Board Independence and Firm Performance in the IT Industry: The Moderating Role of New Entry Threats

Yang Pan
E.J. Ourso College of Business
Louisiana State University, Baton Rouge, LA 70803

Peng Huang, Anandasivam Gopal
Robert H. Smith School of Business
University of Maryland, College Park, MD 20742

Abstract

Prior research on corporate governance has offered contradictory empirical evidence on the relationship between the independence of the board of directors – the degree to which the board consists of outside directors who are not affiliated with the company – and firm performance. Building on the contingency view of corporate governance, we argue that the presence of significant new entry threats (NET), a unique feature that differentiates the IT industry from many other industries, is a critical contextual variable that moderates this relationship. Leveraging a novel NET measure based on text mining, we show that facing high NET, firms with boards with a higher proportion of independent directors, who contribute to explorative organizational learning, carry out more effective monitoring, and offer independent opinions in strategic decision making, outperform firms with fewer independent board members. To address the endogeneity of board independence, we use the enactment of the Sarbanes-Oxley Act and related changes to the NYSE/NASDAQ listing rules as exogenous shocks; we show that our results are robust to the correction for endogeneity issues. Further, we show that our findings are generalizable to other high tech industries that face similar significant threats of new entry emerging from fast-moving industry dynamics. However, these results do not extend to slow-moving industries that have stable market structure, thereby facing lower and less volatile levels of NET. We discuss the implications for future research and provide managerial guidelines for practice as well.

Keywords: *new entry threats, board independence, board of directors, corporate governance, firm performance, Sarbanes-Oxley Act, text mining*

1. Introduction

The issue of corporate governance has seen much research within the management literature in the last two decades and continues to generate debate among practitioners and researchers alike. The role of corporate governance received significant attention during the accounting scandals at companies such as Enron and WorldCom in the early 2000s, which prompted the enactment of the Sarbanes-Oxley Act of 2002. Part of the responsibility for these crises was attributed to the board of directors of these firms, ostensibly elected to provide much-needed advisory and oversight functions on behalf of shareholders. Within the fast-moving information technology (IT) sector, corporate governance is of particular importance for a number of reasons. First, the IT sector is associated with fast clock-speed and rapid technological change (McAfee and Brynjolfsson 2008), which puts pressure on firms to continually adapt to changing market conditions. In such contexts, the advisory role played by the board is of vital importance. Second, the typical model of entrepreneurship within the IT sector gives rise to many IT firms with powerful founder-CEOs who also serve as the chairman of the board (Wasserman 2008); such CEO-chairman duality is often associated with weak boards in general. The prevalence of these conditions within the IT industry suggests that the firm's executives can potentially act against the best interests of shareholders. For instance, it is well known that IT firms such as Google and Facebook often adopt a dual-class share structure, effectively ensuring that the firm's founders and top executives maintain control of the company (Gompers et al. 2010). Such tight control can sometimes evoke dissidence from shareholders and governance activists in the form of complaints or demands for reform; consider, for instance, the recent lawsuit against Facebook's board of directors by a shareholder, alleging excessive director compensation, breach of fiduciary duty, and unjust enrichment.[1] The board of directors is thus of significant importance in managing agency issues that can affect the long-term viability of the firm.

At the heart of the debate surrounding corporate governance lies the unresolved question of the

[1] http://www.reuters.com/article/us-facebook-lawsuit-idUSKBN0EK1YO20140609

relationship between the independence of the board – the degree to which the board consists of outside directors who are not affiliated with the company – and firm performance. Despite many years of research, this relationship remains theoretically and empirically ambiguous. Some scholars maintain that from an agency perspective, the board should include a majority of "outside" directors since insiders on the board are less able to perform their fiduciary role: they lack objectivity in decision making and may support CEOs out of their own career considerations (Ellstrand et al. 2002). On the other hand, some researchers note that independent directors may lack industry or firm-specific knowledge that is required to make well-informed decisions (Baysinger and Hoskisson 1990), whereas insider representation on the board leads to greater management commitment (Baysinger et al. 1991) and more effective monitoring of top managers due to superior information (Eisenhardt 1989). Interestingly, this lack of theoretical agreement is reflected in empirical findings as well (Wagner III et al. 1998); prior research has reported a positive correlation (Baysinger and Butler 1985; Pearce and Zahra 1992), a negative correlation (Bhagat and Black 2001; Vintila et al. 2015; Zahra and Stanton 1988), as well as no correlation (Daily and Dalton 1992; Daily and Dalton 1994; Dalton et al. 1998; Kesner 1987; Park and Shin 2004). To reconcile these contradictory findings, Pearce and Zahra (1992) proposed a contingency perspective of corporate governance, arguing that there is no perfect, one-size-fits-all corporate governance approach. Rather, the effectiveness of governance mechanisms depends on the organizational environment and other contextual factors about the focal firm (Gani and Jermias 2006; Hutchinson and Gul 2004).

Building on this contingency view of corporate governance, we argue that the presence of constant new entry threats (hereafter, *NET*), a unique feature that differentiates the IT industry from others such as the airline or auto sectors, is one such critical contextual variables that moderates the relationship between board independence and financial performance. NET is a disruptive force that often challenges incumbents in the marketplace, as highlighted by Porter's five competitive forces model (Porter 1979). Its influence has become particularly salient in recent years where the pace of digital innovations is altering the nature of competition, and recent developments in crowdfunding platforms, accelerators, and entrepreneurial

ecosystems have further lowered barriers to entry within the high-tech industry, making it easier for new ventures to acquire financial resources via channels beyond the model of venture-capital funding (Aggarwal and Singh 2013; Kim and Hann 2014). With high levels of NET, incumbents in the IT industry must spot these threats quickly and adjust their strategies accordingly, since the associated turbulent environment can lead to considerable observed entry into the incumbent's product markets, and therefore heightened contemporaneous competition in the foreseeable future (Goolsbee and Syverson 2008).

The presence of outside, independent directors on the board is likely to play a more critical role under turbulent environments, such as when a firm faces high NET. Under such contexts, independent members on the board are more conducive to explorative organizational learning and the initiation of strategic changes (Johnson et al. 1993; Van Den Bosch et al. 1999), which are often necessary in response to NET. In addition, the benefits of independent board members are amplified under turbulent environments via the two functions that boards are meant to provide: first, they strengthen internal monitoring and oversight functions, acting on behalf of shareholders to resolve agency issues and cut management slack (Ryan and Wiggins 2004). Second, they provide knowledge and resources that may not be easily available within the organization to aid decision making on strategic issues (Hillman et al. 2000). In this paper, we therefore investigate how the degree of new entry threats an incumbent faces moderates the relationship between board independence and firm performance, thereby adding to the contingency perspective of corporate governance.

Empirically establishing the moderating effect of NET on the relationship between board independence and performance is challenging for two reasons. First, threats from new entries represent forward-looking estimations of the extent to which the potential future competition may influence firm profit or product market performance, which are yet to be fully materialized at the current moment; thus they are difficult to observe and measure (Hoberg et al. 2014). As such, there are no ready-to-use and accepted industry classifications for startup firms, causing difficulties for the incumbents to identify startups that are threatening their product markets. Second, to the extent that firms make board member appointment

decisions partly in response to its competitive environment, board independence may be correlated with a variety of unobserved variables that influence firm performance, therefore causing endogeneity concerns. For instance, Boone et al. (2007) find that board size and board independence increase as firms grow and diversify over time. Other scholars have implicated other factors such as the R&D intensity of the industry as well as institutional forces may be at play, all of which may influence both board structure as well as firm performance (Hermalin and Weisbach 2003). The presence of these confounds makes it difficult to disentangle the true effect of board independence on firm performance.

To overcome the first challenge, we adopt a novel, text-based measure of new entry threats introduced by Pan et al. (2015). The unique text-based measure of NET overcomes the limitations of static industry classifications that lack longitudinal variations, and provides the basis for us to empirically examine the specific research questions of interest here. We address the second challenge – the endogeneity of board independence – by leveraging the enactment of Sarbanes-Oxley Act and subsequent changes to the NYSE/NASDAQ listing rules (collectively referred to as *SOX* hereafter) as a natural experiment that exogenously shifts board independence for a subset of public firms in the U.S. These changes provide an ideal identification strategy, since they create differential shocks to board independence of compliant firms (those with boards that included more than the required ratio of independent directors prior to SOX) and to that of non-compliant firms (those with boards that included less than the required ratio of independent directors prior to SOX), but ensure that such changes are independent of the unobserved firm-specific variables that are correlated with firm performance.

We estimate our models using panel data methods using a sample of public firms in the IT hardware and software industries over the period of 1997-2013; these years are selected based on joint data availability on board characteristics, new entry threats and firm-level data on financial performance. Consistent with prior literature (Bhagat and Black 2001), our results show that a higher level of board independence is *not* significantly associated with superior firm performance. More importantly, we consistently find a moderating effect of NET: facing greater new entry threats, firms with a higher

proportion of independent board members systematically outperform those with insider-dominated boards. These findings are robust to the use of instrumental variables estimations and a variety of alternative measures of firm performance. We also show our findings are generalizable to other industry segments that share the propensity of facing high NET – these include the IT services and pharmaceutical industries. However, these effects do not extend to industries characterized by relatively homogenous market structure, and the associated low levels of NET, such as the oil and natural gas, or agricultural manufacturing sectors.

Our work provides several useful contributions to extant research in information systems and corporate governance. First, prior research on corporate governance has been unable to establish a direct relationship between board independence and firm financial performance (Bhagat and Black 2001), leading to the ongoing debate over the usefulness of regulatory interventions with regard to board composition. Our finding helps by partly resolving one aspect of this debate, indicating that board independence does help firms significantly mitigate the negative impacts of new entry threats in the IT industry. We thus provide evidence of an important boundary condition – i.e., the turbulent environment associated with NET – and show the contingencies under which board independence contributes positively to firm performance in the IT industries. More importantly, we show that due to the variations in NET that are typically faced by IT firms, corporate governance in this industry has a more nuanced relationship with firm performance, compared to firms in traditional industries where corporate governance has been extensively studied.

Second, we extend the IS literature by drawing attention to an important construct – new entry threats, which is particularly relevant in the IT industries due to its fast-changing, hypercompetitive nature (Mendelson and Pillai 1998). Being able to identify and respond to new entry threats from entrepreneurial ecosystems effectively has become increasingly vital in the IT sector. However, little empirical research has examined how NET shapes competitive dynamics and firm strategy, largely due to the lack of a proper measure that is sufficiently differentiated from contemporaneous competition or actual entry. We fill this gap by exploring the role of new entry threats in influencing the incumbent firms' operational performance indirectly through its moderating influence on the relationship between corporate governance and firm

performance. Furthermore, we contribute to the small but important literature on quantifying both the extent to which individual firms are threatened by new entry as well as the influence of such threats on firm decision making and industry dynamics (Pan et al. 2015).

Finally, our findings have important implications for managerial practices with regard to corporate governance. Although the selection of board members is a complex process and a multitude of factors should be jointly considered, our analyses show that the influence of independence of board directors cannot be overlooked, especially when the firm operates in a hypercompetitive environment and faces high levels of new entry threats. Compared to internal board members, independent directors are more likely to broaden the scope of organizational learning, and bring unique resources and perspectives that help firms respond to the threats. Our work thus supports a contingency perspective on board independence (Pearce and Zahra 1992), with special relevance to the IT industry.

2. Theory and Hypothesis

2.1 Board Independence and Firm Performance

Corporate governance involves a set of rules, mechanisms and processes by which corporations are controlled and directed. The primary objective of corporate governance is to provide corporate oversight such that upper management's actions will be aligned with the interest of shareholders (Pearce and Zahra 1992). The board of directors in particular is a central mechanism by which a large part of corporate oversight is carried out. The board also plays an important role in helping with strategic decision making within the firm (Carpenter and Westphal 2001; Judge and Zeithaml 1992). The positive impact of informed board members on the decisions made by the firm has been documented in prior research (Hermalin 2005). By providing robust support in the forms of oversight and advice, the board can enable the focal firm to make better decisions and overcome challenges, thereby enhancing the firm's position in the marketplace. Researchers and policy-makers have advocated for governance reform that focuses on enhancing the abilities of the board, such as through regulating the selection of directors and the separation of the roles of

CEO and chairman of the board (Black 1992).[2] Within these initiatives, one has been particularly noteworthy since it directly influences the extent to which the board is able to exert oversight and provide advice: board independence (Bhagat and Black 2001). The prevailing sentiment is that the presence of outside, independent board members should ideally provide the firm with value, leading to a positive impact on firm performance, all else equal. However, the empirical evidence on this relationship is largely inconclusive and often contradictory (Bhagat and Black 2001; Dalton et al. 1998) – researchers have failed to find systematic evidence that firms with predominantly non-executive boards achieve superior financial performance (Donaldson and Davis 1994).

There are alternative theoretical perspectives that shed light on how board independence may affect firm performance. The dominant view held by practitioners, grounded in agency theory (Jensen and Meckling 1976), maintains that the primary duty of the corporate board is to serve as a monitoring mechanism that helps protect shareholders from opportunistic behavior by managers. Therefore, independent directors are believed to be more effective at carrying out the monitoring functions and reducing agency costs, leading to superior firm performance. This view has found some empirical support in the literature; for example, Baysinger and Butler (1985) find that a greater proportion of outside independent directors has a mild and lagged effect on firm performance, but they also note that firms with the best performance records did not have the greatest change in board independence. In an alternative setting, Pearce and Zahra (1992) found that board size as well as the representation by outsiders has a positive association with the firm's financial performance. Thus, some empirical validation of the agency theory perspective on board independence does exist.

An alternative perspective on the role of board composition emerges from arguments based on stewardship theory. It suggests that managers are good stewards instead of opportunistic agents, they are inherently trustworthy, and act in the best interest of the owners (Davis et al. 1997; Donaldson 1990;

---

[2] See, for example, *TIAA-CREF Policy Statement on Corporate Governance*, available at https://www.tiaa.org/public/pdf/pubs/pdf/governance_policy.pdf

Donaldson and Davis 1991). In contrast to the postulates of agency theory, scholars argue that corporate boards with a preponderance of *inside* board members lead to higher firm performance because such practices add to the available expertise of the board, provide unified leadership that removes ambiguity with regard to responsibilities, and give status reward to executives (Dalton et al. 1998; Donaldson 1990). Others have noted the potential benefits of insider directors as well, such as more effective evaluation of top managers due to superior context-specific information (Baysinger and Hoskisson 1990), and greater R&D spending on the part of the firm (Baysinger et al. 1991). Beyond helping with specific firm-level decisions, removing inside directors may also lead to the negative consequences of depriving the firm of important firm- and industry-specific knowledge which, in the longer term, will hurt firm performance (Baysinger and Hoskisson 1990). Therefore, these arguments lead to the testable hypothesis that board independence is negatively associated with firm performance. Empirical evidence consistent with this hypothesis can also be found in the literature. For example, Kesner (1987) reported a positive association between the proportion of inside directors and the return to investors while Bhagat and Black (2001), studying 934 large US firms, showed that firms with a greater proportion of outside directors were associated with significantly lower financial and stock market performance in the following 3 years. Similar conclusions are reported in a more recent study by Vintila et al. (2015) in their study of a sample of high-tech firms.

Adding to the complexity of the issue are a significant number of studies that intriguingly find no direct relationship between board independence and firm performance (Daily and Dalton 1992; Daily and Dalton 1994; Park and Shin 2004; Singh and Davidson III 2003). In fact, multiple meta-analyses have concluded that there is no systematic evidence to suggest that an increase in the percentage of outside directors enhances firm performance (Dalton et al. 1998; Finegold et al. 2007). Thus, the presence of ambiguous results regarding the actual impact of board independence on firm performance, the various theoretical perspectives notwithstanding, remains a topic of considerable debate in the corporate governance literature. It is possible that methodological limitations, or differences, may in part be driving

these diverging results; the studies on board independence across sectors and time periods are not easily replicable nor are they comparable in a straightforward manner (Young 2003). However, a more compelling explanation for these diverging results arises from a contingency perspective of governance proposed by Pearce and Zahra (1992) who argue that the relationship between governance and firm performance is complex, and likely to be contingent on a series of contextual variables and organizational factors that influence the extent to which oversight may be needed or that emphasize the environment the firm operates in. Thus, contingency variables consistent with this perspective include the firm's growth opportunities (Hutchinson and Gul 2004), its overall strategy (Gani and Jermias 2006) and whether the firm is operating in heavily institutionalized environments (Peng 2004). One such environmental factor that is particularly relevant to the IT industry is if the firm operates in a dynamic context where there is considerable *new entry threat*, which has the potential to disrupt the firm in its native product markets in the foreseeable future, described next.

2.2 The Moderating Role of New Entry Threats

Building on the contingency perspective of corporate governance (Pearce and Zahra 1992), we argue that the dynamic environment under which a firm operates forms an important boundary condition that moderates the relationship between board independence and firm performance. The disruptive influence of new ventures in the IT industry has been noted in prior research (Kim et al. 2016) and represent a credible source of environmental volatility for incumbents (Samila and Sorenson 2011). While contemporaneous competition from other incumbents is also a source of environmental volatility (Hoberg et al. 2014), NET is inherently different due to its forward-looking nature and its potential for creative destruction (Aghion and Howitt 1992).[3] Under the conditions of dynamism and environmental turbulence, we argue that maintaining a board with a high proportion of independent directors is particularly valuable, with implications for firm performance, for several reasons.

[3] In all our regression models, we control for contemporaneous competition. We thank an anonymous reviewer for this point.

First, new entry threats, particularly from startups, are often associated with the introduction stage of a new, superior technology or a fundamentally different business model, and embody systematic shifts in the technological landscape or changes in the assumptions and routines upon which the incumbents operate (Christensen et al. 1998). Under such conditions, the contribution of inside, executive directors may be limited from an organizational learning perspective (March 1991). Prior research on organizational learning suggests that in stable knowledge environments, the focus of learning and knowledge absorption is on *exploitation*. In contrast, when in a turbulent knowledge environment, the focus should be, and is optimally deployed, on *exploration* instead (Van Den Bosch et al. 1999). As exploitation builds on the value inherent in existing knowledge, inside directors, with greater firm knowledge and industry-specific expertise, may contribute more to firm performance through efficiency, routinization, refinement, and execution under stable environments (Westphal 1999). However, when there is greater learning opportunities from external environment, such as when a firm faces new entry threats and when new technologies and business models are being introduced, outside (independent) directors are likely to be more open to exploring new opportunities, acquiring new capabilities and adapting to changing environment through variation, flexibility, risk taking and experimentation (Greve 2007). Thus, in the presence of environmental volatility and a concomitant emphasis on exploration, a greater proportion of independent board members should lead to better firm performance.

Second, when facing high levels of new entry threats, incumbents need to respond through rethinking their existing strategic orientations, consider resource reconfigurations, and identify appropriate responses to the possibilities of emerging competition in their product market (Hillman et al. 2000). In such contexts, independent board members are significant sources of information and other resources; they represent valuable stores of knowledge, networks, and capabilities that are available to the firm (Kesner 1988) and not easily replicated from within the firm (Hillman and Dalziel 2003). For example, the networks and information provided by outside directors could help the incumbent firm pursue opportunities in new markets and industries, while also helping the firm advance through the formation of strategic alliances

(Pearce and Zahra 1992), all of which are likely to help the firm respond optimally to environmental volatility. Inside directors, with their concentrated exposure to existing strategies within the firm, are less likely on the margin to notice or consider alternative approaches (Carpenter and Westphal 2001). Indeed, prior research indicates that while internal board members may have greater proximal knowledge about the firm and its workings, the perspective brought in by independent members is particularly influential during times of strategic change and turbulence (Forbes and Milliken 1999; Rosenstein and Wyatt 1997). Beyond providing new knowledge and perspective, independent board members may help firms unlearn entrenched organizational habits that are obsolete or no longer functional (Nystrom and Starbuck 1984). In addition, the presence of independent board members can ameliorate the negative effects of "groupthink" visible in embedded group members, thereby questioning taken-for-granted elements of strategy (Forbes and Milliken 1999). Thus, from a resource dependence perspective (Hillman and Dalziel 2003), firms that face turbulence in their product markets are likely to benefit more from the presence of independent board members than firms in a stable environment.

Third, the value of independent board members in the presence of new entry threats is also consistent with the agency view of corporate governance. The board is responsible for monitoring the executives on behalf of the shareholders (Hermalin and Weisbach 2003). Prior research show that the role of governance and oversight is more likely with independent board members rather than insiders who are associated with the firm (Hermalin 2005; Westphal 1999). Consistent with this reasoning, Boone et al. (2007 and Baker and Gompers (2003 find that independent boards reduce the bargaining power of the CEO and incentives of empire-building, thereby ensuring that managerial decisions are long-term optimal for the firm. During the turbulent periods characterized by high levels of new entry threats, this monitoring capability is essential to ensure that the firm's executives take the appropriate strategic reaction to improve the firm's long-term viability, instead of short-term myopic decision making that may provide personal benefits to the manager but will affect the firm negatively in the long run (Guo and Masulis 2015). Prior research also shows that under turbulent environment, boards with heterogeneous external ties are better

able to carry out the monitoring function due to their broad knowledge structures (Carpenter and Westphal 2001). The monitoring function also helps the firm to cut management slack and improve efficiency during the period of turbulence, e.g., cutting unnecessary expenses and scaling back highly risky projects. Thus, from an agency perspective (Hillman and Dalziel 2003), the value of board independence in terms of reducing overall agency costs and ensuring alignment between the goals of the firm and executives is higher when a firm faces high levels of new entry threats.

Finally, prior research shows that the level of board involvement in strategic decision making increases with more independent board members (Judge and Zeithaml 1992). For instance, Johnson et al. (1993) find that boards dominated by outside directors are more likely to initiate corporate restructuring and strategic change. Inside directors are usually reluctant to voice different opinions during strategic decision making because they are worried about challenging the authority of the CEO (Westphal 1998). Therefore, firms with more inside directors tend to be inertial to strategic changes, making them less adaptable to changing environments that are often associated with new entry threats. In summary, multiple theoretical perspectives on corporate boards – organizational learning, agency theory and resource dependency – suggest that volatile environments characterized by high new entry threats play an important role in moderating the relationship between board independence and the firm's operating performance. Therefore, we propose:

Hypothesis 1: Under high levels of new entry threats, firms with a higher proportion of independent board members perform better than those with a lower proportion of independent board members.

3. Data and Variables

3.1 Sample and Data Sources

The dataset we use to conduct our empirical tests is constructed using multiple sources. We focus on the firms in the IT software, hardware and Telecom industries identified by 18 four-digit NAICS industry codes

(Kim et al. 2016).[4] Financial data and other firm characteristics are obtained from Compustat. To measure board independence, we obtain data on board members of U.S.-based public firms from RiskMetrics (formerly Investor Responsibility Research Center), whose coverage is primarily on the S&P 1500 firms. Our variable of new entry threats is adopted from Pan et al. (2015), who describe such threats as emerging from venture-funded startup firms and measure them using a text-mining approach that compares the product descriptions of the incumbents with those of the new entrepreneurial startups. Our primary sample consists of 583 publicly-traded firms over the period of 1997-2013 with 4,175 firm-year observations, representing an unbalanced panel. The sample period includes years when there was considerable turbulence in the IT sector (e.g., the Internet boom and bubble burst), the period of the global financial crisis in 2008 and the recovery afterwards, as well as other less volatile years. Together, the dataset provides considerable longitudinal variation in the measures of new entry threats and board independence that allows us to use firm-level fixed effects panel data models to control for many unobserved firm heterogeneities. We describe the key variables in our analyses below. A summary of the variable definitions can be found in Table 1.

[Insert Table 1 here]

It should be noted that in the unbalanced panel dataset, most of the missing observations are due to delayed arrival (i.e. firms entering the dataset as a public firm subsequent to the start of our observation time-period) or early exit (firm were delisted from the marketplace due to mergers, acquisitions, bankruptcy, privatization, and so on). As long as the reason for missing data is caused by reasons not systematically correlated with the error terms of the estimated equations, the estimation remains unbiased and consistent (Baltagi et al. 2008). In our case, thus, the presence of missing observations leading to an unbalanced panel is unlikely to cause significant biases in estimation.[5]

[4] Our IT sample is defined by 4 digit NAICS code: 2211, 3332, 3333, 3336, 3339, 3341, 3342, 3343, 3344, 3345, 3346, 5112, 5171, 5172, 5173, 5174, 5179 and 5181.
[5] We thank an anonymous reviewer for this important clarification.

3.2 Variables

New Entry Threats (NET). We adopt a novel measure, derived from text mining techniques that are increasingly gaining favor in IS research (Ghose et al. 2012; Li et al. 2014), to capture the threats emerging from startups, introduced by Pan et al. (2015). While the full details on the construction and validation of the NET measure are available in Pan et al. (2015), we briefly discuss the intuition behind this measure here. New entry threats are calculated as the cosine similarity between the product description of an incumbent firm and the aggregated product descriptions from startups that received first-round venture capital funding in a specific year. The product descriptions of established firms are obtained from annual reports (10-Ks) that are updated as required by financial market regulations (Hoberg and Phillips 2016; Tetlock 2011; Tetlock et al. 2008). The product descriptions of startups are obtained from the VentureXpert dataset, commonly used in entrepreneurship research (Aggarwal et al. 2012). The VC-backed entrepreneurial firms have baseline quality and therefore represent credible threats of realized entry to incumbents (Aggarwal et al. 2015). Conceptually, this measure captures how the text of an established firm's product description is similar to the text of product descriptions from the technology-based startup ecosystem. Intuitively, the cosine similarity-based *NET* measure is bounded between 0 and 1, with higher values representing greater threats of new entry.

Board Independence. Following prior work (Knyazeva et al. 2013), we define board independence as the fraction of the board represented by independent (non-gray outsider) directors. We exclude gray directors, who are outside board members with familial or business ties to the firm or its senior management, or have conflicts of interests that can compromise a board's major functions. The average firm in our sample has a board comprising of nine directors, of whom 73% are independent and 27% are gray directors or internal officers (including the CEO). We report average board independence by year in Table 2. The statistics indicate that average board independence significant changed over the period 2002-2007 after SOX and other related regulatory changes, and the general trend is increasing over time.

[Insert Table 2 here]

Firm Performance. We start by measuring firm performance using Return on Assets (ROA), defined as operating income before depreciation and amortization (OIBDA) divided by total assets (AT). This measure captures overall operating performance of a firm and is a commonly used firm profitability measure in finance and IS (Anderson and Reeb 2003; Bharadwaj 2000). We also consider an alternative definition of ROA, measured as net income over total assets. Prior research has also used return on equity (ROE) as an alternative measure of operational performance (Allen and Gale 2000) – we use this measure in our analysis as well. The summary statistics for the dataset are displayed in Table3, indicating mean ROA is 11.1% (1.9%) using OIBDA (using Net Income), while mean ROE for the sample is 11.5%.

Control Variables. Following prior literature (Anderson and Reeb 2003; Giroud and Mueller 2011), we control for a vector of firm characteristics that may affect a firm's performance, including firm size, asset tangibility, leverage, capital expenditure, and product market competition. We control for contemporaneous competition by calculating the Herfindahl-Hirschman index based on market shares, where competitors are identified by the increasingly popular Text-based Network Industry Classification (TNIC) scheme created by Hoberg and Phillips (2016. Unlike the traditional NAICS classification, TNIC classifications are updated every year as firms file 10-K reports, allowing for a more accurate measure of contemporaneous competition. We control for firm size using the natural log of total assets. In addition, following previous studies of corporate board of directors (Triana et al. 2013; Zona et al. 2015), we control for a set of board structure variables that may influence firm performance, including CEO duality, board size, average age of board members, average tenure of board members, and number of board interlocks. In our sample, the CEO also holds the position of the chairman of the board in approximately 65% of the firms. On average, a firm in our sample has a board of 9 directors with an average age of 60 and tenure of 9 years with the focal company, while 5 of them also sit on the board of (therefore create interlocks with) other companies.

[Insert Table 3 here]

4. Results

We discuss the results of our analysis in stages, starting with firm-level fixed effects models. We then provide additional analyses where we address the endogeneity of board independence, use alternative samples and alternative measures of the moderator variable, and show that the results are robust to each of these specifications. Beyond considering these relationships within the focal IT industry, we also estimate similar models for other industry sectors that may not be as technology-intensive for two reasons. First, examining the results from other industries that are less volatile and dynamic than the IT industry helps establish the boundary conditions of the effects we postulate; to the extent that NET is less of a problem in other industries, the relationship between board independence and performance may be less nuanced. Second, if the role of NET is indeed important, as we argue, testing these relationships in industries which experience low levels of NET provides a test of falsifiability. Comparisons between the IT industry, on the one hand, and other industries with lower average levels of NET, on the other, allow us to establish the robustness of our arguments. We describe the obtained results in more detail below.

4.1 Results from Panel Data Models with Fixed Effects

In order to evaluate the moderating effect of *NET* on the relationship between *board independence* and corporate operating *performance*, we estimate a panel data model of the following form:

$$\begin{aligned} Performance_{i,t+1} = \lambda_i + \phi_t + \beta_1 \times BoardIndp_{i,t} + \beta_2 \times NET_{i,t} \\ + \beta_3 \times BoardIndp_{i,t} \times NET_{i,t} + X_{i,t}\theta + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where *i* indexes the firms, and *t* indexes the time periods. In the baseline model we use ROA as the dependent variable. The variable $NET_{i,t}$ is the text-based measure of new entry threats. $BoardIndp_{i,t}$ denotes the proportion of independent, outside directors. X_{it} is a set of firm characteristics that may affect firms' operating performance. We control for time-invariant unobservable firm characteristics by including firm fixed effects λ_i. ϕ_t is a set of year dummies we use to control for economy-wide shocks. We estimate the models using OLS regressions with robust standard clustered at the firm level to control for serial correlation (Wooldridge 2010). ε_{it} represents the idiosyncratic error. To compare our results to prior

literature on board independence, we also evaluate the main effect of $BoardIndp_{i,t}$ on firm performance by presenting results from a model without the interaction term $BoardIndp_{i,t} \times NET_{i,t}$.

Table 4 reports the results from our baseline panel data model with firm fixed effects. The dependent variable in Column (1) and Column (2) is ROA, operationalized as OIBDA divided by total assets. Column (1) shows the direct effects of *board independence* on firm performance, and Column (2) adds the interaction with *NET* in the model. We repeated this pattern for other alternative measures of performance in the table. In the models examining direct effects of *board independence* on performance (columns 1, 3, and 5), we find that the coefficients of $BoardIndp_{i,t}$, although positive, are consistently insignificant, suggesting that variations in board independence are, by themselves, not directly associated with firm performance, an observation that is consistent with prior studies (e.g., Bhagat and Black 2001). Interestingly, we also find that *NET* is consistently associated with a decline in firm performance. It is possible that the potential technology changes associated with new entry threats may raise the wages level in the labor market, making it difficult for the incumbents to maintain their human capital. In addition, high levels of NET may raise the perception of riskiness of the incumbent in the capital market, making it more costly for the incumbent to raise capital. As a result, the rising labor cost, together with the higher cost of capital induced by entry threats lead to significant increases in operating costs and deteriorating performance (Fallick et al. 2006).

[Insert Table 4 here]

The results pertaining to the moderating effect of *NET* on the relationship between *board independence* and firm performance are reported in columns 2, 4, and 6 of Table 4. We find that the interaction terms of *board independence* × *NET* are significantly positive at the 5% level or lower across all performance measures, confirming our conjecture that NET positively moderates the relationship between board independence and firm performance. Effect size calculations based on column (2) suggest that for firms experiencing low levels of *NET* (i.e., one s.d. below mean), a change in *Board Independence* from 0% to 100% leads to a 4.38 percentage point decrease in ROA ($p < 0.01$), equivalent to a reduction of

$335.17 million in operating income before depreciation (OIBDA) when total assets are evaluated at the mean level. In contrast, at high levels of *NET* (i.e., one s.d. above mean), a change in *Board Independence* from 0% to 100% results in a 5.92 percentage point increase in ROA ($p<0.01$), equivalent to a gain of almost $480.05 million in OIBDA on average. To illustrate the marginal effects in a more intuitive manner, in Figure 1a we plot the predicted levels of ROA as a function of board independence under high vs. low levels of NET (using a sample median split), along with 95% confidence intervals. The results support our theoretical argument that a higher percentage of independent board directors, who strengthen the monitoring functions while also providing knowledge resources and independent opinions, are particularly valuable when firm operates under turbulent environment such as when facing high NET. In Figure 1b we plot the average marginal effect of board independence on ROA as a function of NET, together with 95% confidence intervals for the marginal effect. The plot shows that the marginal effect of board independence on performance becomes greater as NET increases, supporting the hypothesis postulated about the moderating effect of NET.

[Insert Figure 1a and Figure 1b here]

It is arguable that IT firms experiencing high NET are likely to be in industries which are more innovative on average; it is this innovativeness that leads to high NET, which then influences performance. Therefore, it is important to account for the innovativeness of the firm before we can partial out the influence of NET. We perform additional tests to rule out this alternative explanation, which are described in detail in the Online Appendix. Specifically, we report on a set of regressions controlling for the innovation capabilities of incumbent firms, so that the incremental effect of NET on performance can be estimated. All the findings from this alternative specification are consistent with those reported above, thereby establishing robustness.

4.2 Addressing Endogeneity of Board Independence

The baseline analyses assume that board independence is strictly exogenous. However, endogeneity concerns arise when there are unobserved variables that are correlated with both firm's operating

performance and board composition. Corporate governance structures, including the appointment of the board of directors, are endogenous decisions made by firms in response to the environment in which they operate. For example, a growing body of research focuses on optimal board design, including the representation of independent directors on boards (Boone et al. 2007; Raheja 2005). Others suggest that drivers of independent boards may include the private benefits of control and CEO's influence over director appointments (Hermalin and Weisbach 1998). In yet another context, Luoma and Goodstein (1999 argue that board formation is often a result of institutional pressures experienced by the firm in its environment. In effect, there are reasons to suggest that board formation is endogenous. As a result, the estimated effect of independent board directors on firm performance may be confounded with unobserved heterogeneities.

To address these concerns, we relax the strict exogeneity assumption of board independence by using a quasi-experimental setup – the regulatory changes with regard to board composition – to construct instrumental variables for board independence. During our sample period, an important set of new and tightened corporate governance requirements was introduced with the enactment of Sarbanes-Oxley Act. The main provisions included increased penalties for fraudulent financial activities, independence of audit committees, CEO and CFO certified financial statements, real-time disclosure of equity transactions by corporate insiders, and so on (Chhaochharia et al. 2016). In response to the enactment of SOX, major U.S. stock exchanges required their listed companies to comply with additional corporate governance obligations, such as the requirement for a majority of independent directors on the board, existence or creation of audit, nomination and compensation committees, and board sessions without insiders (Wintoki 2007; Zhang 2007). These regulatory changes form the basis of our identification strategy.

Specifically, we use the enactment of the Sarbanes-Oxley Act and the subsequent changes in the NYSE/NASDAQ listing rules as an exogenous determinant of our endogenous variable – board independence. One of the key requirements of SOX was that a majority of directors on a firm's board should be outsiders, or independent directors who has 'no material relationship' (either directly or as a partner, shareholder or officer of an organization that has a relationship with the company) with the listed company

(Banerjee et al. 2015; Chhaochharia et al. 2016). The enactment of SOX was thus associated with a significant, exogenously mandated increase in the number of independent directors for non-compliant firms (i.e., firms with fewer than 50% independent directors prior to SOX), but did not significantly affect the board independence of compliant firms (i.e., firms with greater than 50% independent directors prior to SOX). In addition, there is no reason to believe this exogenous event influences firm performance through any channel other than changing firms' board independence, making it an ideal instrument (Angrist and Pischeke 2008, p.117). Therefore, we use the enactment of SOX to construct an instrument for board independence. Conceptually, our identification strategy is similar to that used in Cohen-Zada and Sander (2011), who examine the effect of religious participation on happiness, and use the state-level repeal of "blue laws" that prohibit retail activity on Sundays as an exogenous event, to construct an instrument for the endogenous church attendance variable. Figure 2 demonstrates the trends of average board independence for compliant firms and non-compliant firms for the years before and after SOX. Compared to the compliant firms, there is a substantial increase in average board independence for non-compliant firms around the year of SOX enactment in 2002. Thus, model-free evidence shows that the enactment of SOX is indeed associated with significant exogenous shocks to board independence, particularly in non-compliant firms.

[Insert Figure 2 here]

To construct the instrument, we assign firms in our sample to one of two groups based on their board composition in the year prior to SOX. The first group (compliant group) consists of firms that had already met the regulatory requirements in the year prior to SOX, i.e. they had a majority (more than 50%) of board directors that were independent directors in the year prior to SOX. The second group (non-compliant group) includes the "treated" firms that had not met the requirements with regard to board independence in the year prior to SOX. We create a dummy variable indicating whether a firm belongs to "treated" or control group. We also construct a *post-SOX* timing indicator that equals one if the observation occurs in 2002 or later. Whereas SOX was enacted in mid-2002, we also use an alternative cutoff to

construct the timing indicator that equals one if the observation occurs in year 2003 or later as a robustness check (Chhaochharia et al. 2016). The instrumental variable for *Board Independence* is thus defined as the interaction of the *non-compliant group* × *post-SOX* dummy (Banerjee et al. 2015). For models with interaction *NET* × *Board Independence*, we further interact this instrument with *NET* to address the potential endogeneity of *NET* × *Board Independence* in the full model.

The results from 2SLS regressions are reported in Table 5 and Table 6. Table 5 represents the results with instrumental variables using 2002 as the cutoff for the *post-SOX* indicator. The first-stage regression results of the IV on *Board Independent* in a model without interaction terms are shown in Column (1). The estimated coefficient of the instrument, *non-compliant firms * post-SOX*, is positive and significant at the 1% level, consistent with the expectation that non-compliant firms were indeed adding independent board directors after the enactment of SOX. The first-stage regressions of the IVs on *Board Independent* and *NET * Board Independent* in the model with the interaction term are reported in Column (3) and Column (4), which show that the coefficients of the instrument, *non-compliant firms * post-SOX*, are broadly consistent with the first stage analysis without the interaction term in Column (1). For all IV regressions, we report the F-statistics for the test of weak instrument (Stock and Yogo 2005). For the main effects model (Column 2), the value of the first stage F-statistic (187.30) is larger than the conventional rule-of-thumb value of 10, as suggested by Staiger and Stock (1997, showing that the instrument is not weak. The F-statistic is also higher than the Stock-Yogo critical value of 16.38 at the 10% maximal IV size (Stock and Yogo 2005). Column (2) and Column (5) show the second stage of the 2SLS regression accounting for the endogeneity of *Board Independence* without and with the interaction term of *NET * Board Independence*, respectively. The second stage results from Column (2) show that board independence is not significantly associated with firm performance even after we correct for its endogeneity. The second stage results in Column (5) are qualitatively similar and in the same direction as in our baseline estimates but render larger coefficient sizes; the larger estimates may reflect the effect of the instruments, which provide conditional marginal effects rather than unconditional marginal effects. The higher estimates could

also result from a local average treatment effect. Since it is hard to exactly identify why coefficient estimates are higher, we recommend caution in using point estimates from the analysis for predictions outside the sample. That said, the direction of the effects is estimated reliably, allowing us to conclude that even after accounting for endogeneity, the support for Hypothesis 1 remains robust. Furthermore, we repeat the IV analyses but by treating 2003 as the cutoff for the time-period indicator and present the results in Table 6. We observe that the results are highly consistent with Table 5.

[Insert Table 5 and Table 6 here]

A lingering concern is whether the results in 2SLS regressions are mainly driven by the construction of the panel, which includes more observations long after SOX, when most public firms were already compliant. In order to address this concern, we conduct a robustness test in which we limit the observations to years before 2007, creating a sample with equal number of years prior to SOX (1997-2001) and post SOX (2002 to 2006). We report the results using this sample in Table 7, with both fixed effects models and 2SLS models. Here again, the results are fully consistent with those from the full sample.

[Insert Table 7 here]

While the enactment of SOX is a reasonable instrument in the current context, it is arguable that the law led to regulatory changes other than simply the formation of the board and therefore, the estimated effects on performance may be due to the other mandated changes within incumbent firms. However, we highlight that our identification strategy is not only based on the timing of SOX, but also on the division of the sample into compliant and non-compliant groups, and therefore takes advantage of the difference-in-difference approach. Nevertheless, we also consider alternative instruments that have been used in prior research. One such instrument pertains to the local supply of directors for the incumbent firm (Knyazeva et al. 2013), under the argument that a higher supply of local directors may increase the likelihood of independent directors being appointed by the focal incumbent firm. In the Online Appendix, we present the

results of 2SLS regressions with this alternative instrument for board independence.[6] The results show that our findings are robust to the use of this IV. In summary, the results from the baseline regressions as well as the multiple sets of IV regressions, taken together, provide strong support for the finding that new entry threats moderate the relationship between board independence and firm operating performance. Inasmuch as the 2SLS results show the same pattern as baseline regressions, the endogeneity of *Board Independence* is unlikely to change the conclusions drawn from the analyses.

4.3 Alternative Measure of NET using 3-Year Rolling Window

It is possible that the turbulent environment associated with high level of NET is present not only due to new ventures that are recently incorporated and funded by venture capitalists, but also carried over from startups that are funded earlier in time. To address this potential concern, we construct an alternative measure of the moderating variable by calculating the average level of NET an incumbent firm faces using a 3-year moving window prior to the current period. We present the regression results using this alternative definition of NET in Table 8. In addition, the results from the 2SLS model but using this alternative measure of NET are reported in Table 9. We find that the moderating effect of NET is highly consistent, and quantitatively similar to that presented in Table 4.[7]

[Insert Table 8 and Table 9 here]

4.4 Analyses with the Sample Including IT Service Firms

While the main analyses reported above focus on the IT hardware and software sector, it is of particular interest to evaluate if the findings are generalizable to a more inclusive set of IT sectors. Specifically, we expand the sample to include IT services firms that are identified by the following four-digit NAICS industries: data processing, hosting, and related services; computer systems design and related services; and management, scientific, and technical consulting services (Hecker 2005). We replicate the analysis after

[6] We thank the Senior Editor and an anonymous reviewer for raising these points and the suggestion to consider alternative instrumental variables.

[7] In addition to using a 3-year moving window, we have also experimented with constructing the average NET using a 2-year moving window, and the findings are highly consistent.

adding these firms to the dataset from above, referring to this as the IT "full sample", which now includes 667 firms with 4,751 observations. Table 10 shows the results using the IT "full sample" (which includes IT service firms), with ROA as the dependent variable. Consistent with the results from the baseline analysis, the direct effect of *Board Independence* on performance is positive but not significant. We also find consistent support for the hypothesized moderating effect of *NET*. The coefficient of the interaction term *NET* * *Board Independence* is positive and significant at the 1% level, showing consistency with the results reported earlier.

[Insert Table 10 here]

4.5 Comparison with Level II & III High Tech Industries

In this section, we further examine the generalizability of our findings by extending the analyses to other non-IT high-tech industries. Analyses across industries are useful since they allow us to probe the robustness of our findings in a more generalizable setting, as well as provide opportunities for falsifiability tests and comparisons between industries. To define alternative but relevant industry segments, we use the set of four-digit NAICS codes identified by the Bureau of Labor Statistics (Hecker 2005). Particularly, Hecker (2005) defined 46 four-digit NAICS high-tech industries by their intensity of employment of technology-oriented workers, several of which are in non-IT industries. Within these industries, three levels of technology intensity were defined, from the most technology intensive to the least technology intensive. In order to evaluate the generalizability of our results, we first repeat our analysis on a sample that includes only Level I high-tech industries (including industries such as pharmaceutical and medicine manufacturing, aerospace product and parts manufacturing, etc.) together with all IT industries. We choose these industries because firms within these sectors tend to face significant threats of new entry and fast-changing dynamics. Consider, for instance, the mean NET across the firms in Level I high tech is 0.630, which is very similar to the average NET for the baseline IT sample used above of 0.629. Combining these samples provides an effective dataset of 798 firms with 5,736 observations. The results from the analyses are shown in Table 11 and show the same pattern as in the main analyses reported earlier, indicating that our findings may be

generalizable to other industries that experience volatility and relatively higher levels of NET, such as the pharmaceutical industry.

[Insert Table 11 here]

We next run the same analyses using a sample that includes only the level II and level III high-tech industries as defined in Hecker (2005). These firms are associated with 8 four-digit NAICS code industries, and typical firms in this group belong to sectors such as basic chemical manufacturing, oil and gas extraction, pesticide, fertilizer, agricultural chemical manufacturing, and so on. We report the results with level II and level III high tech industries in Table 12. Interestingly, the moderating effects of *NET* on the relationship between *board independence* and firm performance are no longer significant (in columns 2, 4, and 6 of Table 12). There are several potential explanations. First, the absence of the moderating effect of NET might be a result of the low and relatively homogeneous levels of NET in these industries; the mean of NET in level II and level III high tech is 0.25, compared to 0.629 in IT industries and 0.630 in level I high tech. Therefore, the contribution of independent board of directors under stable environments may not be as significant in terms of firm performance as they would be in more turbulent environments, even though they are required to be present from a regulatory perspective. It is also arguable that firms in these industries are relatively less sensitive to NET due to higher entry barriers – the presence of potential new entrants does not change market structure in a significant way, thereby reducing the value of strategic advice and counsel that independent board members may provide. While the true mechanism cannot be identified cleanly here, our results do highlight the notion that NET has different implications for corporate governance in relatively stable industries versus industries that are highly dynamic and experience rapid change, such as the IT and level I high tech industries.

[Insert Table 12 here]

5. Discussion and Conclusion

In this study we examine how threats emerging from entrepreneurial ventures moderate the much-debated relationship between the independence of incumbent firms' board of directors and their operational

performances in the IT sector. Using data on a panel of 583 firms in the IT hardware, software and telecom industries over the period of 1997-2013, we find that board independence has a positive but non-significant association with operating performance, consistent with prior literature (Bhagat and Black 2001). More importantly, we show that under high NET, IT firms with boards including a large proportion of independent directors, who arguably contribute to explorative organizational learning and more effective monitoring, outperform firms with boards that retain a larger proportion of insiders, a finding that is consistent with prior work suggesting that corporate governance need not be treated as a one-size-fits-all solution but is contingent on the environmental context. The results are robust to alternative regression specifications, as well as the endogeneity of board independence, addressed through multiple IV strategies based on the enactment of the Sarbanes Oxley Act as well as local supply of directors. Further, we show that our results appear generalizable to some other industry contexts, such as IT services and the level I high-tech sectors, where new entry threats and board independence remain relevant.

Our work makes several important contributions to research and managerial practice. First, we contribute to the literature on corporate governance (e.g., Coles et al. 2008; Hillman and Dalziel 2003) by examining how contextual factors, such as the level of new entry threats, moderate the relationship between board characteristics and firm performance. Prior literature has provided equivocal guidance on whether there is a definitive relationship between board independence and improvement in firm performance (Bhagat and Black 2001; Coles et al. 2008), often leading to divergent policy advice. By showing how the nature of this relationship varies in response to the degree of *NET*, we illustrate the role of a critical boundary condition and provide a possible explanation for the ambiguous findings in prior literature. Board independence may not matter – or even be undesirable – if industry structure is stable and experiences limited turbulence; in such contexts, the knowledge resources and monitoring that external board members provide may not be as important as those involving routinization and efficiency that are better provided by insiders. It is in turbulent environments that independent board members provide value that cannot be substituted by insiders. This effect is especially salient in IT and level I high tech industries where a

significant part of the fast-moving dynamic and turbulence is fed by the high rate of new entry in the form of entrepreneurial ventures. In contrast, in less technology intensive industries, with stable market structures and homogeneous levels of NET, the association between board independence and firm performance is much weaker. We empirically identify these effects using a strategy that leverages the exogenous variations in the number of independent directors imposed by Sarbanes-Oxley Act and related changes to the NYSE/NASDAQ listing rules.

Second, we add to extant IS literature on competitive dynamics in the IT industry by drawing attention to an important but understudied construct that has tremendous implications in the IT sector – new entry threats. Since the IT sector is particularly associated with hyper-competition, fast clock-speed, and rapid technological changes (McAfee and Brynjolfsson 2008), being able to identify and measure new entry threats from the startup ecosystems has become increasingly vital. New entry threat, as a conceptual entity, has existed in the literature since the early days of strategy and industrial organization (Porter 2008). However, because the threat from the individual entrepreneurial startup is difficult to observe, and no existing measure of the threats at aggregated levels has been developed, there is little empirical work that investigates how new entry threats change the competitive dynamics. For example, prior work has focused mostly on competition and turbulence arising from peer incumbents or from actual observed entry of competitors, rather than the threat of new entry from the entrepreneurial ecosystem (Hoberg et al. 2014). In this paper, we contribute beyond just the validation of this measure to also showing how it helps capture nuances and shed light on existing academic debates about important constructs and relationships such as those involving corporate governance. Indirectly, we believe our work here also helps showcase the value of this new measure of NET, with a special focus on the value of adopting machine learning/text-mining techniques in studying questions of relevance to governance and firm strategy. For IS strategy researchers, our study highlights the need to study boards and other corporate governance mechanisms as a source of strategic value within the fast-moving IT industry. Fast clock-speed and hyper-competition are the norm in technology markets, and as markets impose stress and uncertainty on incumbents, it is up to the governance

regime within the firm to help create effective responses to these imperatives. Governance can strengthen or weaken a firm's ability and effectiveness in its response to turbulent environments such as one that is constantly under the pressure of new entry threats. Boards represent one of such governance mechanisms, and inasmuch as the IT industry continues to be characterized by turbulence and hyper-competition, further work is needed within the IS community to fully explicate the role of governance.

A potential limitation of this work is that by focusing on new entry threats emerging from very early-stage entrepreneurs receiving first-stage funding, we do not fully capture the threats that more imminent from mature entrepreneurial firms that are either in later stages of funding or close to offering an IPO. However, we want to stress that these firms, often with mature products and established business models, resemble more closely the observed entry instead of threats of entry, with the latter associated with greater uncertainty and variation. Because observed entries are relatively easy for the incumbent firms to identify, it is our intention to use a measure of NET that only includes threats that emerge from entrepreneurial firms at their early stages of development when they are still experimenting with product prototypes and the viability of their business models are still not proven.

Our work here also points the way for future research in this area. First, we recognize that governance is a multi-faceted construct and we only capture one aspect of it through our focus on the board. There are other forms in which firms govern their constituents, such as through design of compensation mechanisms, board interlocks, the presence of checks and balances on executives (as measured by the G-index, for instance (Gompers et al. 2003)), and so on. We see limited research on these constructs within the IS literature, arguably where much more work is needed. Second, we characterize board members broadly as independent or not, but this characterization masks considerable heterogeneity in the skills, experience and social capital they bring to the table. Unfortunately, this level of granularity of data is difficult to gather for large samples, but nevertheless represents an interesting extension of our work. Finally, new entry threats emerging from entrepreneurs represent one source of turbulence for incumbents – other sources include threats from foreign technology firms, threats from the open source market (e.g., in

the new Big Data ecosystem where most products are open source (Madden 2012)), and threats from rapid technological change per se. We believe there is considerable opportunity for future work that enhances our understanding of how these forces affect the viability, and the performance, of incumbents in the IT industry. We also show how recent advances in machine learning/text mining can be leveraged to address these questions of economic interest, thus responding to recent calls for incorporating machine learning in business research (Athey 2015).

References

Aggarwal, R., Gopal, R., Gupta, A., and Singh, H. 2012. "Putting Money Where the Mouths Are: The Relation between Venture Financing and Electronic Word-of-Mouth," *Information Systems Research* (23:3-part-2), pp. 976-992.

Aggarwal, R., Kryscynski, D., and Singh, H. 2015. "Evaluating Venture Technical Competence in Venture Capitalist Investment Decisions," *Management Science* (61:11), pp. 2685 - 2706.

Aggarwal, R., and Singh, H. 2013. "Differential Influence of Blogs across Different Stages of Decision Making: The Case of Venture Capitalists," *MIS Quarterly* (37:4), pp. 1093-1112.

Anderson, R. C., and Reeb, D. M. 2003. "Founding-Family Ownership and Firm Performance: Evidence from the S&P 500," *Journal of Finance* (58:3), pp. 1301-1328.

Angrist, J. D., and Pischke, J.-S. 2008. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton university press.

Athey, S. 2015. "Machine Learning and Causal Inference for Policy Evaluation," *Proceedings of the 21th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*: ACM, pp. 5-6.

Baker, M., and Gompers, P. A. 2003. "The Determinants of Board Structure at the Initial Public Offering," *Journal of Law and Economics* (46:2), pp. 569-598.

Banerjee, S., Humphery-Jenner, M., and Nanda, V. 2015. "Restraining Overconfident Ceos through Improved Governance: Evidence from the Sarbanes-Oxley Act," *Review of Financial Studies* (28:10), pp. 2812-2858.

Baysinger, B., and Hoskisson, R. E. 1990. "The Composition of Boards of Directors and Strategic Control: Effects on Corporate Strategy," *Academy of Management review* (15:1), pp. 72-87.

Baysinger, B. D., and Butler, H. N. 1985. "Corporate Governance and the Board of Directors: Performance Effects of Changes in Board Composition," *Journal of Law, Economics, & Organization* (1:1), pp. 101-124.

Baysinger, B. D., Kosnik, R. D., and Turk, T. A. 1991. "Effects of Board and Ownership Structure on Corporate R&D Strategy," *The Academy of Management Journal* (34:1), pp. 205-214.

Bhagat, S., and Black, B. 2001. "The Non-Correlation between Board Independence and Long-Term Firm Performance," *Journal of Corporation Law* (27:2), pp. 231-274.

Bharadwaj, A. S. 2000. "A Resource-Based Perspective on Information Technology Capability and Firm Performance: An Empirical Investigation," *MIS Quarterly* (24:1), pp. 169-196.

Black, B. S. 1992. "Agents Watching Agents: The Promise of Institutional Investor Voice," *UCLA L. Rev.* (39), pp. 811-1791.

Boone, A. L., Field, L. C., Karpoff, J. M., and Raheja, C. G. 2007. "The Determinants of Corporate Board Size and Composition: An Empirical Analysis," *Journal of Financial Economics* (85:1), pp. 66-101.

Brown, L. D., and Caylor, M. L. 2006. "Corporate Governance and Firm Valuation," *Journal of Accounting and Public Policy* (25:4), pp. 409-434.

Carpenter, M. A., and Westphal, J. D. 2001. "The Strategic Context of External Network Ties: Examining the Impact of Director Appointments on Board Involvement in Strategic Decision Making," *Academy of Management journal* (44:4), pp. 639-660.

Chhaochharia, V., Grinstein, Y., Grullon, G., and Michaely, R. 2016. "Product Market Competition and Internal Governance: Evidence from the Sarbanes–Oxley Act," *Management Science* (forthcoming).

Cohen-Zada, D., and Sander, W. 2011. "Religious Participation Versus Shopping: What Makes People Happier?," *The Journal of Law and Economics* (54:4), pp. 889-906.

Coles, J. L., Daniel, N. D., and Naveen, L. 2008. "Boards: Does One Size Fit All?," *Journal of Financial Economics* (87:2), pp. 329-356.

Daily, C. M., and Dalton, D. R. 1992. "The Relationship between Governance Structure and Corporate Performance in Entrepreneurial Firms," *Journal of Business Venturing* (7:5), pp. 375-386.

Daily, C. M., and Dalton, D. R. 1994. "Corporate Governance and the Bankrupt Firm: An Empirical Assessment," *Strategic Management Journal* (15:8), pp. 643-654.

Dalton, D. R., Daily, C. M., Ellstrand, A. E., and Johnson, J. L. 1998. "Meta-Analytic Reviews of Board Composition, Leadership Structure, and Financial Performance," *Strategic management journal* (19:3), pp. 269-290.

Davis, J. H., Schoorman, F. D., and Donaldson, L. 1997. "Toward a Stewardship Theory of Management," *Academy of Management review* (22:1), pp. 20-47.

Donaldson, L. 1990. "The Ethereal Hand: Organizational Economics and Management Theory," *The Academy of Management Review* (15:3), pp. 369-381.

Donaldson, L., and Davis, J. H. 1991. "Stewardship Theory or Agency Theory: Ceo Governance and Shareholder Returns," *Australian Journal of management* (16:1), pp. 49-64.

Donaldson, L., and Davis, J. H. 1994. "Boards and Company Performance-Research Challenges the Conventional Wisdom," *Corporate governance: An international review* (2:3), pp. 151-160.

Eisenhardt, K. M. 1989. "Agency Theory: An Assessment and Review," *Academy of management review* (14:1), pp. 57-74.

Ellstrand, A. E., Tihanyi, L., and Johnson, J. L. 2002. "Board Structure and International Political Risk," *Academy of Management Journal* (45:4), pp. 769-777.

Fallick, B., Fleischman, C. A., and Rebitzer, J. B. 2006. "Job-Hopping in Silicon Valley: Some Evidence Concerning the Microfoundations of a High-Technology Cluster," *Review of Economics and Statistics* (88:3), pp. 472-481.

Finegold, D., Benson, G. S., and Hecht, D. 2007. "Corporate Boards and Company Performance: Review of Research in Light of Recent Reforms," *Corporate Governance: an international review* (15:5), pp. 865-878.

Forbes, D. P., and Milliken, F. J. 1999. "Cognition and Corporate Governance: Understanding Boards of Directors as Strategic Decision-Making Groups," *Academy of Management Review* (24:3), pp. 489-505.

Gani, L., and Jermias, J. 2006. "Investigating the Effect of Board Independence on Performance across Different Strategies," *International Journal of Accounting* (3:41), pp. 295-314.

Ghose, A., Ipeirotis, P. G., and Li, B. 2012. "Designing Ranking Systems for Hotels on Travel Search Engines by Mining User-Generated and Crowdsourced Content," *Marketing Science* (31:3), pp. 493-520.
Giroud, X., and Mueller, H. M. 2011. "Corporate Governance, Product Market Competition, and Equity Prices," *Journal of Finance* (66:2), pp. 563-600.
Gompers, P., Ishii, J., and Metrick, A. 2003. "Corporate Governance and Equity Prices," *Quarterly Journal of Economics* (118:1), pp. 107-156.
Gompers, P. A., Ishii, J., and Metrick, A. 2010. "Extreme Governance: An Analysis of Dual-Class Firms in the United States," *Review of Financial Studies* (23:3), pp. 1051-1088.
Goolsbee, A., and Syverson, C. 2008. "How Do Incumbents Respond to the Threat of Entry? Evidence from the Major Airlines," *Quarterly Journal of Economics* (123:4), pp. 1611-1633.
Greve, H. R. 2007. "Exploration and Exploitation in Product Innovation," *Industrial and Corporate Change* (16:5), pp. 945-975.
Guo, L., and Masulis, R. W. 2015. "Board Structure and Monitoring: New Evidence from Ceo Turnovers," *Review of Financial Studies* (28:10), pp. 2770-2811.
Hecker, D. E. 2005. "High-Technology Employment: A Naics-Based Update," *Monthly Lab. Rev.* (128), p. 57.
Hermalin, B. E. 2005. "Trends in Corporate Governance," *Journal of Finance* (60:5), pp. 2351-2384.
Hermalin, B. E., and Weisbach, M. S. 1998. "Endogenously Chosen Boards of Directors and Their Monitoring of the Ceo," *American Economic Review* (88:1), pp. 96-118.
Hermalin, B. E., and Weisbach, M. S. 2003. "Boards of Directors as an Endogenously Determined Institution: A Survey of the Economic Literature," *Economic Policy Review* (9:1), pp. 7-26.
Hillman, A. J., Cannella, A. A., and Paetzold, R. L. 2000. "The Resource Dependence Role of Corporate Directors: Strategic Adaptation of Board Composition in Response to Environmental Change," *Journal of Management Studies* (37:2), pp. 235-256.
Hillman, A. J., and Dalziel, T. 2003. "Boards of Directors and Firm Performance: Integrating Agency and Resource Dependence Perspectives," *Academy of Management Review* (28:3), pp. 383-396.
Hoberg, G., Phillips, G., and Prabhala, N. 2014. "Product Market Threats, Payouts, and Financial Flexibility," *Journal of Finance* (69:1), pp. 293-324.
Hoberg, G., and Phillips, G. M. 2016. "Text-Based Network Industries and Endogenous Product Differentiation," *Journal of Political Economy* (124:5), pp. 1423-1465.
Hutchinson, M., and Gul, F. A. 2004. "Investment Opportunity Set, Corporate Governance Practices and Firm Performance," *Journal of corporate finance* (10:4), pp. 595-614.
Jensen, M. C., and Meckling, W. H. 1976. "Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structure," *Journal of Financial Economics* (3:4), pp. 305-360.
Johnson, R. A., Hoskisson, R. E., and Hitt, M. A. 1993. "Board of Director Involvement in Restructuring: The Effects of Board Versus Managerial Controls and Characteristics," *Strategic Management Journal* (14:S1), pp. 33-50.
Judge, W. Q., and Zeithaml, C. P. 1992. "Institutional and Strategic Choice Perspectives on Board Involvement in the Strategic Decision Process," *Academy of Management Journal* (35:4), pp. 766-794.
Kesner, I. F. 1987. "Directors' Stock Ownership and Organizational Performance: An Investigation of Fortune 500 Companies," *Journal of Management* (13:3), pp. 499-508.
Kesner, I. F. 1988. "Directors' Characteristics and Committee Membership: An Investigation of Type, Occupation, Tenure, and Gender," *Academy of Management Journal* (31:1), pp. 66-84.
Kim, K., Gopal, A., and Hoberg, G. 2016. "Does Product Market Competition Drive Cvc Investment? Evidence from the Us It Industry," *Information Systems Research* (27:2), pp. 259-281.
Kim, K., and Hann, I.-H. 2014. "Crowdfunding and the Democratization of Access to Capital: A Geographical Analysis," *Robert H. Smith School Research Paper*), p. Available at SSRN: http://ssrn.com/abstract=2334590.

Knyazeva, A., Knyazeva, D., and Masulis, R. W. 2013. "The Supply of Corporate Directors and Board Independence," *Review of Financial Studies* (26:6), pp. 1561-1605.
Li, B., Singh, P., and Wang, Q. 2014. "Zoom in Ios Clones: Examining the Antecedents and Consequences of Mobile App Copycats," *35th International Conference on Information Systems (ICIS)*, Auckland, New Zealand.
Luoma, P., and Goodstein, J. 1999. "Research Notes. Stakeholders and Corporate Boards: Institutional Influences on Board Composition and Structure," *Academy of Management Journal* (42:5), pp. 553-563.
Madden, S. 2012. "From Databases to Big Data," *IEEE Internet Computing* (16:3), pp. 4-6.
March, J. G. 1991. "Exploration and Exploitation in Organizational Learning," *Organization science* (2:1), pp. 71-87.
McAfee, A., and Brynjolfsson, E. 2008. "Investing in the It That Makes a Competitive Difference," *Harvard Business Review* (86:7/8), pp. 98-107.
Mendelson, H., and Pillai, R. R. 1998. "Clockspeed and Informational Response: Evidence from the Information Technology Industry," *Information Systems Research* (9:4), pp. 415-433.
Nystrom, P. C., and Starbuck, W. H. 1984. "To Avoid Organizational Crises, Unlearn," *Organizational Dynamics* (12:4), pp. 53-65.
Pan, Y., Huang, P., and Gopal, A. 2015. "Enemies (Almost) at the Gate: New Entry Threats and R&D Investments in the U.S. It Industry," *New Entry Threats and Innovation in the US IT Industry (May 18, 2015). Robert H. Smith School Research Paper No. RHS* (2607674).
Park, Y. W., and Shin, H.-H. 2004. "Board Composition and Earnings Management in Canada," *Journal of corporate Finance* (10:3), pp. 431-457.
Pearce, J. A., and Zahra, S. A. 1992. "Board Composition from a Strategic Contingency Perspective," *Journal of management studies* (29:4), pp. 411-438.
Peng, M. W. 2004. "Outside Directors and Firm Performance During Institutional Transitions," *Strategic management journal* (25:5), pp. 453-471.
Porter, M. E. 1979. "How Competitive Forces Shape Strategy," *Harvard Business Review* (57:2), pp. 137-145.
Porter, M. E. 2008. "The Five Competitive Forces That Shape Strategy," *Harvard Business Review* (86:1), pp. 137-145.
Raheja, C. G. 2005. "Determinants of Board Size and Composition: A Theory of Corporate Boards," *Journal of Financial and Quantitative Analysis* (40:02), pp. 283-306.
Rosenstein, S., and Wyatt, J. G. 1997. "Inside Directors, Board Effectiveness, and Shareholder Wealth," *Journal of Financial Economics* (44:2), pp. 229-250.
Ryan, H. E., and Wiggins, R. A. 2004. "Who Is in Whose Pocket? Director Compensation, Board Independence, and Barriers to Effective Monitoring," *Journal of Financial Economics* (73:3), pp. 497-524.
Singh, M., and Davidson III, W. N. 2003. "Agency Costs, Ownership Structure and Corporate Governance Mechanisms," *Journal of Banking & Finance* (27:5), pp. 793-816.
Staiger, D. O., and Stock, J. H. 1997. "Instrumental Variables Regression with Weak Instruments," *Econometrica* (65:3), pp. 557-586.
Stock, J. H., and Yogo, M. 2005. *Identification and Inference for Econometric Models: Essays in Honor of Thomas Rothenberg*. Cambridge, UK: Cambridge University Press.
Tetlock, P. C. 2011. "All the News That's Fit to Reprint: Do Investors React to Stale Information?," *Review of Financial Studies* (24:5), pp. 1481-1512.
Tetlock, P. C., Saar-tsechansky, M., and Macskassy, S. 2008. "More Than Words: Quantifying Language to Measure Firms' Fundamentals," *Journal of Finance* (63:3), pp. 1437-1467.
Triana, M. d. C., Miller, T. L., and Trzebiatowski, T. M. 2013. "The Double-Edged Nature of Board Gender Diversity: Diversity, Firm Performance, and the Power of Women Directors as Predictors of Strategic Change," *Organization Science* (25:2), pp. 609-632.

Van Den Bosch, F. A., Volberda, H. W., and De Boer, M. 1999. "Coevolution of Firm Absorptive Capacity and Knowledge Environment: Organizational Forms and Combinative Capabilities," *Organization science* (10:5), pp. 551-568.

Vintila, G., Paunescu, R. A., and Gherghina, S. C. 2015. "Does Corporate Governance Influences Corporate Financial Performance? Empirical Evidences for the Companies Listed on Us Markets," *International Business Research* (8:8), p. 27.

Wagner III, J. A., Stimpert, J., and Fubara, E. I. 1998. "Board Composition and Organizational Performance: Two Studies of Insider/Outsider Effects," *Journal of Management Studies* (35:5), pp. 655-677.

Wasserman, N. 2008. "The Founder's Dilemma," *Harvard Business Review* (86:2), pp. 102-109.

Westphal, J. D. 1998. "Board Games: How Ceos Adapt to Increases in Structural Board Independence from Management," *Administrative Science Quarterly* (43:3), pp. 511-537.

Westphal, J. D. 1999. "Collaboration in the Boardroom: Behavioral and Performance Consequences of Ceo-Board Social Ties," *Academy of Management Journal* (42:1), pp. 7-24.

Wintoki, M. B. 2007. "Corporate Boards and Regulation: The Effect of the Sarbanes–Oxley Act and the Exchange Listing Requirements on Firm Value," *Journal of Corporate Finance* (13:2), pp. 229-250.

Wooldridge, J. M. 2010. *Econometric Analysis of Cross Section and Panel Data*. Cambridge, MA: MIT press.

Young, B. 2003. "Corporate Governance and Firm Performance: Is There a Relationship," *Ivey Business Journal* (68:1), pp. 1-5.

Zahra, S. A., and Stanton, W. W. 1988. "The Implications of Board of Directors Composition for Corporate Strategy and Performance," *International journal of management* (5:2), pp. 229-236.

Zhang, I. X. 2007. "Economic Consequences of the Sarbanes–Oxley Act of 2002," *Journal of Accounting and Economics* (44:1), pp. 74-115.

Zona, F., Gomez-Mejia, L. R., and Withers, M. C. 2015. "Board Interlocks and Firm Performance toward a Combined Agency–Resource Dependence Perspective," *Journal of Management* (Forthcoming).

Figure 1a: Predicted ROA as a Function of Board Independence, Low and High NET

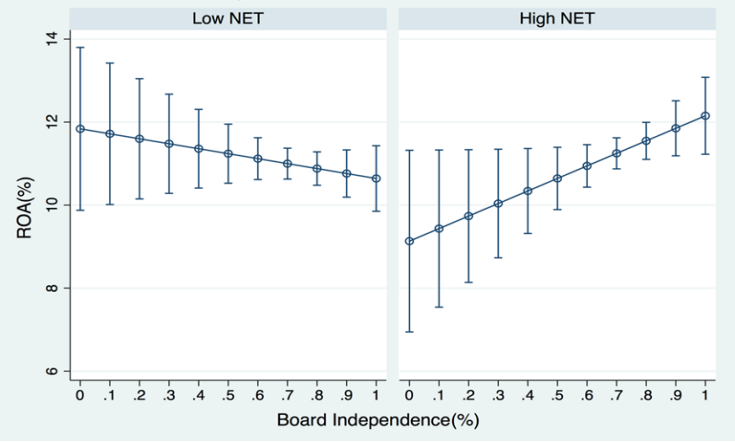

Figure 1b: Average Marginal Effect of Board Independent on ROA, Conditional on NET

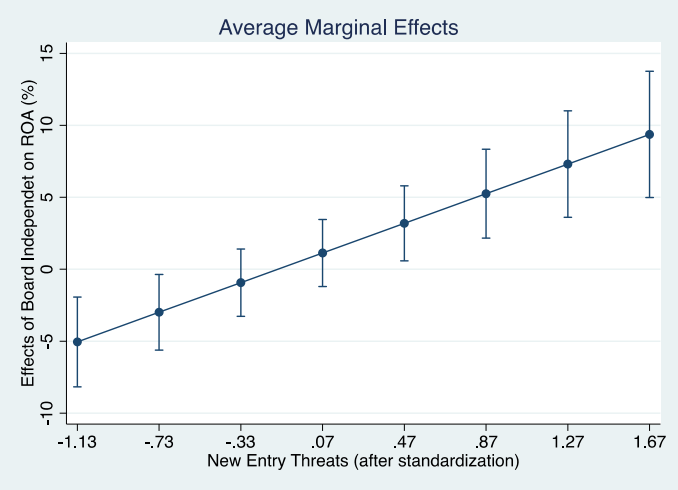

Figure 2: Average Board Independence over Years

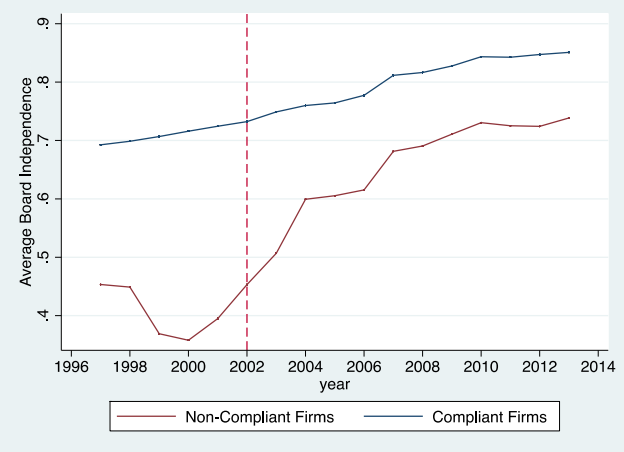

Table 1: Variable Definitions and Data Sources

Main Interest Variables	Definition
ROA_{it}	Operating income before depreciation to total assets ratio of firm *i* in year *t*
ROA_{it} (Alternative)	Net income to total assets ratio of firm *i* in year *t*
ROE_{it}	Net income to common shareholders' equity of firm *i* in year *t*
NET_{it}	New entry threat measured by *term frequency–inverse document frequency* weighted cosine similarity.
Board $Independence_{it}$	Ratio of independent board members over total board members of firm *i* in year *t*
Board Characteristic Controls (Source: Risk Metrics)	
$CEO\_Duality_{it}$	Firm's CEO also holds the position of the chairman of the board for firm *i* in year *t*
Board $Size_{it}$	Number of board members of firm *i* in year *t*
Board $Tenure_{it}$	The average tenure of board members of firm *i* in year *t*
Board Age_{it}	The average age of board members of firm *i* in year *t*
$Interlocks_{it}$	Number of interlock directors of firm *i* in year *t*
Firm Characteristic Controls (Source: Compustat)	
$Assets_{it}$	Total assets of firm *i* in year *t* (in $ Billion)
$Asset\_tangibility_{it}$	Net property, plants and equipment to total assets ratio of firm *i* in year *t*
$Leverage_{it}$	Total debt of firm *i* in year *t* divided by its total assets
$CapExp/Assets_{it}$	Capital expenditure to total assets ratio of firm *i* in year *t*
$TNIC\_HHI_{it}$	Herfindahl-Hirschman Index of firm *i* in year *t* based on Text-based Network Industry Classifications (TNIC) (Hoberg et al. 2014).
R&D $Intensity_{it}$	R&D expenditure to total assets ratio of firm *i* in year *t*
Tobin's Q_{it}	Market to book ratio of firm *i* in year *t* as defined in Brown and Caylor (2006

Table 2: Sample Composition, by Year

This table contains the sample composition by year for the focal variables. Variable definitions are in Table 1. We define Δ Board_Indp = Mean Board_Independence (t) – Mean Board_Independence (t-1).

Year	Obs.	**New Entry Threat (t)**			**Board Independence (t)**			Δ BoardIndp
		Mean	Median	Std dev	Mean	Median	Std dev	
1997	174	0.056	0.043	0.046	0.651	0.680	0.184	
1998	206	0.053	0.040	0.041	0.653	0.667	0.183	0.002
1999	239	0.049	0.035	0.040	0.636	0.667	0.199	-0.017
2000	236	0.073	0.056	0.052	0.643	0.667	0.186	0.007
2001	274	0.078	0.072	0.053	0.655	0.696	0.173	0.012
2002	261	0.071	0.064	0.046	0.682	0.700	0.153	0.027
2003	276	0.074	0.067	0.049	0.704	0.714	0.144	0.022
2004	280	0.074	0.070	0.046	0.721	0.750	0.131	0.017
2005	265	0.067	0.062	0.040	0.732	0.750	0.126	0.011
2006	244	0.060	0.053	0.043	0.746	0.760	0.130	0.014
2007	200	0.058	0.048	0.047	0.785	0.800	0.109	0.039
2008	210	0.057	0.050	0.044	0.785	0.800	0.108	0.000
2009	254	0.056	0.050	0.039	0.795	0.833	0.112	0.010
2010	264	0.058	0.051	0.044	0.808	0.833	0.098	0.013
2011	254	0.055	0.047	0.047	0.807	0.833	0.097	-0.001
2012	264	0.055	0.047	0.046	0.809	0.833	0.094	0.002
2013	270	0.057	0.049	0.046	0.817	0.852	0.090	0.008

Table 3: Summary Statistics and Correlation Coefficients

This table reports the summary statistics for primary variables constructed based on the sample of U.S. S&P 1500 firms in the IT Industries from 1997 to 2013. See Table 1 for the description of the variables.

Variable	Mean	Std. dev.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. ROA	11.129	8.341	1															
2. ROA_alternative	1.945	15.992	0.597*	1														
3. ROE	11.505	205.879	0.013	0.036*	1													
4. New Entry Threats	0.062	0.046	-0.061*	-0.105*	-0.01	1												
5. Board Independence	0.733	0.154	0.027	0.063*	-0.03	-0.119*	1											
6. CEO Duality	0.655	0.475	-0.007	-0.014	0.023	-0.049*	0.005	1										
7. Board Size	8.738	2.343	0.127*	0.081*	0.022	-0.209*	0.187*	0.078*	1									
8. Board Tenure	9.383	3.668	0.111*	0.118*	-0.012	-0.112*	-0.241*	-0.036*	-0.082*	1								
9. Board Age	60.028	4.443	0.054*	0.117*	-0.011	-0.281*	0.214*	-0.049*	0.181*	0.426*	1							
10. Interlocks	4.840	5.054	0.149*	0.055*	0.042*	-0.028	0.148*	0.168*	0.564*	-0.143*	0.092*	1						
11. Assets (Billions)	8.109	21.004	0.094*	0.058*	0.013	0.083*	0.140*	0.081*	0.415*	-0.067*	0.129*	0.409*	1					
12. Asset Tangibility (%)	23.701	21.153	0.019	-0.017	0.031*	-0.432*	0.062*	0.131*	0.431*	-0.039*	0.111*	0.169*	0.218*	1				
13. Leverage (%)	16.071	16.307	-0.045*	-0.084*	0.062*	-0.244*	0.079*	0.107*	0.320*	-0.098*	0.076*	0.166*	0.139*	0.507*	1			
14. Cap Exp/Asset (%)	4.402	3.631	0.156*	-0.019	0.061*	-0.109*	-0.148*	0.095*	0.160*	-0.017	-0.079*	0.149*	0.123*	0.576*	0.209*	1		
15. HHI TNIC	0.167	0.165	0.049*	0.015	-0.011	-0.024	0.002	-0.021	-0.060*	0.028	0.037*	0.050*	-0.098*	-0.275*	-0.078*	-0.131*	1	
16. R&D Intensity	8.160	6.009	-0.186*	-0.241*	0.009	0.320*	-0.158*	-0.097*	-0.329*	-0.062*	-0.206*	-0.173*	-0.176*	-0.273*	-0.293*	-0.029	-0.095*	1
17. Tobin's Q	1.956	1.368	0.366*	0.199*	0.012	0.237*	-0.144*	-0.015	-0.188*	0.000	-0.213*	-0.017	-0.079*	-0.288*	-0.281*	-0.001	0.019	0.161*

Note:

We include IT software and hardware Industries, which is defined by 4-digit NAICS code: 2211, 3332, 3333, 3336, 3339, 3341, 3342, 3343, 3344, 3345, 3346, 5112, 5171, 5172, 5173, 5174, 5179 and 5181.

Table 4: Board Independence, New Entry Threats and Firm Performance

This table reports the estimates for firm operating performance as dependent variables. All the independent variables are lagged one year. The dataset constructed based on the sample of U.S. S&P 1500 firms in the IT Industries from 1997 to 2013.

	ROA (%) Operationalized as OIBDA / Total Asset		ROA (%) Operationalized as Net Income / Total Asset		ROE (%) Net Income/ Common Shareholders' Equity	
	(1)	(2)	(3)	(4)	(5)	(6)
Board Independence	1.019	0.769	1.776	1.406	2.280	1.939
	(1.196)	(1.178)	(2.158)	(2.110)	(7.126)	(7.087)
New Entry Threats	-0.550**	-4.275***	-1.530***	-7.464***	-2.520**	-11.891***
	(0.253)	(0.821)	(0.499)	(2.191)	(1.164)	(4.206)
*New Entry Threats * Board Independence*	-	5.148***	-	8.283***	-	12.965**
		(1.065)		(2.749)		(5.360)
Board-related controls						
CEO Duality	-0.649**	-0.601**	-1.234*	-1.169*	-2.398	-2.251
	(0.297)	(0.293)	(0.668)	(0.662)	(1.642)	(1.619)
Board Size	0.039	0.028	0.240	0.217	0.708*	0.681
	(0.091)	(0.090)	(0.188)	(0.186)	(0.428)	(0.427)
Board Tenure	-0.045	-0.047	0.034	0.041	0.013	0.031
	(0.066)	(0.066)	(0.124)	(0.125)	(0.327)	(0.327)
Board Age	-0.059	-0.052	-0.089	-0.082	-0.107	-0.104
	(0.068)	(0.067)	(0.123)	(0.123)	(0.325)	(0.325)
Interlocks	0.005	0.000	-0.019	-0.026	-0.293	-0.312
	(0.036)	(0.036)	(0.060)	(0.061)	(0.199)	(0.200)
Firm-related controls						
Log (Assets)	-1.391***	-1.530***	-5.842***	-6.013***	-9.896***	-10.293***
	(0.356)	(0.350)	(1.137)	(1.135)	(3.554)	(3.535)
PPE / Assets	2.552	2.356	-5.151	-5.473	-26.697**	-27.655**
	(1.995)	(2.003)	(5.201)	(5.209)	(12.405)	(12.407)
Leverage	-0.347	-0.325	5.191	5.226	-12.677	-12.424
	(1.438)	(1.436)	(4.050)	(4.042)	(9.099)	(9.080)
Capx / Assets	-3.582	-3.559	-2.899	-2.865	15.824	15.618
	(4.491)	(4.474)	(9.781)	(9.734)	(25.275)	(25.243)
R&D Intensity	-0.052	-0.061*	-0.116	-0.130	-0.293*	-0.318*
	(0.036)	(0.036)	(0.090)	(0.090)	(0.178)	(0.178)
Tobin's Q	1.007***	1.016***	1.216***	1.246***	1.877***	1.926***
	(0.147)	(0.148)	(0.395)	(0.400)	(0.482)	(0.488)
TNIC HHI	-1.538**	-1.701**	-2.627	-2.886*	-10.023**	-10.418**
	(0.757)	(0.752)	(1.718)	(1.713)	(4.580)	(4.583)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
No. Of Firms	583	583	587	587	583	583
Observations	4,175	4,175	4,167	4,167	4,195	4,195
R-squared	0.645	0.649	0.564	0.567	0.468	0.470

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

New entry threats are standardized with mean of zero and standard deviation of one.

Table 5: 2 SLS Regression with Instruments from Sarbanes-Oxley Act

This table reports the estimates for firm operating performance, ROA operationalized as OIBDA / Total Asset as dependent variables. The instrument variable is constructed with SOX timing cutoff of year 2002. All independent variables are lagged one year.

	SOX implementation year = 2002				
	1st stage without interaction	2nd stage without interaction	1st stage with interaction	1st stage with interaction	2nd stage with interaction
DV:	*Board Independence*	*ROA*	*Board Independence*	*NET × Board Independence*	*ROA*
	(1)	(2)	(3)	(4)	(5)
Non-compliant Firms After SOX (z1)	0.137***	-	0.141***	0.049**	-
	(0.014)		(0.014)	(0.022)	
z1 × New Entry Threats (z2)	-	-	-0.016	0.050*	-
			(0.010)	(0.027)	
Board Independence	-	4.697	-	-	-22.642*
		(5.467)			(11.998)
New Entry Threats	0.001	-0.519**	0.002	0.713***	-44.287**
	(0.003)	(0.260)	(0.003)	(0.009)	(17.802)
New Entry Threats × Board Independence	-	-	-	-	60.860**
					(24.626)
Board-related controls					
CEO Duality	0.019***	-0.731**	0.019***	-0.010	0.400
	(0.005)	(0.324)	(0.005)	(0.007)	(0.601)
Board Size	-0.000	0.075	-0.000	0.002	-0.032
	(0.002)	(0.094)	(0.002)	(0.002)	(0.164)
Board Tenure	-0.011***	0.004	-0.011***	-0.000	-0.303*
	(0.001)	(0.093)	(0.001)	(0.002)	(0.175)
Board Age	0.007***	-0.037	0.007***	-0.002	0.280*
	(0.001)	(0.083)	(0.001)	(0.001)	(0.163)
Interlocks	0.001	-0.014	0.001	0.001	-0.057
	(0.001)	(0.035)	(0.001)	(0.001)	(0.078)
Firm-related controls					
Log (Assets)	0.005	-1.533***	0.006	0.027***	-3.094***
	(0.005)	(0.375)	(0.005)	(0.007)	(0.833)
PPE / Assets	-0.096***	3.048	-0.092***	0.021	-1.642
	(0.033)	(2.198)	(0.033)	(0.044)	(3.803)
Leverage	-0.024	0.371	-0.024	-0.014	0.547
	(0.021)	(1.594)	(0.021)	(0.027)	(2.194)
Capx / Assets	-0.223***	-2.165	-0.219***	-0.040	-6.613
	(0.077)	(5.135)	(0.077)	(0.101)	(7.972)
R&D Intensity	-0.000	-0.054	-0.000	0.002***	-0.177**
	(0.001)	(0.038)	(0.001)	(0.001)	(0.073)
Tobin's Q	-0.001	0.976***	-0.001	-0.003	1.089***
	(0.002)	(0.144)	(0.002)	(0.002)	(0.212)
TNIC HHI	-0.017	-2.113***	-0.017	0.027	-4.213***
	(0.015)	(0.806)	(0.015)	(0.018)	(1.566)
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
First stage F-stat:	-	187.30	-	-	14.94
Stock-Yogo critical value, 10% max IV size	-	16.38	-	-	7.03
No. Of Firms	337	337	337	337	337
Observations	3,349	3,349	3,349	3,349	3,349

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

New entry threats are standardized with mean of zero and standard deviation of one. The sample is reduced because we only include firms that have data in 2001 (the year before SOX) for constructing the IV.

Table 6: 2SLS Regression with Instruments from SOX, Alternative Cutoff Year

This table reports the estimates for firm operating performance, ROA operationalized as OIBDA / Total Asset as dependent variables. All independent variables are lagged one year.

	SOX implementation year = 2003				
	1st stage without interaction	2nd stage without interaction	1st stage with interaction	1st stage with interaction	2nd stage with interaction
DV:	*Board Independence*	*ROA*	*Board Independence*	*NET × Board Independence*	*ROA*
	(1)	(2)	(3)	(4)	(5)
Non-compliant Firms After SOX (z1)	0.125***	-	0.127***	0.058***	-
	(0.013)		(0.013)	(0.021)	
z1 × New Entry Threats (z2)	-	-	-0.005	0.069**	-
			(0.010)	(0.028)	
Board Independence	-	3.738	-	-	-20.822**
		(5.420)			(9.775)
New Entry Threats	0.001	-0.567**	0.001	0.717***	-31.034***
	(0.003)	(0.253)	(0.003)	(0.009)	(10.140)
New Entry Threats × Board Independence	-	-	-	-	42.153***
					(13.946)
Board-related controls	Yes	Yes	Yes	Yes	Yes
Firm-related controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
First stage F-stat:	-	155.48	-	-	19.33
Stock-Yogo critical value, 10% max IV size	-	16.38	-	-	7.03
No. Of Firms	356	356	356	356	356
Observations	3,522	3,522	3,522	3,522	3,522

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. New entry threats are standardized with mean of zero and standard deviation of one. The instrument variable is constructed with SOX timing cutoff of year 2003.

Table 7: Subsample Analysis with Balanced Number of Years before and after SOX

This table reports the estimates for firm operating performance as dependent variables. All the independent variables are lagged one year. Sample is constructed based on U.S. S&P 1500 firms in the IT Industries from 1997 to 2006.

	Fixed Effect Model		Fixed Effect with IV (second stage)	
	(1)	(2)	(3)	(4)
DV: ROA				
Board Independence	3.076*	3.212*	6.195	-2.651
	(1.655)	(1.647)	(9.979)	(10.696)
New Entry Threats	-0.641*	-3.336***	-0.694**	-15.107**
	(0.363)	(1.131)	(0.347)	(7.618)
*New Entry Threats * Board Independence*	-	4.002***	-	21.430*
		(1.489)		(11.336)
Board-related controls	Yes	Yes	Yes	Yes
Firm-related controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
First stage F-stat:	-	-	31.93	9.36
Stock-Yogo critical value, 10% max IV size	-	-	16.38	7.03
No. Of Firms	486	486	345	345
Observations	2,459	2,459	2,207	2,207
R-squared	0.698	0.700	-	-

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. New entry threats are standardized with mean of zero and standard deviation of one. IV was constructed based on the cutoff timing of SOX in 2003.

Table 8: NET Measured by 3-Year Moving Window

This table reports the estimates for firm operating performance as dependent variables. All the independent variables are lagged one year. The dataset constructed based on the sample of U.S. S&P 1500 firms in the IT Industries from 1997 to 2013.

	ROA (%) Operationalized as OIBDA / Total Asset		ROA (%) Operationalized as Net Income / Total Asset		ROE (%) Net Income/ Common Shareholders' Equity	
	(1)	(2)	(3)	(4)	(5)	(6)
Board Independence	0.073	-0.215	0.720	0.218	-3.000	-3.519
	(1.281)	(1.261)	(2.349)	(2.295)	(7.146)	(7.134)
Ave ($NET_{t-2}+NET_{t-1}+NET_t$)	-0.377	-4.063***	-1.332**	-7.481***	-2.045*	-12.221***
	(0.285)	(0.897)	(0.541)	(2.384)	(1.195)	(4.158)
Ave ($NET_{t-2}+NET_{t-1}+NET_t$)*	-	5.049***	-	8.430***	-	13.852**
Board Independence		(1.160)		(3.029)		(5.429)
Board-related controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm-related controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
No. Of Firms	547	547	552	552	549	549
Observations	3,795	3,795	3,775	3,775	3,802	3,802
R-squared	0.662	0.666	0.585	0.587	0.513	0.514

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

New entry threats are standardized with mean of zero and standard deviation of one.

Table 9: 2SLS Regression with NET Measured by 3-Year Moving Window

This table reports the estimates for firm operating performance, ROA operationalized as OIBDA / Total Asset as dependent variables. All independent variables are lagged one year.

	SOX implementation year = 2003				
	1st stage without interaction	2nd stage without interaction	1st stage with interaction	1st stage with interaction	2nd stage with interaction
DV:	*Board Independence*	*ROA*	*Board Independence*	*NET × Board Independence*	*ROA*
	(1)	(2)	(3)	(4)	(5)
Non-compliant Firms After SOX (z1)	0.138***		0.139***	0.040**	-
	(0.014)		(0.014)	(0.020)	
z1 × Ave ($NET_{t-2}+NET_{t-1}+NET_t$) *(z2)*	-	-	-0.001	0.092***	-
			(0.011)	(0.030)	
Board Independence	-	-0.714	-	-	-13.943**
		(5.108)			(6.681)
Ave ($NET_{t-2}+NET_{t-1}+NET_t$)	-0.003	-0.377	-0.003	0.721***	-22.441***
	(0.004)	(0.287)	(0.004)	(0.010)	(6.736)
Ave ($NET_{t-2}+NET_{t-1}+NET_t$) *× Board Independence*	-	-	-	-	30.185***
					(9.144)
Board-related controls	Yes	Yes	Yes	Yes	Yes
Firm-related controls	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
First stage F-stat:	-	180.60	-	-	31.72
Stock-Yogo critical value, 10% max IV size	-	16.38	-	-	7.03
No. Of Firms	353	353	353	353	353
Observations	3,245	3,245	3,245	3,245	3,245

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

New entry threats are standardized with mean of zero and standard deviation of one.

The instrument variable is constructed with SOX timing cutoff of year 2003.

Table 10: Sample Including IT Services Industries

This table reports the estimates for firm operating performance as dependent variables. All independent variables are lagged one year. Sample is constructed based on U.S. S&P 1500 firms in the full IT Industries (hardware, software, telecom, IT-based services) from 1997 to 2013.

	Fixed Effect Model		Fixed Effect with IV (second stage)	
DV: ROA	(1)	(2)	(3)	(4)
Board Independence	0.366	0.187	2.632	-14.710*
	(1.099)	(1.092)	(5.191)	(8.499)
New Entry Threats	-0.453**	-3.640***	-0.479**	-29.876***
	(0.231)	(0.806)	(0.233)	(11.244)
*New Entry Threats * Board Independence*	-	4.487***	-	41.454***
		(1.041)		(15.741)
Board-related controls	Yes	Yes	Yes	Yes
Firm-related controls	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
First stage F-stat:	-	-	161.22	16.01
Stock-Yogo critical value, 10% max IV size	-	-	16.38	7.03
No. Of Firms	667	667	398	398
Observations	4,751	4,751	3,957	3,957
R-squared	0.661	0.664	-	-

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
New entry threats are standardized with mean of zero and standard deviation of one.
We define IT services industries by 3 digit NAICS code: 5182, 5415, and 5416.
IV was constructed based on the cutoff timing of SOX in 2003.

Table 11: Board Independence, NET, and Firm Performance in IT and Level I High Tech Sample

This table reports the estimates for firm operating performance as dependent variables. All the independent variables are lagged one year. Sample is constructed based on U.S. S&P 1500 firms in the IT and high-tech level I industries[8] from 1997 to 2013.

	Fixed Effect Model		Fixed Effect with IV (second stage)	
DV: ROA	(1)	(2)	(3)	(4)
Board Independence	-0.735	-0.930	0.138	-9.175
	(1.097)	(1.094)	(4.637)	(6.766)
New Entry Threats	-0.626***	-3.323***	-0.650***	-28.831**
	(0.224)	(0.741)	(0.226)	(12.096)
*New Entry Threats * Board Independence*	-	3.815***	-	39.940**
		(0.971)		(17.036)
Board-related controls	Yes	Yes	Yes	Yes
Firm-related controls	Yes	Yes	Yes	Yes
Year & Firm FE	Yes	Yes	Yes	Yes
First stage F-stat:	-	-	203.69	15.55
Stock-Yogo critical value, 10% max IV size	-	-	16.38	7.03
No. Of Firms	798	798	473	473
Observations	5,736	5,736	4,769	4,769
R-squared	0.682	0.683	-	-

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
New entry threats are standardized with mean of zero and standard deviation of one.
IV was constructed based on the cutoff timing of SOX in 2003.

[8] Here, the sample is restricted to Hecker (2005) Level I high tech industries (including industries such as pharmaceutical and medicine manufacturing, aerospace product and parts manufacturing etc.) and all IT industries.

Table 12: Board Independence, NET and Firm Performance in Level II & III High Tech Sample

This table reports the estimates for firm operating performance as dependent variables. All the independent variables are lagged one year. Sample is constructed based on U.S. S&P 1500 firms in the Level II & III Non-IT High Tech Industries[9] from 1997 to 2013.

	ROA (%) Operationalized as OIBDA / Total Asset		ROA (%) Operationalized as Net Income / Total Asset		ROE (%) Net Income/ Common Shareholders' Equity	
	(1)	(2)	(3)	(4)	(5)	(6)
Board Independence	-2.089	-2.021	0.735	0.684	4.894	4.469
	(1.451)	(1.443)	(1.340)	(1.345)	(5.507)	(5.534)
New Entry Threats	-0.672*	-1.525	-1.082**	-0.392	-3.090	1.527
	(0.399)	(0.980)	(0.455)	(1.279)	(1.930)	(3.980)
*New Entry Threats * Board Independence*	-	1.036	-	-0.840	-	-5.596
		(1.060)		(1.536)		(4.906)
Board-related controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm-related controls	Yes	Yes	Yes	Yes	Yes	Yes
Year & Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
No. Of Firms	177	177	176	176	174	174
Observations	1,403	1,403	1,408	1,408	1,408	1,408
R-squared	0.544	0.545	0.532	0.533	0.383	0.383

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
New entry threats are standardized with mean of zero and standard deviation of one.

[9] The sample includes all Level II and Level III non-IT industries (Hecker 2005), such as basic chemical manufacturing, oil and gas extraction, Pesticide, fertilizer, and other agricultural chemical manufacturing etc. More specifically, the four-digit NAICS codes are 2111, 3241, 3251, 3252, 3253, 3255, 3259, 3369, 4234, 4862, 5232, and 5612.

Board Independence and Firm Performance in the IT Industry:
The Moderating Role of New Entry Threats

Online Appendix

Appendix 1: Controlling for firm innovativeness

One potential concern with regard to the effect of NET on firm performance is that NET may partly capture the effect of the innovativeness of a firm. For example, less innovative firms may face higher levels of NET, and at the same time they are likely to have lower performance. These firms also likely to benefit to a greater extent from an independent board than more innovative firms. Alternatively, highly innovative firms with higher relative performance may operate in sectors that see high NET in general. In such cases, the value of an independent board may not be as compelling. Effectively, we need to account for the innovativeness of the firm in the analysis. We therefore add a measure of the innovativeness of the incumbent firm in our regressions as a control variable. We measure the innovativeness of a firm by taking the natural log of the number of patents that the firm applied, or was granted, in the prior 3-year or 5-year period. We present the results from this model in Table A1. We observe that all our findings still hold and the coefficient estimates of the variables of interest are very similar to those in the main model in Table 4.

[Insert Table A1 here]

Appendix 2: Alternative instrumental variable regression using local director supply

As an alternative identification strategy, we use local director supply as an instrumental variable to address the endogeneity of board independence, following prior literature on corporate governance (Knyazeva et al. 2013). Knyazeva et al. (2013) show that there is a strong impact of the pool of local director candidates on board composition, and firms located in proximity to larger pools of local director talent tend to have more independent boards. According to Guner, Malmendier, and Tate (2008), the most common outside director candidate is an executive at another nonfinancial firm, followed by an executive at a financial firm, and then one with non-corporate backgrounds. Following Knyazeva et al. (2013), we construct the local director pool variable as the density of nonfinancial firms within the same metropolitan or micropolitan

areas where the focal firm is located. We calculate the density by the number of firms (excluding financial firms and direct competitors) standardized by the population of the metropolitan or micropolitan area. The data on metropolitan or micropolitan areas and population are obtained from U.S. Census Bureau 2010 database. Natural logs are used to address the right skewness of the densities. Because executives of direct competitors are unlikely to join the board due to concerns over conflicts of interest, we exclude firms in the same 4-digit NAICS industry from the calculation of the local director pools. We use a firm's headquarter location (5-digit zip code) as reported in Compustat to determine the metropolitan or micropolitan area.

The results of the 2SLS estimation are shown in Table A2. Qualitatively, the results from the second stage estimates are consistent with the FE specification we presented in Table 4. The coefficient of *NET* Board independence* is again positive and statistically significant, providing further evidence for the finding that NET positively moderates the relationship between board independence and firm performance. However, we suggest that caution be exercised when interpreting the results from Table A2, particularly with regard to the magnitude of the point estimates, as the low value of first stage F-tests indicate local supply of board candidates may be subject to weak instrument concerns, potentially because firms in the IT industries, particularly software firms, are highly concentrated in a few geographic clusters, leading to the lack of variation in the instrument.

[Insert Table A2 here]

References:

Güner, A. B., Malmendier, U., and Tate, G. 2008. "Financial expertise of directors," *Journal of Financial Economics* (88:2), pp 323-354.

Knyazeva, A., Knyazeva, D., and Masulis, R. W. 2013. "The supply of corporate directors and board independence," *Review of Financial Studies* (26:6), pp 1561-1605.

Table A1: Board Independence, New Entry Threats and Firm Performance

This table reports the estimates for firm operating performance as dependent variables. We control firm innovativeness in each specification. Firm innovativeness is operationalized as the natural log of the number of patents the firm applied in the past 3 years (Column 1) or the past 5 years (Column 2), and the number of patent granted in the past 3 years (Column 3) or the past 5 years (Column 4). All the independent variables are lagged for one year. The dataset is constructed based on the sample of U.S. S&P 1500 firms in IT Industries from 1997 to 2013.

Dependent Variable	ROA			
	(1)	(2)	(3)	(4)
Board Independence	0.711	0.717	0.775	0.766
	(1.172)	(1.172)	(1.174)	(1.175)
New Entry Threats	-4.066***	-4.090***	-4.202***	-4.209***
	(0.817)	(0.817)	(0.821)	(0.821)
*New Entry Threats * Board Independence*	4.917***	4.941***	5.075***	5.080***
	(1.054)	(1.054)	(1.062)	(1.062)
Firm Innovativeness Controls:				
Log(# of Applied Patents in last 3 years)	-0.373***			
	(0.091)			
Log(# of Applied Patents in last 5 years)		-0.341***		
		(0.083)		
Log(# of Granted Patents in last 3 years)			-0.233***	
			(0.087)	
Log(# of Granted Patents in last 5 years)				-0.205**
				(0.081)
Board-related controls	Yes	Yes	Yes	Yes
Firm-related controls	Yes	Yes	Yes	Yes
Year & Firm FE	Yes	Yes	Yes	Yes
No. Of Firms	582	582	582	582
Observations	4,175	4,175	4,175	4,175
R-squared	0.651	0.651	0.650	0.650

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
New entry threats are standardized with mean of zero and standard deviation of one.

Table A2: 2 SLS Regression with Local Director Pool as the Instrument Variable

This table reports the estimates for firm operating performance, ROA operationalized as OIBDA / Total Asset as dependent variables. The instrument variable is *Local Director Pool*, which defined by the number of firms in the same metropolitan or micropolitan areas excluding financial firms and competitors (Knyazeva et al. 2013).

	SOX implementation year = 2002	
	2nd stage without interaction	2nd stage with interaction
DV:	*ROA*	*ROA*
	(1)	(2)
Board Independence	64.651	-6.731
	(43.411)	(80.639)
New Entry Threats	-0.710**	-120.700*
	(0.297)	(72.662)
New Entry Threats × Board Independence	-	165.070*
		(99.773)
Board-related controls		
CEO Duality	-1.830**	1.814
	(0.763)	(2.030)
Board Size	0.052	-0.472
	(0.148)	(0.500)
Board Tenure	0.703	0.075
	(0.492)	(0.940)
Board Age	-0.494	-0.287
	(0.338)	(0.694)
Interlocks	-0.046	0.280
	(0.071)	(0.232)
Firm-related controls		
Log (Assets)	-0.302	-3.954
	(0.440)	(2.539)
PPE / Assets	1.868	-8.974
	(5.785)	(11.265)
Leverage	1.192	-2.653
	(3.453)	(6.813)
Capx / Assets	47.862***	35.074*
	(9.257)	(18.989)
R&D Intensity	-0.388***	-0.576***
	(0.043)	(0.142)
Tobin's Q	1.196***	1.694***
	(0.115)	(0.436)
TNIC HHI	-1.614	-7.448*
	(1.391)	(4.228)
Firm FE	Yes	Yes
Year FE	Yes	Yes
First stage F-stat:	7.29	1.43
Stock-Yogo critical value, 10% max IV size	16.38	7.03
No. Of Firms	515	515
Observations	4,322	4,322

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
New entry threats are standardized with mean of zero and standard deviation of one.