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CORPORATE GOVERNANCE AND RETURNS ON INFORMATION TECHNOLOGY INVESTMENT: EVIDENCE FROM AN EMERGING MARKET†

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Prior studies have reported mixed findings on the impact of corporate information technology (IT) investment on firm performance. This study investigates the effect of corporate governance, an important management control mechanism, on the relation between IT investment and firm performance in the Taiwanese electronics industry. Specifically, we explore board independence and foreign ownership, which have increasingly become salient factors concerning corporate governance in emerging markets. We address their roles across firms of different sizes and in industries where degrees of competitiveness run a wide gamut. Our results show a positive moderating effect of board independence on the IT investment-firm performance relation, especially when competition intensifies. Furthermore, we find that the greater the foreign ownership in small firms, the more positive the IT investment-firm performance relation, suggesting that foreign investors may bring IT expertise to help small firms reap the benefits of using IT.

resources from the external environment (e.g., Dalton *et al*., 1998: 273). Using this integrated lens, prior research examines whether corporate governance can improve specific managerial decisions (Denis and McConnell, 2003). Our study builds on this strand of research in an effort to address the specific managerial activity of IT investment. Such study has been lacking in corporate governance research.

Second, the resource-based view (RBV) also motivates us to examine the joint effect of corporate governance and IT investment. The RBV argues that 'it is inappropriate to conclude that access to capital, per se, is a source of competitive advantage' (Mata, Fuerst, and Barney, 1995: 496) and has long noted the critical role of resource complementarity in improving firm performance (Barney, 1991; Peteraf, 1993). Rooted in RBV, recent research on IT returns emphasizes organizational resources complementary to IT, including organizational structures and policies in making IT investment (Melville, Kraemer, and Gurgaxani, 2004). Corporate governance represents organizational structures at the governance level and determines corporate policies and rules, which therefore may stand out as a complementary resource for IT investment. But, to date, corporate governance has received little attention in research on IT returns, as indicated by several reviews of that literature (Chan, 2000; Kohli and Devaraj, 2003; Melville *et al*., 2004).

This study focuses on the electronics industry in an emerging economy, Taiwan. We choose this research setting for two theoretical reasons. First, according to agency theory, IT managers may overinvest to accumulate excessive IT assets for their own interests (Fama and Jensen, 1983; Jensen and Meckling, 1976), and they may imitate each other even if imitation deviates from optimal investment decisions (e.g., Graham, 1999; Scharfstein and Stein, 1990). In a recent interview, Soumitra Dutta, dean of external relations at INSEAD, stated: 'We are finding the tech people tend to focus on the 'new'—finding a business case for the 'new.' Very little thought goes into the benefit' (Stafford, 2007). Given that emerging markets generally have weak judicial systems to protect shareholders' rights (Fan and Wong, 2005; Klapper and Love, 2004; Lemmon and Lins, 2003), internal corporate governance mechanisms (e.g., boards of directors) may play a significant role in aligning managers' and shareholders' interests (e.g., La Porta, Lopez-de-Silanes, and Shleifer, 1999; Shleifer and Vishny, 1997).

Second, firms in emerging markets may lack knowledge and expertise in IT management, which

that intense competition may make the monitoring role of corporate boards more desirable, or competition itself may serve as a bonding mechanism to mitigate agency problems (e.g., Scharfstein, 1988; Schmidt, 1997). Therefore, we extend the line of research on board independence by investigating its role across industries. Second, we investigate *foreign ownership*—that is, the share of foreign investment in a firm's common stock (Claessens *et al*., 2000; Douma *et al*., 2006). Foreign investors' knowledge and experience in deploying IT may benefit companies in emerging markets, which is the so-called 'spillover' of IT management expertise (Aitken and Harrison, 1999). We further compare the role of foreign ownership between large and small firms, given different resource endowments across firms of different sizes (Damanpour, 1996; Forman, 2005; Zhu *et al*., 2006). We empirically examine the above factors based on a sample of 719 Taiwanese companies from 2001 to 2005.

Our study contributes to the literature in four different ways. First, our research offers a new insight into why prior studies report mixed findings on the relation between IT and performance (e.g., Kohli and Devaraj, 2003). As evident in our results, the relation between IT and performance is moderated by corporate governance. Specifically, the higher the board independence, the more positive the relation, suggesting that internal advising and monitoring mechanisms can help companies achieve IT returns. Also, foreign ownership can mitigate resource disadvantages of small firms by contributing IT expertise to help them manage IT more effectively. Together these results reveal specific conditions under which IT investment may lead to competitive advantage.

Second, this work has an important implication for research on board composition. The extant literature has generated *mixed* findings about the impact of board composition on firm performance, as indicated by several literature review papers.[3] Dalton *et al*. (1998: 284) suggest: 'We are not optimistic that future research in the general areas of board composition/financial performance. . . would be fruitful. Also, the evidence would not seem to provide much confidence in further examinations of possible moderating influences on those relationships.' Yet, we find that the interaction between board independence and IT investment is significantly associated with better firm performance. To our knowledge, this work is the first to examine the role of board independence in IT investment. Our finding suggests that investigating the role of board composition in specific investment activities can be a promising direction for future research.

Third, we find that the moderation effect of board independence on IT returns is salient in more competitive rather than less competitive industries. This finding suggests that controlling principal/agent conflicts through board monitoring may be more beneficial as competition intensifies. The relation between competition and monitoring has received attention in modeling papers (e.g., Scharfstein, 1988; Schmidt, 1997), but the literature falls short of empirical evidence. Our work contributes to this burgeoning literature by relating the role of corporate governance to industry competition.

Fourth, our results shed light on corporate governance in an international setting. 'For many countries, there is only limited empirical evidence regarding issues related to the effectiveness of boards of directors. . .for some there is no evidence at all' (Denis and McConnell, 2003: 9). In addition to the board of directors, we have also examined factors specific to an emerging market. Foreign ownership, according to our results, does not benefit all domestic firms. We find a positive relation of foreign ownership to IT returns for small firms and those with low excess control. These findings help bridge the literature gap.

LITERATURE REVIEW

IT investment and firm performance

Prior studies relate firm performance to either annual IT investment or accumulated IT stock. Annual IT investment includes hardware, software, and costs related to maintenance, personnel, and

[3] A review of empirical papers in the 1980s concludes: 'In summary, research on the potential impact of outside directors' representation on corporate performance yields mixed results' (Zahra and Pearce, 1989: 316). Meta-analyses in the 1990s also report mixed findings about the link between board structures and firm performance. For instance, Dalton *et al*. (1998: 278) show 'results of the meta-analysis for board composition and financial performance. . . for all samples considered simultaneously (159 samples, n = 40,160) indicate little support for a systematic relationship of this type.' A more recent literature review (Hermalin and Weisbach, 2003: 20), again, finds that 'board composition is not related to corporate performance,' which is confirmed by another recent literature review (Denis and McConnell, 2003: 6).

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training (Chari, Devaraj, and David, 2008; Kobelsky *et al*., 2008). IT stock consists of accumulated hardware capital and the capitalized value of IT labor spending (Dewan, Shi, and Gurbaxani, 2007; Hitt and Brynjolfsson, 1996).[4] In the literature on IT returns, firm performance refers to accounting-based operating performance or the stock market-based assessment of firm value (e.g., Anderson, Banker, and Ravindran, 2006; Chari *at al*., 2008). The accounting-based performance is either the current period performance (e.g., Hitt and Brynjolfsson, 1996; Tam, 1998) or future performance (e.g., Anderson *et al*., 2006; Kobelsky *et al*., 2008). Based on these various measures, the relation between IT investment and firm performance is found to be elusive (Kobelsky *et al*., 2008; Kohli and Devaraj, 2003).

There is little evidence on IT returns in emerging markets. Dewan and Kraemer (2000) use country-level statistics to estimate IT's contribution to output and find insignificant IT returns in emerging markets. Tam (1998) shows that IT investments by firms in four Asian-Pacific economies may improve or reduce return on assets, while consistently having an insignificant relation to shareholder wealth. A possible explanation is that the market-based valuation depends on the 'efficient market hypothesis' but in less mature markets, investors' expectation may diverge from IT impacts on firm performance (Tam, 1998). Following this argument, we investigate IT returns for Taiwanese firms.

Why is corporate governance important for IT returns?

According to the principal/agent literature, managers may seek to maximize their own utility by overconsuming company resources or selecting suboptimal investments (e.g., Fama and Jensen, 1983; Jensen and Meckling, 1976). From this notion, managers may make excessive IT investments because a larger IT department brings higher power and salaries. In addition, the literature of career concerns suggests that managers may intentionally imitate others' investment decisions to enhance their professional reputations, with little or no regard to their firms' IT needs (e.g., Graham, 1999; Scharfstein and Stein, 1990). Institutional theory also argues that making a substantial IT investment may merely represent managers' attempt to comply with institutional pressures, and thus may not necessarily lead to improved firm performance (Abrahamson and Rosenkopf, 1997).

These agency problems may occur because evaluating managers' IT investment decisions requires technology-related information that shareholders often lack. Shareholders may therefore evaluate managers' IT decisions on the basis of industry consensus (Kauffman and Li, 2003). Consequently, managers may take advantage of asymmetric information to support their investment decisions (e.g., Fama and Jensen, 1983), and may tend to follow others in order to maintain their reputations and secure their jobs, rather than assess the economic impacts of such decisions on their companies (Graham, 1999). Imitation may also happen if managers lack the information and skills to select optimal investments for their companies and simply follow others to reduce decision costs (Abrahamson and Rosenkopf, 1997).

Agency problems are a particular concern in Asian Pacific countries and emerging markets (Gedajlovic and Shapiro, 1998; Hoskisson *et al*., 2005). Research on emerging markets (including Taiwan) shows that companies tend to chase new technologies without learning how to use them (Zhu *et al*., 2006). Research on Singapore suggests that firms imitate competitors in IT adoption to avoid being considered as technologically less advanced (Teo, Wei, and Benbasat, 2003). A recent study on China also shows that IT investment may be subject to imitation (Liang *et al*., 2007). Imitation may lead to excessive or uneconomic IT investments, resulting in an insignificant and even negative IT-performance relation (Abrahamson and Rosenkopf, 1997).

Corporate governance can reduce the agency problems given its monitoring function; in addition, governance mechanisms may be actively involved in technology investments through counsel and advice (Dalton *et al*., 1998; Zahra and Pearce, 1989). As such, corporate governance may play a significant role in bringing the needed information and skills in IT management. Following

[4] IT investment differs from other capital investments in that IT has a fast depletion rate. In addition, although labor expense in general is not included in capital investment, spending on IT labor (e.g., personnel, developing software, templates, training) creates an asset that lasts, on average, three years and is commonly included in IT investment (e.g., Hitt and Brynjolfsson, 1996; Dewan *et al*., 2007). We address these features of IT investment by computing IT stock and relating it to firm performance in the sensitivity analysis section.

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Denis and McConnell (2003), the specific governance mechanisms of interest are the board of directors and ownership structure. The next section hypothesizes board independence across industries and foreign ownership across firms of different sizes.

HYPOTHESES DEVELOPMENT

Board independence

The corporate board of directors serves as an important internal mechanism in making significant managerial decisions and in limiting managerial inefficiencies (e.g., Daily and Dalton, 1994; La Porta *et al*., 1999; Young, Tsai, and Hsieh, 2008). The corporate board *directly* monitors IT investment when the volume is large (Klein, 2002b; Kor, 2006). The board also meets regularly with internal and external auditors to review the firm's financial statements, audit process, and internal controls, which creates an *indirect* monitoring function for IT investment (Bhagat and Black, 2002). Board members also offer advice for IT investment as described by the resource dependence perspective that boards are important boundary spanners that provide timely information to top management (Zahra and Pearce, 1989).

The corporate board consists of inside directors (those employed by the company) and outside directors (e.g., chief executive officers [CEOs] of other firms, investment bankers, former governmental officials, major suppliers). An outsider majority board is associated with high independence, while an insider majority board is associated with low independence (Dalton *et al*., 1998). A board with higher independence may be more effective because outside directors are more objective and have access to external information that is less available to inside directors (e.g., Carpenter, Pollock, and Leary, 2003; Daily and Dalton, 1994). Outside directors also have the incentive to protect their reputation and avoid litigation (e.g., Beasley *et al*., 2000; Klein, 2002b). These studies support the notion of better monitoring and advising by outsider majority boards. In contrast, 'boards which are insider dominated may be less effective at meeting their control, resource dependence and counseling/expertise roles' (Dalton *et al*., 1998: 275).

The literature, however, shows inconclusive evidence on how board independence relates to firm performance. Klapper and Love (2004) and Durnev and Kim (2005) find a positive relation between corporate governance and firm value, with board independence being one of the governance components. While Black, Jang, and Kim (2006), Choi, Park, and Yoo (2007), and Young *et al*. (2008) report a positive effect of board independence on firm value,[5] Bhagat and Black (2002) report a negative effect of board independence on firm value, and Mak and Li (2001), Carter, Simkins, and Simpson (2003), and Brown and Caylor (2006) report no effect of board independence on firm value. Denis and McConnell (2003) review studies in an international setting and conclude that board independence is not conclusively associated with superior performance; however, the corporate board may impact performance by influencing managerial decisions in specific activities. In the same vein, we test the impact of board independence in the specific setting of IT investment. The above discussion leads to a positive moderation effect of board independence as follows:

> *Hypothesis1: Board independence positively moderates the relation between IT investment and firm performance.*

Industry competitiveness and board independence

The above moderation effect (Hypothesis 1) may differ across industries with different degrees of competitiveness. The industrial organization literature commonly uses industry concentration as a proxy for industry competitiveness (e.g., Cohen and Levin, 1989; Porter, 2001). High industry concentration (thus low competitiveness) increases a firm's profitability because of insulation of competition, thus lowering the marginal value of new technology investment. On the contrary, i0012 Tc1i1n-

profitability, for example, using IT to increase efficiencies in business processes (e.g., Devaraj and Kohli, 2003; Ray, Barney, and Muhanna, 2004; Dong, Xu, and Zhu, 2009).

As discussed earlier, agency problems must be alleviated in order to convert IT's potential benefits to realized performance improvement. This is particularly important for firms facing intense competition (e.g., Hermalin, 1992; Schmidt, 1997). That is, the marginal value to the firm of reducing agency problems is higher when the firm is operating in more competitive industries than in less competitive industries. Consequently, board monitoring would benefit firms more as industry competitiveness becomes more intensive.

In another stream of research on managerial incentives, several theoretical papers imply that increased competition may work as a bonding mechanism to decrease agency problems by providing more performance evaluation information to stakeholders (e.g., Nalebuff and Stiglitz, 1983). This is because intense competition makes firm performance more sensitive to uneconomic investments. However, Scharfstein (1988) shows that competition actually increases managerial actions for self-interest when the marginal ut. marginaltheorewhenper73.5(iilitz,srm777stryheorquect)-40792(b)-0(o)-29[(T)-

Hypothesis 3: Foreign ownership positively moderates the relation between IT investment and firm performance.

Firm size and foreign ownership

Compared to small firms, large firms have more expertise in deploying technologies, because they can afford to hire major consulting firms to provide specialized services and offer expert advice (e.g., Forman, 2005; Zhu *et al*., 2006). Damanpour (1996: 695) argues that 'large organizations employ more professional and skilled human resources, and have high technical knowledge and technical potential and, thus, are in the forefront of technological development.' This may weaken the importance of the technological knowledge spilled over from foreign investors. Indeed, empirical research shows that the spillover effect of foreign ownership is not significant for large firms (Aitken and Harrison, 1999).

In contrast, smaller firms are affiliated with 'resource poverty' in deploying IT (e.g., Forman, 2005; Zhu *et al*., 2006). Specifically, these small firms may lack IT knowledge and skills, which is a significant barrier to IT returns. Also, unlike large firms that can encourage and even require business partners to use IT in interfirm business processes, small firms may find it difficult to identify business partners using compatible technologies, a barrier to realizing IT value (Melville *et al*., 2004). Furthermore, CEOs and directors of small firms are usually less constrained by organizational systems and structures and therefore may have more discretion than large firms (e.g., Daily and Dalton, 1994; Klein, 2002b; Zahra and Pearce, 1989). The relatively weaker internal control systems and the lack of comprehensive audit systems in small firms may curtail the potential returns on IT investment. Research on corporate governance in emerging markets suggests that foreign investors may be endowed with good monitoring capabilities (e.g., Douma *et al*., 2006). They may also act as a link to the global supply chain, which features widespread use of IT (e.g., Kraemer *et al*., 2006). This is an important business resource that enables domestic firms to apply IT to digitize supply chain processes and thus derive IT value (Melville *et al*., 2004; Powell and Dent-Micallef, 1997).

In sum, foreign investors can contribute their IT expertise, enhance board structure, and increase access to the business resources needed for using IT. Therefore, foreign ownership may strengthen a small firm's ability to generate value from deploying IT. This leads us to expect small firms to benefit more from foreign ownership in IT value creation than large firms.

Hypothesis 4: The moderation effect of foreign ownership in the IT investment-firm performance relation is more positive for small firms than for large firms.

METHODOLOGY

Data

Our data is from three sources. First, we obtain data concerning corporate IT investment from a database created by the Taiwanese Institute for Information Industry, funded by the Taiwanese government. Since 2001, the Taiwanese Institute for Information Industry has authorized China Credit Information Service Ltd (CCIS) to collect corporate-level IT investment data through face-to-face interviews and then verify for accuracy. CCIS has been in the industry for more than 40 years and is well known for its high integrity and reliability in conducting large-scale surveys. As such, the Taiwanese government has used the CCIS IT survey data to set up various policies and regulations (e.g., governmental fund allocation and industry development policies). Second, we collect financial performance information from the Financial Report Database compiled by the *Taiwan Economic Journal* (*TEJ*), which contains data extracted from Taiwanese firms' annual financial reports. Third, we obtain information about firms' ownership structures and board composition from the *TEJ*'s Corporate Database. The two *TEJ*'s databases cover only publicly listed companies on the Taiwan Stock Exchange.[6] These datasets provide a unique opportunity to assess the role of

[6] In this study, all sample companies are domestic Taiwanese companies. Regarding the definition of domestic companies, the Taiwanese Securities Law requires that more than half of the company's capital is from Taiwanese nationals or Taiwanese-owned companies. By contrast, a company is labeled as a foreign company if more than 50 percent of its capital is from foreign investors (either foreign nationals or foreign institutional investors). Based on Taiwan government regulation, none of the foreign companies are publicly listed and traded in Taiwan.

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Table 1. Industry sectors

Industry sector	Frequency	Percentage of sample
Electronic components	135	18.8
Photoelectric products	131	18.2
Motherboard scheme	110	15.3
Integrated circuits	95	13.2
Electronic channel	81	11.3
Software applications	37	5.1
Network modem	34	4.7
General electronics	30	4.2
Consumer electronics	26	3.6
Communication technologies	21	2.9
Systematic product and others	19	2.7
Total	*719*	*100.0*

corporate governance in IT returns,[7] and can attenuate possible biases due to the use of primary survey data (Kohli and Devaraj, 2003). After merging data among different sources, we obtain a sample of Taiwanese electronics industries from 2001 to 2005, which is a nonbalanced panel including 719 observations. The distribution of industry sectors is shown in Table 1.

Variables in hypotheses

Return on assets (ROA). Firm performance is measured by *ROA*, the ratio of net income to the year-end book value of total assets, which is a widely used measure in research on corporate governance and firm performance (e.g., Douma *et al*., 2006; Gedajlovic and Shapiro, 2002; Klein, 1998). We use *ROA* to examine how firm performance relates to IT investment. Efficiency gains from using IT may lead to higher *ROA*, but uneconomic IT investment may lower *ROA*. Therefore, the relation between *ROA* and IT is shaped by how the uneconomic investment is controlled. In this study, we examine both current period *ROA* and future *ROA*, defined as the two-year average *ROA* subsequent to IT investment.

IT investment (ITINV). In our data, the amount of annual IT investment includes hardware, software, and costs concerning maintenance, personnel, and training. This measure covers all major components of corporate IT spending (Dewan *et al*. 2007; Kobelsky *et al*., 2008; Hitt and Brynjolfsson, 1996). Following previous research (e.g., Dewan *et al*., 2007), we divide a firm's IT investment by its total assets for size adjustment.

Board independence (BIND). Following prior studies (e.g., Bhagat and Black, 2002; Dalton *et al*., 1998; Kor, 2006; Peng, 2004), we use the proportion of outside directors, a commonly used measure, for board independence. However, outside directors include affiliated and nonaffiliated directors. Affiliated directors include past managers, relatives of current managers, affiliated attorneys, and consultants to the firm, while nonaffiliated directors are those without such affiliations (e.g., Daily and Dalton, 1994; Klein, 1998). Therefore, in the sensitivity analysis we use the proportion of nonaffiliated directors (e.g., Klein, 1998; Yermack, 1996) and a composite index based on the proportions of affiliated and nonaffiliated directors.

Foreign ownership (FOR). We measure foreign ownership by the percentage of common stock owned by foreign investors. This has been used in the literature to study the spillover of technological knowledge associated with foreign ownership (e.g., Aitken and Harrison, 1999; Chibber and Majumdar, 1999).

Industry competitiveness. We measure industry competitiveness by the four-firm concentration ratio (*CR4*) for each firm, which equals the percentage of total sales in the firm's industry sector accounted for by the four largest firms in the same sector. *CR4* is negatively related to industry competitiveness (e.g., Cohen and Levin, 1989; Porter, 2001).

Total assets (ASSETS). We use total assets to measure firm size (e.g., Gedajlovic and Shapiro, 2002; Peng, 2004) and classify our sample into small and large companies.

Control variables

We control for firm growth (*GROWTH*), which may be positively associated with *ROA* (e.g., Brush, Bromiley, and Hendrickx, 2000; Gedajlovic and Shapiro, 2002; Hitt and Brynjolfsson, 1996). We measure *GROWTH* using the one-year growth rate of sales (e.g., Brush *et al*., 2000) and expect a positive coefficient of *GROWTH*.

Given that a firm's performance may be influenced by its debt financing, we control for leverage (*LEV*), defined as the debt to equity ratio (e.g., Erickson, 1998; Minton and Schrand, 1999).

[7] In contrast, information about IT investment of U.S. companies in recent years is not available in public datasets.

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Shareholders may have incentives to expropriate bondholders' wealth by investing in high risk, high return projects. As such, bondholders may demand higher rents by increasing the costs of debt (Jensen and Meckling, 1976). On the other hand, debt financing may 'urge' managers to maintain their promises to pay out future cash flows. Thus, increased leverage may reduce cash flows available for spending at the discretion of managers (Jensen, 1986). Since previous research on IT investment reports a negative relation of leverage to *ROA* (e.g., Hitt and Brynjolfsson, 1996), we expect a negative coefficient of *LEV*.

Following prior studies, we also include market share (*SHARE*), the ratio of a firm's sales to the total industry sale (see a literature review by Szymanski, Bharadwaj, and Varadarajan, 1993). *SHARE* can proxy for a firm's negotiation power, and thus may be positively correlated with firm performance. The literature, however, contains mixed findings regarding both the sign and the statistical significance of the market share-firm performance relation (Szymanski *et al*., 1993). This may be because of the inclusion of another proxy for negotiation power (e.g., firm growth), which weakens the statistical association between market share and firm performance (e.g., Hitt and Brynjolfsson, 1996; Szymanski *et al*., 1993). Hence, we do not predict the sign of *SHARE*.

Another control variable is free cash flow (*FCF*), which gauges the availability of slack resources (Tan and Peng, 2003). It provides one approach to cope with the problem of lacking knowledge and skills, for instance, obtaining services and advice from consulting firms. Controlling for *FCF* thus helps partial out the role of spillover associated with foreign ownership. We follow Bushee (1998) to measure *FCF* as cash flow from operations less capital expenditures.

In addition, we include equity-based executive compensation (*COMP)*, that is, the percentage of equity to the total executive compensation (Mak and Li, 2001; Yermack, 1996). Rediker and Seth (1995) find a negative relation between board independence and executives' equity ownership, suggesting that *COMP* may help align managers' and shareholders' interests, thus reducing the monitoring potential of directors. *COMP*, however, may also result in an 'entrenchment effect' in that higher equity ownership can provide managers with freedom to pursue their own objectives without fear of reprisal (Denis and McConnell, 2003). Its relation to firm performance is thus shaped by two conflicting effects—alignment vs. entrenchment—which may explain why prior research shows an inconclusive relation between *COMP* and firm value (Mak and Li, 2001).

We also control for research and development intensity (*RD*), which may enhance firm performance (e.g., Hitt and Brynjolfsson, 1996; McWilliams and Siegel, 2000). We measure *RD* as a firm's R&D expenditures divided by sales (e.g., McWilliams and Siegel, 2000) and expect the sign of *RD* to be positive. We also control for firm age (*AGE*). Firms may accumulate resources over years, and thus we expect firm age to be positively related to firm performance. In addition, evidence in emerging markets suggests that older firms may be more entrenched and less likely to appoint outside directors (Peng, 2004). Finally, following prior research on board composition and firm performance (e.g., Klein, 1998: 292), we control for one-year lagged performance (ROA_{-1}). We expect a positive coefficient of ROA_{-1} since performance measures are positively correlated over time (e.g., Brush *et al*., 2000; Peng, 2004).

Regression model

To the best of our knowledge, there is no regression model readily available in the extant literature that links firm performance to corporate governance and IT investment. We thus develop a regression model based on prior studies, which uses the following specification to examine the relation of firm performance to corporate governance:

$ROA = f$ (corporate governance variables, lagged *ROA*, other control variables).

This model has been applied for investigating the board of directors (e.g., Klein, 1998) and ownership structures (e.g., Brush *et al*., 2000; Douma *et al*., 2006; Gedajlovic and Shapiro, 2002), and it has been used to relate firm performance to corporate governance in emerging markets (e.g., Joh, 2003; Qi *et al*., 2000). We expand the model by including IT investment, in line with the management literature that has long linked *ROA* to R&D investment using cross-sectional regressions (e.g., McWilliams and Siegel, 2000). This leads to our regression model as follows:

$$ROA = \sum_{k=1}^{13} \beta_k x_k + \beta_0$$

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$$= \beta_1\ ITINV + \beta_2\ BIND + \beta_3\ ITINV \times BIND + \beta_4\ FOR + \beta_5\ ITINV \times FOR + \beta_6 GROWTH + \beta_7 LEV + \beta_8 SHARE + \beta_9 FCF + \beta_{10} COMP + \beta_{11} RD + \beta_{12} AGE + \beta_{13} ROA_{-1} + \beta_0 \quad (1)$$

where $x_k (k = 1, 2, \ldots 13)$ is the k[th] explanatory variable (in vector terms, $[x_1, x_2, \ldots x_{13}] = [$*ITINV, BIND, ITINV×BIND, FOR, ITINV×FOR, GROWTH, LEV, SHARE, FCF, COMP, RD, AGE,* $ROA_{-1}]$), $\beta_k (k = 1, 2, \ldots 13)$ is the corresponding regression coefficient, and β_0 is an intercept.

According to this model, the relation between firm performance and IT investment is a function of board independence (*BIND*) and foreign ownership (*FOR*), expressed by the following first-order derivative:

$$\partial ROA \Big/ \partial ITINV = \beta_1 + \beta_3 BIND + \beta_5 FOR$$

where β_1 represents the direct IT-performance relation, and β_3 and β_5 represent moderating effects of board independence and foreign ownership, respectively. According to the hypotheses proposed earlier, we expect significantly positive β_3 (Hypothesis 1) and β_5 (Hypothesis 3).

In Hypotheses 2 and 4, we are concerned with differential moderating effects of corporate governance across industry sectors and size classes. We use the dummy variable regression method to test such differential effects (Gujarati, 1988). Specifically, we create a dummy C for industry competitiveness: $C = 1$ for firms with *CR4* above the sample median; $C = 0$ for firms with *CR4* below the sample median. Then, we estimate the following regression model:

$$ROA = C\left(\sum_{k=1}^{13} \beta_k^C x_k\right) + (1 - C)\left(\sum_{k=1}^{13} \beta_k^{1-C} x_k\right) + \alpha_0 + C\alpha_0^C \quad (2)$$

where $x_k (k = 1, 2, \ldots 13)$ denotes the explanatory variable as defined in Model (1) above, and β_k^C and β_k^{1-C} are regression coefficients for less competitive industries ($C = 1$) and more competitive industries ($C = 0$), respectively. The regression also specifies the differential intercept (by $C\alpha_0^C$), which indicates how much the intercept in the less competitive industries differs from the base intercept (α_0). To see the implications of Model (2), we obtain:

$$\textit{Less competitive industries } (C = 1): \quad \partial ROA \Big/ \partial ITINV = \beta_1^C + \beta_3^C BIND + \beta_5^C FOR$$

$$\textit{More competitive industries } (C = 0): \quad \partial ROA / \partial ITINV = \beta_1^{1-C} + \beta_3^{1-C} BIND + \beta_5^{1-C} FOR$$

where β_3^C and β_3^{1-C} gauge the moderating effect of board independence in less and more competitive industries, respectively. Hypothesis 2 proposes that β_3^{1-C} is more positive than β_3^C.

We create another dummy $A : A = 1$ for firms with *ASSETS* above the sample median; $A = 0$ for firms with *ASSETS* below the sample median. Then, we estimate the following model:

$$ROA = A\left(\sum_{k=1}^{13} \beta_k^A x_k\right) + (1 - A)\left(\sum_{k=1}^{13} \beta_k^{1-A} x_k\right) + \gamma_0 + A\gamma_0^A$$

where $x_k (k = 1, 2, \ldots 13)$ is the explanatory variable as defined in Model (1), and β_k^A and β_k^{1-A} are regression coefficients for large and small firms, respectively. $A\gamma_0^A$ is the differential intercept and γ_0 is the base intercept. We obtain:

$$\textit{Large firms } (A = 1): \ \partial ROA \Big/ \partial ITINV = \beta_1^A + \beta_3^A BIND + \beta_5^A FOR$$

$$\textit{Small firms } (A = 0): \ \partial ROA \Big/ \partial ITINV = \beta_1^{1-A} + \beta_3^{1-A} BIND + \beta_5^{1-A} FOR$$

where β_5^A and β_5^{1-A} represent the moderating effect of foreign ownership for large and small firms, respectively. Hypothesis 4 proposes that β_5^{1-A} is more positive than β_5^A.

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RESULTS

Summary statistics

Table 2 summarizes the descriptive statistics of the key variables on both the full sample and subsamples. Table 3 shows Pearson correlations. The ANOVA results in Table 2 show that small firms in our sample have greater *ROA* (both current and future), consistent with the nature of the electronics industries (Dedrick and Kraemer, 2005). The production of commodity electronic products (e.g., modems, motherboards, and flat-panel displays) is characterized by asset-intensive, high-volume, but low-return manufacturing. In contrast, applications providers and firms focused on design and services enjoy high profitability, while their operations require relatively fewer assets.

The ANOVA also shows that foreign investors target firms in less competitive industries, possibly because investments in these firms are less risky. The mean board independence is also higher in less competitive industries. It may be because firms in these industries are more inclined to rely on board independence to immunize themselves against managerial incentives for self-interest (Nalebuff and Stiglitz, 1983). Or, it may simply be that *BIND* is positively correlated with *FOR* (see Table 3), and the mean *FOR* is higher in less competitive industries. Because our focus is on how *BIND* moderates IT value while the corporate governance variables are correlated with several control variables (Table 3), it is difficult to draw conclusions based solely on the univariate analysis and we need to proceed to a multivariate regression.

Table 2 also shows that small firms have higher *BIND*, consistent with prior research showing a negative relation between firm size and audit committee independence (Klein, 2002b: 440): 'Larger firms have stronger internal controls systems than smaller firms... If the firms' internal controls act as in-house monitoring mechanisms, then larger firms require less alternative monitoring...' A similar rationale can explain the observation in our sample. The ANOVA also indicates that firms in less competitive industries and larger firms have more free cash flow, consistent with expectations (Forman, 2005; Zhu *et al*

Table 2. Descriptive statistics

	Full sample		Less competitive vs. more competitive industries					Large firms vs. small firms				
			CR4 above median		*CR4* below median		ANOVA	*ASSETS* above median		*ASSETS* below median		ANOVA
	Mean	S.D.	Mean	S.D.	Mean	S.D.	*t*-statistic	Mean	S.D.	Mean	S.D.	*t*-statistic
ROA (current)	0.151	0.114	0.158	0.118	0.152	0.120	0.66	0.132	0.104	0.170	0.121	−4.61***
ROA (future)	0.149	0.109	0.146	0.086	0.159	0.126	−1.47	0.139	0.101	0.172	0.121	−3.58***
ITINV	0.037	0.617	0.004	0.005	0.094	1.033	−1.39	0.003	0.05	0.070	0.871	−1.48
BIND	0.163	0.187	0.281	0.175	0.015	0.044	27.48***	0.145	0.177	0.182	0.196	−2.69***
FOR	0.055	0.097	0.070	0.107	0.042	0.089	3.56***	0.079	0.109	0.031	0.076	6.90***
CR4	0.208	0.069	0.223	0.087	0.188	0.001	7.64***	0.202	0.406	0.214	0.088	−2.47**
ASSETS	9.583	23.711	9.493	18.842	10.773	32.434	−0.61	17.380	31.705	1.807	0.812	9.30***
GROWTH	0.111	0.363	0.148	0.299	0.063	0.408	2.81**	0.150	0.380	0.073	0.342	2.84***
LEV	0.673	0.618	0.607	0.617	0.737	0.631	−2.53**	0.681	0.561	0.665	0.670	0.33
SHARE	0.322	1.729	0.382	1.888	0.201	0.427	1.75*	0.346	1.607	0.299	1.844	0.36
FCF	3.498	13.238	6.796	14.418	1.206	3.020	2.88***	4.914	15.690	0.293	0.440	6.57***
COMP	0.228	0.331	0.248	0.351	0.233	0.331	0.53	0.282	0.348	0.107	0.252	7.59***
RD	0.028	0.041	0.024	0.042	0.040	0.043	−4.44***	0.025	0.033	0.032	0.047	−2.09**
AGE	16.870	7.729	19.677	7.909	15.104	7.316	7.28***	17.341	7.812	15.800	7.445	2.47**
ROA_{-1}	0.169	0.122	0.166	0.124	0.184	0.128	−1.74*	0.145	0.108	0.193	0.131	−5.34***

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Data from the Taiwanese Institute for Information Industry:

ITINV = annual IT spending (hardware, software and costs concerning maintenance, personnel and training) divided by total assets

Data from TEJ's Corporate Database:
BIND = proportion of outside directors
FOR = proportion of common stock owned by foreign Investors

Data from TEJ's Financial Report Database:

ROA (current) net income ÷ year-end book value of total assets

ROA (future) = 2-year average ROA subsequent to IT investment
CR4 = sales of the four largest firms in the industry ÷ total industry sales
ASSETS = total assets (Taiwan $ billion)
GROWTH = one-year growth rate of sales
LEV = book value of total debt ÷ book value of total equity
SHARE = sales ÷ total industry sales (industry sectors shown in Table 1)
FCF = cash flow from operations less capital expenditures (Taiwan $ billion)
COMP = proportion of equity based executive compensation
RD = research and development expenses ÷ sales
AGE = firm age
ROA_{-1} = ROA in the previous year

Table 3. Pearson correlations

	ROA (current)	ROA (future)	ITINV	BIND	FOR	CR4	ASSETS	GROWTH	LEV	SHARE	FCF	COMP	RD	AGE	ROA$_{-1}$
ROA (current)	1														
ROA (future)	0.973***	1													
ITINV	−0.002	−0.006	1												
BIND	0.114***	0.119***	−0.047	1											
FOR	−0.010	0.006	−0.029	0.089**	1										
CR4	0.008	0.018	−0.016	0.138***	−0.012	1									
ASSETS	−0.149***	−0.137***	−0.018	−0.093**	0.308***	−0.043	1								
GROWTH	0.185***	0.181***	−0.037	0.070*	−0.007	−0.034	0.014	1							
LEV	−0.168***	−0.160***	0.003	−0.126***	−0.120***	−0.109***	−0.016	0.147***	1						
SHARE	0.017	0.018	−0.008	−0.053	0.011	0.724***	0.138***	−0.002	0.013	1					
FCF	−0.148***	−0.135***	−0.013	−0.062*	0.235***	−0.021	0.853***	−0.013	−0.047	0.097***	1				
COMP	0.147***	0.131***	−0.011	−0.211***	0.123***	−0.094**	0.158***	0.006	−0.101***	0.025	0.061	1			
RD	0.178***	0.199***	−0.026	−0.202***	0.043	0.046	0.093**	0.017	−0.082**	0.087**	0.110***	0.110***	1		
AGE	−0.130***	−0.121***	0.036	0.061*	0.002	0.003	−0.016	−0.044	−0.057	−0.011	−0.044	−0.025	−0.227***	1	
ROA$_{-1}$	0.835***	0.809***	−0.009	0.021	−0.008	−0.006	−0.119***	−0.043	−0.159***	0.028	−0.124***	0.208***	0.199***	−0.158***	1

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$. See Table 2 for variable definitions.

investment-*ROA* relation would be more positive for firms with higher board independence. This supports Hypothesis 1.

The coefficient of *FOR* is insignificant ($t = 0.59$), suggesting that the direct relation between foreign ownership and firm performance is not clear. The coefficient of *ITINV* × *FOR* is also insignificant ($t = 0.41$), thus showing no support for Hypothesis 3. A plausible explanation is that large firms with resource advantages in IT management benefit less from IT expertise spillover. This dilutes the influence of *FOR* on the full sample. To further check this explanation, we need to look into the sample split by firm size (discussed below).

Column (8) of Table 4 carries out a joint test (Friedrich, 1982) in order to better interpret the interaction effect between IT investment and corporate governance. In Column (8), *ITINV, BIND*, and *FOR* are mean-centered. Accordingly, the coefficient of *ITINV* represents its effect expected at the mean values of *BIND* and *FOR*. The result shows that IT investment has a significantly positive contribution to firm s4 carr0.2Tf5.40.460t86.4(c37 TD7lt8

Table 4. Regression results on the full sample

$$ROA = \sum_{k=1}^{13} \beta_k x_k + \beta_0 = \beta_1\ ITINV + \beta_2\ BIND + \beta_3\ ITINV \times BIND + \beta_4\ FOR + \beta_5\ ITINV \times FOR$$
$$+\beta_6\ GROWTH + \beta_7\ LEV + \beta_8\ SHARE + \beta_9\ FCF + \beta_{10}\ COMP + \beta_{11}\ RD + \beta_{12}\ AGE + \beta_{13}\ ROA_{-1} + \beta_0$$

	DV = current-period ROA				DV = future ROA			
	(1) Control model	(2) Without ROA_{-1}	(3) Base model	(4) Joint test	(5) Control model	(6) Without ROA_{-1}	(7) Base model	(8) Joint test
	Coef β_k (t-stat)	Coef β_k (t-stat)	Coef β_k (t-stat)	Coef β_k (t-stat)	Coef β_k (t-stat)	Coef β_k (t-stat)	Coef β_k (t-stat)	Coef β_k (t-stat)
ITINV		0.0018	0.00085	1.26***		0.0019	0.0010	1.58***
		(0.23)	(0.21)	(3.71)		(0.26)	(0.25)	(4.55)
BIND		0.016	−0.022	0.35***		0.015	−0.019	0.46***
		(0.45)	(−1.16)	(3.60)		(0.46)	(−0.99)	(4.62)
ITINV×BIND		**19.72*** **	**10.01*** **	**10.01*** **		**21.82*** **	**12.92*** **	**12.92*** **
		(3.79)	**(3.54)**	**(3.54)**		**(4.41)**	**(4.45)**	**(4.45)**
FOR		−0.031	−0.0035	0.034		−0.011	0.014	0.034
		(−0.72)	(−0.15)	(0.71)		(−0.27)	(0.59)	(0.69)
ITINV×FOR		0.75	1.01	1.01		0.30	0.54	0.54
		(0.32)	(0.79)	(0.79)		(0.13)	(0.41)	(0.41)
Controls								
GROWTH	0.064***	0.062***	0.073***	0.073***	0.059***	0.057***	0.067***	0.067***
	(5.79)	(5.64)	(12.29)	(12.29)	(5.60)	(5.42)	(10.95)	(10.95)
LEV	−0.035***							

SHARE	0.0014	0.00048	−0.00062	−0.00062	0.00090	−0.000074	−0.0011	−0.0011
	(0.59)	(0.21)	(−0.49)	(−0.49)	(0.41)	(−0.03)	(−0.84)	(−0.84)
FCF	−0.0016***	−0.0015***	−0.00035**	−0.00035**	−0.0014***	−0.0013***	−0.00028	−0.00028
	(−5.24)	(−4.76)	(−2.08)	(−2.08)	(−4.85)	(−4.46)	(−1.64)	(−1.64)
COMP	0.041***	0.049***	−0.010	−0.010	0.033***	0.041***	−0.013*	−0.013*
	(3.42)	(3.93)	(−1.50)	(−1.50)	(2.90)	(3.46)	(−1.90)	(−1.90)
RD	0.40***	0.42***	0.034	0.034	0.45***	0.48***	0.12**	0.12**
	(3.90)	(4.14)	(0.61)	(0.61)	(4.62)	(4.90)	(2.07)	(2.07)
AGE	−0.0015***	−0.0017***	0.000091	0.000091	−0.0012**	−0.0014***	0.00024	0.00024
	(−2.90)	(−3.15)	(0.32)	(0.32)	(−2.44)	(−2.73)	(0.80)	(0.80)
Lagged ROA			0.73***	0.73***			0.71***	0.71***
			(41.21)	(41.21)			(36.79)	(36.79)
Intercept	0.18***	0.17***	0.021***	0.065***	0.17***	0.16***	0.022***	0.079***
	(14.40)	(12.57)	(2.60)	(4.57)	(14.30)	(12.35)	(2.67)	(5.45)
N	718	718	718	718	718	718	718	718
F-statistic	18.31***	12.78***	170.82***	170.82***	17.16***	12.78***	138.54***	138.54***
R^2	0.153	0.179	0.759	0.759	0.145	0.179	0.719	0.719
Adjusted R^2	0.145	0.165	0.755	0.755	0.136	0.165	0.714	0.714

See Table 2 for variable definitions. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

findings of previous research that has examined their relations with firm performance.

More competitive vs less competitive industries

Table 5 presents regressions of Model (2), using current *ROA* or future *ROA* as the dependent variable. Columns (1) and (3) report results based on non-mean-centered variables, and Columns (2) and (4) report results based on mean-centered variables. Each of the four columns (1)–(4) reports two sets of regression coefficients, that is, for less competitive industries ($C = 1$) and for more competitive industries ($C = 0$). The four columns (1)–(4) show a consistent pattern that the coefficient of $ITINV \times BIND$ is insignificant in less competitive industries while significant in more competitive industries at $p < 0.01$ level. This provides support for Hypothesis 2.

In addition, Columns (2) and (4) of Table 5 show that, holding IT investment and corporate governance equal to sample means, *ITINV* and *BIND* are positively related to firm performance in more competitive environments. This finding is consistent with the notion that IT and board monitoring benefit firms more in more competitive environments. In contrast, in less competitive industries, there is no significant direct or indirect IT-performance relation through interaction with corporate governance. These results suggest that in less competitive industries, firm profitability may result from sources other than new technologies, such as monopoly rents. By contrast, firms operating in more competitive industries need to rely more heavily on new technologies to improve performance.

As to the controls, one notable change compared to the full sample results is that *LEV* becomes insignificant in less competitive industries. Because firms in less competitive industries generally possess more free cash flow (see Table 2), they benefit more from the control function of debt financing (Jensen, 1986). The increased control function would weaken the negative influence of *LEV*. Coefficients on *FCF* are negative yet not significant. Recall that, on average, *FCF* is higher in the subsample where *CR4* is above median (Table 2). Accordingly, the differential intercept of the subsample ($C\alpha_0^C$ in Model (2)) captures some data variation in *FCF*, which may weaken *FCF*'s effect. The possible entrenchment role of *COMP* (Denis and McConnell, 2003) is found to have a negative effect on firm performance in more competitive industries. *RD* is positively related to future *ROA* of firms in more competitive industries because these firms lack monopoly rents and rely on innovations for performance improvement.

Large firms vs small firms

Table 6 shows estimates for Model (3), including regression coefficients for large and small firms. We find a positive coefficient of $ITINV \times BIND$ for both large and small firms, although it is insignificant for small firms when performance refers to current *ROA*. When we use the proportion of non-affiliated directors to measure *BIND* (discussed in the sensitivity analysis), the positive coefficient of $ITINV \times BIND$ is significant for both large and small firms and for both current and future *ROA*. Overall, the moderating effect of board independence is positive and robust across size classes.

The interaction $ITINV \times FOR$ is significant and positive for small firms, suggesting considerable benefits were obtained by small firms from IT expertise spillover associated with foreign ownership. For large firms, *FOR* and $ITINV \times FOR$ are insignificant, consistent with our expectation that large firms are less influenced by foreign involvement. Overall, our results show that small, not large, Taiwanese firms benefit from the IT expertise 'spilled over' from foreign investors. Thus, Hypothesis 4 is supported.[8]

Given the significant, positive interaction of $ITINV \times FOR$ for small firms, the coefficient on *FOR* changes as *ITINV* increases. In Columns (1) and (3), the coefficient of *FOR* is negative for small firms, representing the role of *FOR* when *ITINV* is zero. In the case where firms

[8] To shed additional light, we conducted in-depth interviews with senior managers of three large and two small Taiwanese electronics companies. As informed by the senior managers, foreign investors for small high-tech firms are predominantly corporations whose main objective is to either control the invested company or to solidify supply chain advantages (e.g., to achieve lower cost structures). In return, these small domestic companies seek to obtain advice on IT investments from the foreign investors. On the other hand, the major foreign investors for large companies are corporations and investment trusts whose main objective is to receive cash dividends or capital gains from holding stocks. Unlike small companies, these large domestic companies, because of their relative resource abundance, do not generally need to solicit advice from their foreign investors regarding IT investments. These interviews and statistics (Table 6) offer complementary evidence supporting Hypothesis 4.

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Table 5. More competitive industries vs. less competitive industries

$$ROA = C(\sum_{k=1}^{13} \beta_k^C x_k) + (1 - C)(\sum_{k=1}^{13} \beta_k^{1-C} x_k) + \alpha_0 + C\alpha_0^C$$

	DV = current-period ROA				DV = future ROA			
	(1) Base model		(2) Joint test		(3) Base model		(4) Joint test	
	Less compet. ($C = 1$)†	More compet. ($C = 0$)†	Less compet. ($C = 1$)†	More compet. ($C = 0$)†	Less compet. ($C = 1$)†	More compet. ($C = 0$)†	Less compet. ($C = 1$)†	More compet. ($C = 0$)†
	Coef β_k^C (t-stat)	Coef β_k^{1-C} (t-stat)	Coef β_k^C (t-stat)	Coef β_k^{1-C} (t-stat)	Coef β_k^C (t-stat)	Coef β_k^{1-C} (t-stat)	Coef β_k^C (t-stat)	Coef β_k^{1-C} (t-stat)
ITINV	−0.075	0.0026	0.67	2.07***	−0.039	0.0016	0.75	2.53***
	(−0.75)	(0.59)	(0.87)	(4.03)	(−0.38)	(0.35)	(0.95)	(4.80)
BIND	−0.0021	−0.027	0.028	0.65***	0.034	−0.0053*	0.18	0.73***
	(−0.07)	(−0.94)	(0.17)	(3.99)	(1.03)	(−1.82)	(1.02)	(4.36)
ITINV×BIND	**0.82**	**18.18*****	**0.82**	**18.18*****	**3.80**	**20.98*****	**3.80**	**20.98*****
	(0.17)	**(3.86)**	**(0.17)**	**(3.86)**	**(0.76)**	**(4.34)**	**(0.76)**	**(4.34)**
FOR	−0.078	0.024	0.36	−0.054	−0.063	0.039	0.16	0.044
	(−1.46)	(0.57)	(0.71)	(−0.31)	(−1.14)	(0.92)	(0.31)	(0.25)
ITINV×FOR	11.81	−2.08	11.81	−2.08	6.05	0.15	6.05	0.15
	(0.81)	(−0.39)	(0.81)	(−0.39)	(0.40)	(0.03)	(0.40)	(0.03)
Controls								
GROWTH	0.072***	0.096***	0.072***	0.096***	0.066***	0.086***	0.066***	0.086***
	(6.83)	(10.59)	(6.83)	(10.59)	(6.14)	(9.24)	(6.14)	(9.24)
LEV	−0.014	−0.015***	−0.014	−0.015***	−0.013	−0.013***		

Table 5. (*Continued*)

$$ROA = C(\sum_{k=1}^{13} \beta_k^C x_k) + (1 - C)(\sum_{k=1}^{13} \beta_k^{1-C} x_k) + \alpha_0 + C\alpha_0^C$$

	DV = current-period ROA				DV = future ROA			
	(1) Base model		(2) Joint test		(3) Base model		(4) Joint test	
	Less compet. ($C = 1$)†	More compet. ($C = 0$)†	Less compet. ($C = 1$)†	More compet. ($C = 0$)†	Less compet. ($C = 1$)†	More compet. ($C = 0$)†	Less compet. ($C = 1$)†	More compet. ($C = 0$)†
	Coef β_k^C (t-stat)	Coef β_k^{1-C} (t-stat)	Coef β_k^C (t-stat)	Coef β_k^{1-C} (t-stat)	Coef β_k^C (t-stat)	Coef β_k^{1-C} (t-stat)	Coef β_k^C (t-stat)	Coef β_k^{1-C} (t-stat)
FCF	−0.00035	−0.00021	−0.00035	−0.00021	−0.00056	−0.00019	−0.00056	−0.00019
	(−0.35)	(−1.13)	(−0.35)	(−1.13)	(−0.55)	(−0.95)	(−0.55)	(−0.95)
COMP	−0.017	−0.013	−0.017	−0.013	−0.014	−0.017*	−0.014	−0.017*
	(−1.49)	(−1.28)	(−1.49)	(−1.28)	(−1.24)	(−1.70)	(−1.24)	(−1.70)
RD	−0.15	0.047	−0.15	0.047	−0.070	0.11*	−0.070	0.11*
	(−0.92)	(0.73)	(−0.92)	(0.73)	(−0.43)	(1.67)	(−0.43)	(1.67)
AGE	−0.00030	0.00048	−0.00030	0.00048	0.000048	0.00064	0.000048	0.00064
	(−0.59)	(1.12)	(−0.59)	(1.12)	(0.09)	(1.47)	(0.09)	(1.47)
Lagged ROA	0.73***	0.80***	0.73***	0.80***	0.65***	0.74***	0.65***	0.74***
	(17.93)	(34.58)	(17.93)	(34.58)	(15.47)	(31.20)	(15.47)	(31.20)
Base	0.0039	0.0039	0.079***	0.079***	0.012	0.012	0.10***	0.10***
intercept	(0.36)	(0.36)	(3.88)	(3.88)	(1.05)	(1.05)	(4.87)	(4.87)
Differential	0.044**		−0.01		0.029		−0.032	
Intercept	(2.21)		(−0.27)		(1.43)		(−0.82)	
N		608		608		608		608
F-statistic		73.69***		73.69***		59.90***		59.90***
R^2		0.774		0.774		0.736		0.736
Adjusted R^2		0.764		0.764		0.724		0.724

See Table 2 for variable definitions. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.
† $C = 1$ for firms with above-median *CR4*; $C = 0$ for firms with below-median *CR4*.

Table 6. Large firms vs. small firms

$$ROA = A(\sum_{k=1}^{13} \beta_k^A x_k) + (1 - A)(\sum_{k=1}^{13} \beta_k^{1-A} x_k) + \gamma_0 + A\gamma_0^A$$

	DV = current-period ROA				DV = future ROA			
	(1) Base model		(2) Joint test		(3) Base model		(4) Joint test	
	Large firms ($A = 1$)‡	Small firms ($A = 0$)‡	Large firms ($A = 1$)‡	Small firms ($A = 0$)‡	Large firms ($A = 1$)‡	Small firms ($A = 0$)‡	Large firms ($A = 1$)‡	Small firms ($A = 0$)‡
	Coef $\beta_k{}^A$ (t-stat)	Coef $\beta_k{}^{1-A}$ (t-stat)	Coef $\beta_k{}^A$ (t-stat)	Coef $\beta_k{}^{1-A}$ (t-stat)	Coef $\beta_k{}^A$ (t-stat)	Coef $\beta_k{}^{1-A}$ (t-stat)	Coef $\beta_k{}^A$ (t-stat)	Coef $\beta_k{}^{1-A}$ (t-stat)
ITINV	−0.028	−0.011	1.26***	2.08***	−0.034	−0.014**	1.51***	2.84***
	(−0.75)	(−1.60)	(2.63)	(2.82)	(−0.89)	(−1.97)	(3.05)	(3.74)
BIND	−0.0069	−0.039	0.31**	0.14	−0.012	−0.0081	0.38**	0.26*
	(−0.29)	(−1.19)	(2.04)	(0.99)	(−0.50)	(−0.24)	(2.41)	(1.78)
ITINV×BIND	8.50*	4.88	8.50*	4.88	10.46**	7.33*	10.46**	7.33*
	(1.94)	(1.16)	(1.94)	(1.16)	(2.31)	(1.69)	(2.31)	(1.69)
FOR	−0.0024	−0.25***	0.18	0.76*	0.0017	−0.26**	0.19	1.07**
	(−0.08)	(−2.33)	(0.99)	(1.85)	(0.05)	(−2.35)	(1.04)	(2.53)
ITINV×FOR	**4.88**	**27.33****	**4.88**	**27.33****	**5.19**	**35.98****	**5.19**	**35.98****
	(0.92)	**(2.00)**	**(0.92)**	**(2.00)**	**(0.95)**	**(2.55)**	**(0.95)**	**(2.55)**
Controls								
GROWTH	0.061***	0.095***	0.061***	0.095***	0.058***	0.083***	0.058***	0.083***
	(8.44)	(22.84)	(8.44)	(22.84)	(7.70)	(7.87)	(7.70)	(7.87)
LEV	−0.015***	−0.016***	−0.015***	−0.016***	−0.012**	−0.015**	−0.012**	−0.015**
	(−3.24)	(−2.78)	(−3.24)	(−2.78)	(−2.54)	(−2.46)	(−2.54)	(−2.46)
SHARE	−0.00064	0.00046	−0.00064	0.00046	−0.0019	0.00076	−0.0019	0.00076
	(−0.34)	(0.27)	(−0.34)	(0.27)	(−0.97)	(0.44)	(−0.97)	(0.44)

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Table 6. (*Continued*)

$$ROA = A(\sum_{k=1}^{13} \beta_k^A x_k) + (1 - A)(\sum_{k=1}^{13} \beta_k^{1-A} x_k) + \gamma_0 + A\gamma_0^A$$

	DV = current-period ROA				DV = future ROA			
	(1) Base model		(2) Joint test		(3) Base model		(4) Joint test	
	Large firms ($A = 1$)‡	Small firms ($A = 0$)‡	Large firms ($A = 1$)‡	Small firms ($A = 0$)‡	Large firms ($A = 1$)‡	Small firms ($A = 0$)‡	Large firms ($A = 1$)‡	Small firms ($A = 0$)‡
	Coef β_k^A (t-stat)	Coef β_k^{1-A} (t-stat)	Coef β_k^A (t-stat)	Coef β_k^{1-A} (t-stat)	Coef β_k^A (t-stat)	Coef β_k^{1-A} (t-stat)	Coef β_k^A (t-stat)	Coef β_k^{1-A} (t-stat)
FCF	−0.00038**	−0.0029***	−0.00038**	−0.0029***	−0.00030*	−0.028**	−0.00030*	−0.028**
	(−2.16)	(−3.09)	(−2.16)	(−3.09)	(−1.68)	(−2.87)	(−1.68)	(−2.87)
COMP	−0.012	−0.028*	−0.012	−0.028*	−0.018**	−0.021	−0.018	−0.021
	(−1.55)	(−1.78)	(−1.55)	(−1.78)	(−2.20)	(−1.29)	(−2.20)	(−1.29)
RD	0.038	−0.022	0.038	−0.022	0.14*	0.051	0.14*	0.051
	(0.48)	(−0.27)	(0.48)	(−0.27)	(1.71)	(0.61)	(1.71)	(0.61)
AGE	−0.00018	0.00098*	−0.00018	0.00098*	−0.000051	0.0011**	−0.000051	0.0011**
	(−0.53)	(1.87)	(−0.53)	(1.87)	(−0.14)	(2.10)	(−0.14)	(2.10)
Lagged ROA	0.82***	0.68***	0.82***	0.68***	0.75***	0.63***	0.75***	0.63***
	(32.77)	(22.84)	(32.77)	(22.84)	(29.22)	(20.36)	(29.22)	(20.36)
Base	0.045***	0.045***	0.10***	0.10***	0.038**	0.038**	0.13***	0.13***
intercept	(2.98)	(2.98)	(3.67)	(3.67)	(2.44)	(2.44)	(4.41)	(4.41)
Differential	−0.025		−0.037		−0.014		−0.049	
Intercept	(−1.37)		(−1.09)		(−0.74)		(−1.39)	
N		718		718		718		718
F-statistic		86.82***		86.82***		69.69***		69.69***
R^2		0.773		0.773		0.732		0.732
Adjusted R^2		0.764		0.764		0.721		0.721

See Table 2 for variable definitions. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$

‡ $A = 1$ for firms with above-median *ASSETS*; $A = 0$ for firms with below-median *ASSETS*

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made no IT investment, foreign investors' suggestions for general management might be unsuitable for local environments, consistent with the argument about 'liability of foreignness' (Vernon, 1966; Zaheer, 1995). In Columns (2) and (4), the coefficient of *FOR* becomes positive for small firms, indicating the benefit of foreign ownership expected at the mean value of IT investment. These results suggest that foreign investment does not always benefit small firms, and we need to address its involvement in a specific managerial activity like IT management.

Results for the controls remain qualitatively similar to those based on the full sample, except that *RD* is significantly positive for large firms and *AGE* is significantly positive for small firms. This result supports the notion that larger firms have an advantage in innovations due to economies of scale and tolerance to risks in innovations (Damanpour, 1996). The result for *AGE* suggests that small instead of large firms seem to benefit from resource buildup over time. The coefficients on *COMP* are negative, but the varying significance levels result in no conclusive evidence about its role across size classes.

Sensitivity analysis

We conduct several tests to examine the robustness of the regression results to alternative measures and model specifications. Table 7 presents results of regressions using future *ROA* as the dependent variable. Results based on current *ROA* are qualitatively the same (and thus not tabulated). Results in Table 7 show that our results are robust.

Alternative measures for board independence

Affiliated and nonaffiliated directors may result in different degrees of board independence (Klein, 1998). Panel A of Table 7 uses the proportion of nonaffiliated directors to measure *BIND*, which is more conservative (e.g., Klein, 1998; Yermack, 1996). We then conduct a factor analysis to create a composite index based on the proportion of affiliated directors (*AFF*) and the proportion of nonaffiliated directors (*NONAFF*): $BIND = (1.14 \times NONAFF + 0.65 \times AFF)$. This index assigns a higher weight to nonaffiliated directors than affiliated directors. Regressions using this measure are reported in Panel B. Results in Panels A and B show significantly positive coefficients on *ITINV*×*BIND* in more competitive industries and for both large and small firms, and significantly positive coefficients on *ITINV*×*FOR* for small firms.

IT stock

Another test shows that using annual IT spending (Tables 4–6) and IT stock (Panel C of Table 7) generate qualitatively similar results. This test uses IT stock (*ITSTOCK*), aggregated based on annual IT expenditures,[9] to test Hypotheses 1–4. Except for the positive coefficient of *ITSTOCK*×*BIND,* which is marginally significant for small firms ($p = 0.122$), we observe highly consistent results: *BIND* moderates IT returns in more competitive industries, and *FOR* moderates IT returns for small firms.

Excess control right

We also examine the role of foreign ownership in companies with excess control right, that is, control right of the largest shareholder in excess of its cash flow right (Fan and Wong, 2005; Joh, 2003; Lemmon and Lins, 2003). This test not only examines an important feature of emerging markets (Denis and McConnell, 2003; Hoskisson *et al*., 2005) but also provides additional support to our results. Recall that we predict foreign investors will attempt to help improve firm performance. However, some factors may decrease the incentive for foreign investors to contribute expertise in IT management, which then limits the benefits that can be achieved. The excess control may be one such conflicting factor. We find that, in the sample with high excess control, foreign ownership plays an insignificant role. As the excess control induces the controlling shareholder to expropriate firm value (Dennis and McConnell, 2003; Fan

[9] We follow the literature to compute IT stock (e.g., Dewan *et al*., 2007; Hitt and Brynjolfsson, 1996; Kudyba and Diwan, 2002). There are two components of IT stock: hardware capital and capitalized value of IT labor spending. Estimates from the literature suggest that the value depletion period of computer hardware is three years (e.g., Hitt and Brynjolfsson, 1996; Lichtenberg, 1995). We thus use an annual depletion rate of $1/3$ and aggregate annual spending on hardware in years t-2, t-1, and t to form hardware capital in year t. If hardware expenditure in one year is missing in our dataset, we use the expenditure in the subsequent year as an approximation (Hitt and Brynjolfsson, 1996). The capitalized value of IT labor spending, according to the literature, is estimated to be three times the annual IT labor spending (Dewan *et al*., 2007; Hitt and Brynjolfsson, 1996).

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Table 7. Sensitivity analysis

Panel A: Alternative measure for *BIND*, proportion of non-affiliated directors

	(1) Full sample	(2) Less competitive vs. more competitive industries			(3) Large firms vs. small firms		
		$(C = 1)$†		$(C = 0)$†	$(A = 1)$‡		$(A = 0)$‡
	Coef β_k (t-stat)	Coef $\beta_k{}^{C}$ (t-stat)		Coef $\beta_k{}^{1-C}$ (t-stat)	Coef $\beta_k{}^{A}$ (t-stat)		Coef $\beta_k{}^{1-A}$ (t-stat)
ITINV	1.31***	0.98		2.11***	1.24***		2.87***
	(3.95)	(1.27)		(4.22)	(2.65)		(3.82)
BIND	0.63***	0.33		0.90***	0.43*		0.51**
	(3.92)	(1.35)		(3.66)	(1.87)		(2.11)
ITINV×BIND	**17.97*****	**8.56**		**26.46*****	**12.02***		**14.97****
	(3.85)	**(1.20)**		**(3.69)**	**(1.81)**		**(2.10)**
FOR	0.043	0.23		0.19	0.30*		0.99**
	(0.87)	(0.45)		(1.11)	(1.70)		(2.35)
ITINV×FOR	**0.75**	**7.79**		**4.57**	**8.23**		**33.37****
	(0.57)	**(0.52)**		**(0.89)**	**(1.60)**		**(2.39)**
Controls in Tables 4–6	Included	Included		Included	Included		Included
N	718		608			718	
F-statistic	136.89***		59.03***			69.51***	
R^2	0.717		0.733			0.731	
Adjusted R^2	0.711		0.721			0.721	

Panel B: Alternative measure for *BIND*, a composite index

	(1) Full sample	(2) Less competitive vs. more competitive industries			(3) Large firms vs. small firms		
		$(C = 1)$†		$(C = 0)$†	$(A = 1)$‡		$(A = 0)$‡
	Coef β_k (t-stat)	Coef $\beta_k{}^{C}$ (t-stat)		Coef $\beta_k{}^{1-C}$ (t-stat)	Coef $\beta_k{}^{A}$ (t-stat)		Coef $\beta_k{}^{1-A}$ (t-stat)
ITINV	1.73***	0.81		2.93***	1.70***		2.87***
	(4.70)	(1.05)		(5.16)	(3.12)		(3.79)
BIND	0.37***	0.14		0.62***	0.32**		0.22**
	(4.78)	(1.16)		(4.73)	(2.53)		(1.98)
ITINV×BIND	**10.39*****	**2.96**		**18.03*****	**8.83****		**6.17***
	(4.61)	**(0.83)**		**(4.73)**	**(2.43)**		**(1.88)**
FOR	0.033	0.19		0.024	0.20		1.01**
	(0.68)	(0.36)		(0.14)	(1.06)		(2.37)
ITINV×FOR	**0.54**	**6.78**		**−0.34**	**5.27**		**34.06****
	(0.41)	**(0.45)**		**(−0.06)**	**(0.98)**		**(2.40)**
Controls in Tables 4–6	Included	Included		Included	Included		Included
N	718		608			718	
F-statistic	138.99***		60.46***			69.89***	
R^2	0.720		0.738			0.732	
Adjusted R^2	0.714		0.726			0.722	

See Table 2 for variable definitions. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.
† $C = 1$ for firms with above-median *CR4*; $C = 0$ for firms with below-median *CR4*.
‡ $A = 1$ for firms with above-median *ASSETS*; $A = 0$ for firms with below-median *ASSETS*.

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Table 7. (*Continued*)

Panel C: IT stock§

	(1) Full sample	(2) Less competitive vs. more competitive industries		(3) Large firms vs. small firms	
		$(C = 1)$†	$(C = 0)$†	$(A = 1)$‡	$(A = 0)$‡
	Coef β_k (t-stat)	Coef $\beta_k{}^C$ (t-stat)	Coef $\beta_k{}^{I-C}$ (t-stat)	Coef $\beta_k{}^A$ (t-stat)	Coef $\beta_k{}^{I-A}$ (t-stat)
ITSTOCK	0.81***	0.42	1.54***	0.69**	1.22***
	(4.63)	(1.00)	(5.54)	(2.43)	(3.53)
BIND	0.38***	0.072	0.91***	0.35**	0.24
	(3.90)	(0.46)	(5.20)	(2.37)	(1.64)
ITSTOCK×*BIND*	**5.71*****	**0.38**	**14.25*****	**5.33****	**3.58**
	(3.71)	**(0.15)**	**(5.18)**	**(2.25)**	**(1.55)**
FOR	0.15	0.062	−0.15	0.13	0.81**
	(1.07)	(0.13)	(−0.90)	(0.76)	(2.11)
ITSTOCK×*FOR*	**2.23**	**1.71**	**−3.17**	**1.85**	**14.55****
	(0.97)	**(0.24)**	**(−1.12)**	**(0.67)**	**(2.14)**
Controls in Tables 4–6	Included	Included	Included	Included	Included
N	718	608		718	
F-statistic	138.76***	60.97***		69.49***	
R^2	0.719	0.740		0.731	
Adjusted R^2	0.714	0.727		0.721	

Panel D: Sample split based on excess control right▲

	Excess control right above median		Excess control right below median
	Coefficient (t-stat)		Coefficient (t-stat)
ITINV	0.90*		3.08***
	(1.93)		(4.96)
BIND	0.32**		0.53***
	(2.50)		(2.81)
ITINV×*BIND*	8.40**		15.11***
	(2.18)		(2.77)
FOR	−0.023		0.89***
	(−0.13)		(2.61)
ITINV×*FOR*	**−1.94**		**26.16*****
	(−0.34)		**(2.64)**
Controls in Tables 4–6	Included		Included
N		718	
F-statistic		68.40***	
R^2		0.728	
Adjusted R^2		0.717	

See Table 2 for variable definitions. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.
† $C = 1$ for firms with above-median *CR4*;
$C = 0$ for firms with below-median *CR4*.
‡ $A = 1$ for firms with above-median *ASSETS*; $A = 0$ for firms with below-median *ASSETS*.
§ *ITSTOCK* = accumulated IT stock scaled by total assets. The accumulated IT stock is aggregated based on annual IT expenditures over three years.
▲ Excess control right = control right of the largest shareholder in excess of (i.e., minus) its cash flow right.

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and Wong, 2005; Joh, 2003), it results in conflicts between the controlling shareholder and foreign owners. Conversely, the absence of excess control leads to an environment where foreign investors are motivated to contribute expertise in IT management. Indeed, Panel D shows that foreign ownership plays a significant role in the sample featuring low excess control. This result lends support to our conceptual argument regarding the role of foreign ownership.

Endogeneity issue

We follow Bascle's (2008) suggestion to address possible endogeneity by the Heckman approach and the instrumental variable method. First, we develop a probit model to explain IT investment based on an 'IT needs' model in the literature (Mitra, 2005). The model uses a firm's observable IT spending to proxy for its latent IT needs, and attributes IT spending to the firm's free cash flow and growth options. We adopt this model and further include the two governance factors (*BIND* and *FOR*), firm size (*ASSETS*), and industry dummies (Mitra, 2005).[10] We then create the inverse Mills ratio and use it to control for the possible self-selection (Bharadwaj, Bharadwaj, and Bendoly, 2007; Shaver, 1998). The results (untabulated) show that the coefficient on the inverse Mills ratio is insignificant, and all coefficients on other variables are qualitatively similar, suggesting that the possible endogeneity bias due to self-selection does not harmfully affect our results (Heckman, 1979). Second, our untabulated results using the instrument variable (IV) method also confirm the robustness of our results.[11]

Alternative measure for industry competitiveness

Following the literature (e.g., Lambson and Jensen, 1998), we measure industry competitiveness by another variable—entry costs (*ENTCOST*)—defined as the weighted average gross value of property, plant, and equipment for firms in one industry, weighted by each firm's market share in the industry. The higher the entry costs, the higher the industry concentration and the lower the industry competitiveness (Porter, 2001). We rank all firms in our sample by *ENTCOST* and divide them at the median. Firms with *ENTCOST* above the sample median form the less competitive industries, and firms with *ENTCOST* below the median form the more competitive industries. The untabulated results offer consistent support for our finding that board independence moderates IT value in more competitive industries.

CONCLUDING REMARKS

This section summarizes the above results and contextualizes our findings in Taiwan relative to prior studies in similar research settings. Consistent with prior research in emerging markets (Tam, 1998; Dewan and Kraemer, 2000), we find no conclusive evidence for IT's contribution to firm performance. IT contributes to firm performance only in the presence of complementary corporate governance structures, supporting the notion that addressing agency problems is an important undertaking in international research contexts (Gedajlovic and Shapiro, 1998; Hoskisson *et al*., 2005). Specifically, we find moderating effects of board independence and foreign ownership on IT value, highlighting their roles as organizational resources complementary to IT investment. These moderating roles are new evidence added to the literature on IT returns.

Regarding board independence, we find mixed results about its relation to firm performance, and the relation differs in significance across different levels of IT investment and competition. This is in contrast to the evidence of a positive value implication of corporate governance in Durnev and Kim (2005) and Klapper and Love (2004), and that of board independence shown by Choi *et al*. (2007) and Young *et al*. (2008). One explanation could be the different variables and methods used, as discussed earlier in the hypotheses development section. Overall, our result is consistent with the

[10] We find that IT spending is negatively related to growth options but positively related to the interaction between growth options and free cash flows. These results suggest that, conditioning on substantial free cash flows, firms with high growth options would have high IT needs (Mitra, 2005). The coefficients on *BIND* and *FOR* are significantly negative and significantly positive, respectively. Firms are likely to invest more in IT if they feature lower board independence and higher foreign ownership, because knowledge spillover associated with foreign ownership may encourage IT investment and independent directors help control the volume of investment.

[11] We use the industry median investment volume as an IV (Lev and Sougiannis, 1996). We also add more IVs concerning capital costs and investment constraints (the leverage ratio, and the firm's beta, a measure of the volatility of the firm's stock market price that is a driver of the cost of capital), which are used by prior research as IVs for IT investment (Brynjolfsson and Hitt, 2003). These tests generate consistent results.

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literature review by Denis and McConnell (2003) in an international setting, as well as more recent evidence that still suggests an inconclusive relation of board independence with firm performance (Bai *et al*., 2004; Peng, 2004). Furthermore, our result shows new evidence, which prior studies lack, about how board independence moderates IT returns and how the moderating effect differs across industries.

Specifically, we find no moderating effect of board independence on the IT investment-firm performance relation in less competitive industries. In contrast, in more competitive industries, there is a significant interaction effect between IT investment and board independence, which is positively related to firm performance. Information technologies help firms improve performance in competitive environments, while the economic returns to IT investment are positively related to board independence. This supports the conjecture that the corporate board plays a monitoring role in new technology investment. Our findings show that board monitoring benefits intensely competitive industries more than those that are less competitive. Clearly, the relations between IT returns, board independence, and industry competitiveness are rather complex. While we have not completely disentangled the effects, our results offer insights into the role of corporate governance in achieving returns on IT investment.

Moreover, the direct association between foreign ownership and firm performance suggests that foreign ownership may not always improve firm performance. The Taiwanese stock market has a high quality of liquidity. Becht, Bolton, and Roell (2003) suggest that once the market has abundant liquidity, foreign investors have the option to sell the stake rather than to intervene. The limiting monitoring role might explain the insignificance of foreign ownership. While the direct relation between foreign ownership and firm performance is consistent with prior research (e.g., Qi *et al*., 2000; Tan, 2002), we contribute to the literature by showing a significant and positive interaction between IT investment and foreign ownership for small firms. Foreign investors may inject IT expertise that is likely to be applicable across industrialized and emerging markets. Hence, foreign ownership may help small firms to more effectively deploy IT. As an implication for research on corporate governance, our results suggest that analysis of governance structures needs to be situated within specific contexts such as firm size and industry competitiveness. Before discussing the managerial implications of our results, we briefly point out some limitations of our study.

First, we view our work as an initial attempt to analyze the moderation of two corporate governance structures on IT value. One line of future inquiry is to investigate other corporate governance variables (e.g., number of board meetings and directors' industry expertise). Second, future studies can cross-validate our results about foreign ownership using complementary methodologies. For instance, field research can detail how foreign investors are involved in making IT investment decisions and what knowledge and experience are transferred with foreign ownership. Third, although we have examined both annual IT investment and accumulated IT stock, and both current and future firm performance, the cross-sectional nature of the dataset limits our ability to draw conclusions about causality. Readers need to be aware of this limitation when interpreting the results. Notwithstanding these limitations, our study makes significant contributions to both research and practices.

As an important implication for firms considering IT investment, our results suggest that competitive firms should be more proactive in using IT to improve performance. Yet, IT alone does not hold the answer to performance improvement and must

investment activity, rather than linking it directly to overall firm performance. These directions may lead to fruitful areas of future inquiry.

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