.004	1.00					
BM	0.555	.631	−0.179*	−0.076*	−0.149*	−0.129*	−0.083*	−0.099*	1.00				
ROA_{t-1}	.041	0.289	0.024	−0.004	0.027	0.034	0.027	−0.055*	−0.061*	1.00			
S	10580	19823	0.563*	0.705*	0.506*	0.488*	0.007	−0.008	−0.054**	−0.005	1.00		
SG	1.09	0.266	0.093*	0.056*	0.072*	−0.054**	−0.028	0.352*	−0.109*	−0.023	0.059*	1.00	
IT_Capability	.241	.427	0.158*	0.149*	0.120*	0.127*	−0.045**	0.027	−0.032	−0.019	0.183*	0.017	1.00
IT_Spend	0.039	0.071	0.043**	0.061*	0.043**	0.032	0.003	0.011	−0.067*	−0.008	−0.006	0.011	0.073*

Sample size: 2252

(continued on next page)

TABLE 1 (continued)

*, **, *** p<.01, <.05, and p<.1, respectively.

Variable Definitions:

MVE = market value of equity (price * shares);
BE = book value of equity;
Earnings = earnings before extraordinary income;
Net_Dividends = common dividends + purchase of stock–sale of stock;
ADV = advertising expense/sales;
R&D = research and development expense/sales;
BM = book-to-market ratio: book value of equity/market valuation;
ROA_{t-1} = one-year-lagged return-on-asset: earnings before extraordinary income for firm *j* in year *t*−1/assets for firm *j* in year *t*−1;
S = sales;
SG = one-year sales growth rate: sales for firm *j* in year *t*/sales for firm *j* year *t*−1;
IT_Capability = dummy coded as 1 if the firm is designated as an IT leader; and
IT_Spend = IT spending/sales.

variables included in Ohlson's (1995) RIV model are significantly associated with market value. Additionally, the correlations between market valuation and both IT capability and IT spending ratio are significant in both time periods.

IV. RESULTS

The Value Relevance of IT Capability and IT Spending

Table 2, Panel A provides the ordinary least-squares (OLS) estimates for model (2), examining the association between IT (capability and spending) and market value for the pre-Internet period (1992–1994). The first column gives the results from the Ohlson (1995)/RIV base model; consistent with prior results in the accounting literature, book value of equity and net dividends are significantly associated with market value. The second column shows the results after adding IT capability to the model; the coefficient for IT capability is positive and significant, indicating that the firms designated as "IT leaders" (our proxy for IT capability) have higher market values than the non-leaders in the sample. We also find that IT spending is significant when included separately (Column 3); however, IT spending becomes insignificant when IT capability is also included in the model (Column 4).

The results (Column 5) do not qualitatively change when we also control for advertising, R&D expense, prior ROA, sales, book-to-market ratio, and sales growth. As expected, the two proxies for growth, *SG* and *BM*, are positively and negatively associated with market valuation, respectively. The other proxies for halo effect (one-year-lagged return-on-asset, *ROA*) and size (Sales, *S*) are both positively associated with the market value of equity. Again, after controlling for all those factors, the coefficient on IT capability is positive and significant; whereas, the coefficient on IT spending is statistically insignificant.[10] On average, superior IT capability seems to account for about \$1.6 billion in additional market valuation (Column 5). This result further increases our confidence that IT capability is value relevant and provides incremental explanatory power beyond traditional accounting information and other control variables in the extant valuation literature. Hypothesis 1a is therefore strongly supported. At the same time, consistent with resource-based theory and our expectations, these results do not allow us to reject the null H2a regarding the lack of association between IT spending and market values.

Table 2, Panel B documents the results of our analysis for the post-Internet period, 1999–2006. As the table shows, our inferences remain unchanged. IT capability is statistically ($p < 0.01$) and economically value relevant even after controlling for IT spending and other relevant controls (advertising, prior ROA, R&D, sales, book-to-market ratio, and sales growth). The results with regard to IT spending are even stronger in this sample; the coefficient on IT spending is not statistically significant even when IT capability is not included in the model. The results from this analysis are consistent with our earlier findings using the original (1992–1994) data set of IT leaders, lending further support to our hypothesis regarding the value relevance of IT capability. These results suggest that while actual hardware and software may have become cheaper and commodity-like, superior IT capability continues to be a source of distinctive advantage.

Robustness Checks

Appropriate specification of Ohlson's (1995) RIV model has been discussed within the accounting literature due to the potential scale effects associated with market capitalization. To address scale, some authors have suggested deflating variables by a size-related metric while others have suggested that it would be best to simply add a control for size (Barth and Kallapur

[10] Statistical tests also showed that the interaction of IT capability and IT spending was not related to market value.

TABLE 2
Ohlson RIV Results

Panel A: Regression Results for the Ohlson (1995)/RIV Model for 1992–1994[a]

Variable	Base Model for *IW* 500 Sample Estimate (p-value)	*IW* 500 Sample w/IT Capability Estimate (p-value)	*IW* 500 Sample w/IT Spending Estimate (p-value)	*IW* 500 Sample w/IT Capability and IT Spending Estimate (p-value)	*IW* 500 Sample w/IT Capability, IT Spending and Controls Estimate (p-value)
Constant	368.31	1117.11	635.03	907.16	255.41
	(.898)	(.233)	(.522)	(.355)	(.886)
BVE	1.57	1.49	1.54	1.47	.735
	(.000)	(.000)	(.000)	(.000)	(.032)
Earnings	1.55	1.49	1.56	1.50	1.58
	(.194)	(.211)	(.190)	(.209)	(.083)
Net_Dividends	5.92	6.05	5.92	6.03	5.07
	(.004)	(.003)	(.004)	(.004)	(.011)
IT_Capability		2496.46		2344.50	1675.73
		(.017)		(.025)	(.040)
IT_Spend			27489.02	17682.17	−2812.03
			(.040)	(.155)	(.778)
ADV					28132.1
					(.001)
R&D					28579.67
					(.009)
Prior ROA					4751.07
					(.026)
BM					−5092.4
					(.000)
S					.341
					(.006)
SG					2544.50

(continued on next page)

TABLE 2 (continued)

Panel A: Regression Results for the Ohlson (1995)/RIV Model for 1992–1994[a]

Variable	Base Model for *IW* 500 Sample Estimate (p-value)	*IW* 500 Sample w/IT Capability Estimate (p-value)	*IW* 500 Sample w/IT Spending Estimate (p-value)	*IW* 500 Sample w/IT Capability and IT Spending Estimate (p-value)	*IW* 500 Sample w/IT Capability, IT Spending and Controls Estimate (p-value)
					(.032)
Adjusted R^2	.68	.70	.69	.70	.79

Sample size: 654
Dependent variable is *MVE*= market value of equity (price $*$ shares).

Panel B: Regression Results for the Ohlson (1995)/RIV Model for 1999–2006[b]

Variable	Base Model for *IW* 500 Sample Estimate (p-value)	*IW* 500 Sample w/IT Capability Estimate (p-value)	*IW* 500 Sample w/IT Spending Estimate (p-value)	*IW* 500 Sample w/IT Capability and IT Spending Estimate (p-value)	*IW* 500 Sample w/IT Capability, IT Spending and Controls Estimate (p-value)
Constant	72635.5	72698.51	72579.83	72650.18	69526.07
	(.081)	(.079)	(.081)	(.079)	(.103)
BVE	2.43	2.41	2.42	2.41	2.43
	(.000)	(.000)	(.000)	(.000)	(.000)
Earnings	4.4	4.37	4.4	4.37	4.15
	(.034)	(.034)	(.034)	(.034)	(.037)
Net_Dividends	5.85	5.74	5.85	5.75	5.62
	(.006)	(.007)	(.006)	(.007)	(.007)
IT_Capability		4075		4017.34	3980.37
		(.005)		(.006)	(.008)

(continued on next page)

TABLE 2 (continued)

Panel B: Regression Results for the Ohlson (1995)/RIV Model for 1999–2006[b]

Variable	Base Model for *IW* 500 Sample Estimate (p-value)	*IW* 500 Sample w/IT Capability Estimate (p-value)	*IW* 500 Sample w/IT Spending Estimate (p-value)	*IW* 500 Sample w/IT Capability and IT Spending Estimate (p-value)	*IW* 500 Sample w/IT Capability, IT Spending and Controls Estimate (p-value)
IT_Spend			8164.91 (.408)	6597.68 (.490)	3200.41 (.748)
ADV					29333.17 (.113)
R&D					20050.5 (.806)
Prior*ROA*					1757.92 (.812)
BM					−4373.01 (.009)
S					−.017 (.882)
SG					3367.76 (.614)
Adjusted R^2	0.66	0.67	0.66	0.67	0.68

Sample size: 2252

Dependent variable is *MVE*=market value of equity (price ∗ shares).

(continued on next page)

TABLE 2 (continued)

[a] Regression models include year and industry dummies, which are not tabulated. Robust standard errors are used to correct for potential heteroscedasticity (White 1980). The residuals for all the models satisfied distributional assumptions. Multicollinearity, as indicated by variance inflation factors, was consistently low.

[b] Regression models include year and industry dummies, which are not tabulated. Robust standard errors are used to correct for heteroscedasticity. The residuals for all the models satisfied distributional assumptions. Multicollinearity, as indicated by variance inflation factors, was consistently low.

Variable Definitions:

BVE = book value of equity;
Earnings = earnings before extraordinary income;
Net_Dividends = common dividends + purchase of stock–sale of stock;
ADV = advertising expense/sales;
R&D = research and development expense/sales;
BM = book-to-market ratio: book value of equity/market valuation;
ROA_{t-1} = earnings before extraordinary income for firm *j* in year $t-1$/assets for firm *j* in year $t-1$;
S = sales;
SG = one-year sales growth rate: sales for firm *j* in year *t*/sales for firm *j* year $t-1$;
IT_Capability = dummy coded as 1 if the firm is designated as an IT leader; and
IT_ Spend = IT spending/sales.

1996; Easton and Sommers 2003). The literature has also discussed whether net income or income before extraordinary items is the more appropriate way to measure earnings (Ohlson 1999). The use of net income is consistent with the models' assumption of clean surplus; however, net income may include income that is not consistent across years and is therefore difficult to use for predicting future earnings (Shroff 1999).

To determine if our primary regression results are sensitive to the above issues, we reran our model using alternative specifications where the variables are scaled by two size-related metrics (shares, assets).[11] We also tested specifications in which we included alternative controls for size (sales versus assets). Additionally, we reran the models using operating income instead of net income. In all these cases, the regression results mirror those reported in the paper, with the coefficient on IT capability remaining positive and statistically significant and the coefficient on IT spending remaining insignificant.

Another potential concern is that our results might be driven by outliers. To address this concern, we trimmed each sample by the top and bottom 1 percent and reran the analysis. We also examined studentized residuals and Cook's D measures and used standard cutoffs to trim the samples for each regression. The results are again qualitatively unchanged from the results presented, with the coefficient on IT capability remaining positive and statistically significant and that on IT spending remaining insignificant.

Our specification of the Ohlson model includes earnings and IT spending; however, it is likely that some portion of the IT spending has been expensed and is impounded within the reported earnings. Therefore, we added IT spending to the reported earnings to create an estimate of earnings before IT spending and reran our model. Our inferences remain unchanged.

We also investigated the robustness of the results with respect to different control samples generated using a matched sample methodology in which each leader firm is paired with a control firm in the same two-digit SIC industry code with similar size (average sales over a five-year period) and closest book-to-market ratio. However, since IT spending data is not available for firms outside the *IW* 500, this approach allows us to test the robustness of our results with respect to IT capability only. Additionally, following Santhanam and Hartono (2003), we reran our main model using a control sample that consists of *all* the firms in the same two-digit SIC code within +/−30 percent of the five year sales average. In all cases, the results were not materially different from those shown in Table 2, Panels A and B, further increasing our confidence in our findings.

Finally, we also examined the robustness of our findings to changes in the IT capability proxy designation. Our primary approach was to consider each firm-year listing as a leader in *IW* as an independent observation. To determine if our results are sensitive to this treatment, we reran our main model using observations only from the year a firm was first listed as a leader in the *IW* 500. Again, the results were consistent with those reported in Table 2, Panels A and B with respect to sign and significance of the *IT_Capability* and *IT_Spend* variables.

Association of IT (Capability and Spending) with Future Earnings

Table 3 presents the OLS estimates from the future earnings model (Equation (4)) for each of the two time periods examined.

For both time periods, the results indicate that IT capability is a significant predictor of positive future earnings, while IT spending is not.[12] In order to mitigate concerns that these results

[11] Scaling by the number of shares outstanding results in price being the dependent variable. Scaling by assets creates a dependent variable similar to Tobin's q. We additionally ran our analysis using a Tobin's q framework based on Bharadwaj et al. (1999) and find qualitatively similar results.

[12] In an untabulated result, we did find IT spending to be significant when considered by itself in the 1999–2006 data period; however, when IT capability is added to the model, IT spending is insignificant.

TABLE 3
Results of Regression of IT and Future Earnings

Variable	1992–1994 *IW* 500 Sample Estimate (p-value)	1999–2006 *IW* 500 Sample Estimate (p-value)
Constant	−.021	.050
	(.499)	(.089)
ADV	−.039	.246
	(.586)	(.000)
R&D	.323	−.185
	(.004)	(.000)
Prior*ROA*	.420	.011
	(.000)	(.133)
IT_Capability	.008	.009
	(.077)	(.042)
IT_Spend	−.102	.025
	(.321)	(.338)
BM	−.043	−.036
	(.000)	(.000)
S	−.001	−.001
	(.009)	(.277)
SG	.057	.005
	(.026)	(.511)
Sample Size	654	2252
Adjusted R^2	.58	.13

Dependent variable is future earnings, the average of return on assets (*ROA*) over three years.

Variable Definitions:
ADV = advertising expense/sales;
R&D = research and development expense/sales;
BM = book-to-market ratio: book value of equity/market valuation;
ROA_{t-1} = earnings before extraordinary income for firm *j* in year *t*−1/assets for firm *j* in year *t*−1;
S = sales;
SG = one-year sales growth rate: sales for firm *j* in year *t*/sales for firm *j* year *t*−1;
IT_Capability = dummy coded as 1 if the firm is designated as an IT leader for 1992–1994, or *IW* top 100 for 1999–2006; and
IT_Spend = IT spending/sales.

might be driven by outliers, we trimmed the top and bottom 1 percent of the observations based on the dependent variable and reran the models. Results of estimation using the trimmed sample were qualitatively similar to those presented in Table 3. Overall, these results provide strong support for H1b regarding the association of IT capability and future earnings, and the results regarding IT spending are also consistent with expectations (H2b).

Valuation of IT Capability Across Industries

To test H3 regarding differences in value relevance across industries, we re-estimate the full valuation model (Equation (3)) after including a dummy variable, *High_Tech*, and interacting that variable separately with each of our two variables of interest (*IT_Capability* and *IT_Spend*). The *High_Tech* variable is coded as 1 for firms in high-tech industries, and 0 otherwise, following the widely used classification approach suggested by Francis and Schipper (1999).[13] Table 4 shows the regression results for each period. In both periods, the coefficient on the interaction term between *High_Tech* and *IT_Spend* is not significant, consistent with expectations. At the same time, while the coefficient on the interaction term between *High_Tech* and *IT_Capability* is positive, it is insignificant for the 1992–1994 sample; that coefficient, however, is found to be positive and significant for the 1999–2006 sample. Thus, while our analysis finds no significant differences in the value relevance of IT capability across the two industries during the pre-Internet period, the results show that IT capability is valued significantly higher for high-tech firms during the post-Internet period. We also reran our analysis by trimming the top and bottom 1 percent of the data set. The results are consistent in that the interaction terms are insignificant in the pre-Internet sample, and only the high-tech and IT capability interaction term is significant in the post-Internet sample.

Two power-related factors may explain the mixed findings across the two sample periods. First, sample composition appears to have changed overtime, with high-technology firms making up a larger proportion of the sample in the post-Internet "new economy" period compared to the pre-Internet period (29 percent versus 24 percent). Second, with the rise of the Internet, the transformative role of IT (and hence value of superior IT capability) is likely to have become even more pronounced (effect size) in the increasingly dynamic and turbulent high-technology industries. These two factors combine to make it more likely to detect differences in the degree of value relevance of IT Capability across the two industry types in the sample covering the post-Internet period.

V. CONCLUSION

This paper had three primary objectives. The first was to argue that examination of the business value of IT at the firm-level should simultaneously consider potential differential effects of IT spending and IT capability and their impact on forward-looking measures of firm performance. The second objective was to empirically test the propositions that IT capability is an intangible asset that is value relevant and informative about actual future income, while IT spending is not. The third objective was to empirically test whether industry context matters. Our results suggest that, on average, investors reward firms with superior IT capability through increased market value, in recognition of the potential positive impact on the risk and magnitude of the firm's future income stream. Further, IT capability appears to be more value relevant for firms operating in high tech industries in the post-Internet era.

The resource-based theory asserts that in the search for sources of distinctive competitive advantage, it will often be helpful to look to intangible rather than tangible resources. Our empirical findings are consistent with resource-based expectations: Tacit, path-dependent, and socially complex IT capability is positively related to market value, while an explicit resource such as IT spending is not. Thus, this paper also adds to the growing number of empirical tests of resource-base logic, in general, and to the application of resource-based theory to the IT domain, in particular. Moreover, our analysis adds to the body of work in accounting examining the role of intangible assets by showing that superior IT capability contributes to the unrecorded intangible

[13] According to the classification used in Francis and Schipper (1999), high-tech industries include the following SICs: 283 (Drugs); 357 (Computer and Office Equipment); 360 (Electrical Machinery and Equipment, Excluding Computers); 361 (Electrical Transmissions and Distribution Equipment); 362 (Electrical Industrial Apparatus); 363 (Household Appliances); 364 (Electric Lighting and Wiring Equipment); 365 (Household Audio, Video Equipment, Audio Receiving); 366 (Communication Equipment); 367 (Electronic Components, Semiconductors); 368 (Computer Hardware); 481 (Telephone Communications); 737 (Computer Programming, Software, Data Processing); and 873 (Research, Development, Testing Services).

TABLE 4

Ohlson (1995)/RIV Model with High-Tech Interactions[a]

Variable	1992–1994 *IW* 500 Sample w/Interactions Estimate (p-value)	1999–2006 *IW* 500 Sample w/Interactions Estimate (p-value)
Constant	472.39	70299.95
	(.786)	(.103)
BVE	0.702	2.32
	(.038)	(.000)
Earnings	1.67	4.11
	(.064)	(.038)
Net_Dividends	−4.98	5.18
	(.013)	(.014)
IT_Capability	550.31	1239.51
	(.464)	(.295)
IT_Spend	−12032.82	4121.79
	(.188)	(.811)
ADV	26671.84	32371.61
	(.002)	(.071)
R&D	22853.99	11896.24
	(.039)	(.873)
Prior ROA	4988.50	1440.19
	(.027)	(.859)
BM	−4853.39	−3718.45
	(.000)	(.008)
S	.345	.028
	(.004)	(.783)
SG	2301.46	4385.91
	(.055)	(.430)
High _Tech	9.86	6580.87
	(.990)	(.051)
IT_Capability ∗ *High_Tech*	3082.28	8166.78
	(.145)	(.037)
IT_Spend ∗ *High_Tech*	19825.63	−8753.80
	(.351)	(.625)
Sample Size	654	2252
Adjusted R^2	.80	.68

Dependent variable is *MVE*= market value of equity (price ∗ shares).

[a] Regression models include year and industry dummies which are not reported. Robust standard errors are used to correct for heteroscedasticity. The residuals for all the models satisfied distributional assumptions. Multicollinearity, as indicated by variance inflation factors, was consistently low.

Variable Definitions:

BVE = book value of equity;
Earnings = earnings before extraordinary income;
Net_Dividends = common dividends paid + purchase of stock - sale of stock;
ADV = advertising expense/sales;
R&D = research and development expense/sales;
BM = book-to-market ratio: book value of equity/market valuation;

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TABLE 4 (continued)

ROA_{t-1} = earnings before extraordinary income for firm j in year $t-1$/assets for firm j in year $t-1$;
S = sales;
SG = one-year sales growth rate: sales for firm j in year t/sales for firm j year $t-1$;
IT_Capability = dummy coded as one if the firm is designated as an IT leader for 1992–1994, or *IW* top 100 for 1999–2006;
IT_Spend = IT spending/sales; and
High_Tech = a dummy variable coded as 1 for firms in high-tech industries.

asset value of companies. As our results are sustained across two periods even after we control for industry and year fixed-effects as well as the levels of spending on adverting and R&D, we conclude that the distinctive value from IT rests on how IT is deployed and used within an organization, and that IT capability, rather than IT spending, is the primary source of IT-enabled intangible value. These results also explain, at least in part, the mixed empirical findings with respect to IT spending, and are also consistent with Weill's (1993) "IT conversion effectiveness" argument to account for the failure of some firms to translate their IT spending into distinctive advantages.

One limitation of this study is that our operationalization of IT capability is indirect, relying on perceptual ratings. Our analysis of *IW*'s methodology and prior halo effect testing (see Bharadwaj et al. 1999) provides assurances regarding the quality of this indirect proxy measure. And throughout our analysis we control for the effects of prior financial performance as well as size, advertising and R&D expense, which may create a recognition halo effect. However, future research should focus on developing and longitudinally tracking direct measures of IT capability. Indeed, the development of a reliable, standardized measure of IT capability that can be disclosed as a footnote to financial statements would allow firms to recognize an important intangible asset and provide investors with additional value-relevant information. Aside from these measurement issues, research is also needed to gain insights into the institutional factors and practices that foster the development and growth of IT capability within firms.

An additional limitation concerns the question of the sustainability of IT capability. In this regard, it is important to note that "sustainability," as used in the strategy literature and by RBV scholars, does not refer to a particular period of time. Instead, "sustainability" depends on the possibility and extent of competitive duplication. As Barney (1991, 103) states "it is not this period of time that defines the existence of a sustained competitive advantage, but the inability of current and potential competitors to duplicate that strategy that makes a competitive advantage sustained." That being said, the cross-sectional nature of our main analysis does not provide a direct test of sustainability. This does not mean that the advantages identified are not sustainable. The cross-sectional nature of the analysis simply does not allow us to say definitively that they are sustainable; the advantages might be temporary. However, we argue that the advantages we are studying and are detecting are likely to be sustained. First, the dependent variable in Ohlson's (1995) RIV model is market value, a future-looking, risk-adjusted measure of performance that reflects market expectations of the firm's future earnings. If IT capability was imitable, it would almost certainly have been quickly imitated, and the level of observed heterogeneity would not have been as significant as the evidence shows. Second, we also document a link between IT capability and actual future earnings—not just current market value, which reflects market expectations of future earnings. This suggests that the competitive advantages we detected are sustained. A related limitation is that although our analysis shows that IT capability is value relevant above and beyond other variables in extant valuation models, our data set and cross-sectional research design do not allow us to address the question of causality directly, either through some sort of time series or through the use of two-stage least-squares or some other instrumental variables approach. The theory predicts cause and effect; however, we are only able to show associations.

For practitioners, our study highlights the important role of IT management in making the right investment decisions, translating IT expenditures into business value. It also provides evidence that IT capability does matter strategically, rebutting Carr's (2003) broad assertion that IT is no longer a strategic resource. Our findings suggest that while IT spending might be necessary to achieve strategic parity, companies should focus on building superior IT capabilities. We also find evidence which suggests that IT capability is associated with future earnings. These findings have implications on IT-related disclosure strategy for firms and disclosure policy for regulators. Finally, our study also provides evidence that the external environment is a significant contingency, empirically reinforcing the broader perspective articulated in prior studies regarding the need for considering the IT-related industry-specific factors in theoretical models aimed at understanding the potential strategic value of IT.

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