

Do CEO's Long-Term Performance Incentives Induce IT Investments? Theory, Evidence, and Industry Contingencies

Full Paper

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Abstract

Understanding the antecedents of IT investment decisions is a significant line of enquiry in the IT business value literature. Although previous research has shown a positive link between long-term performance plans and corporate decision making, the association between the use of long-term performance plans and IT investment is understudied in the extant literature. Drawing on agency theory, we posit that the existence of a long-term performance plan and a greater percentage of compensation based on long-term measures are associated with a greater percentage of IT investments to sales. We further propose that these relationships are contingent upon the nature of the industry and the IT role within the industry. Specifically, we assert that high-tech industries witness stronger associations between long-term performance plans and IT investments, while industries where IT plays a transformative role witness weaker relationships. Our empirical analysis of 173 firms in the United States supports our theoretical propositions.

Keywords

Executive Compensation, IT Investments, Chief Executive Officer

Introduction

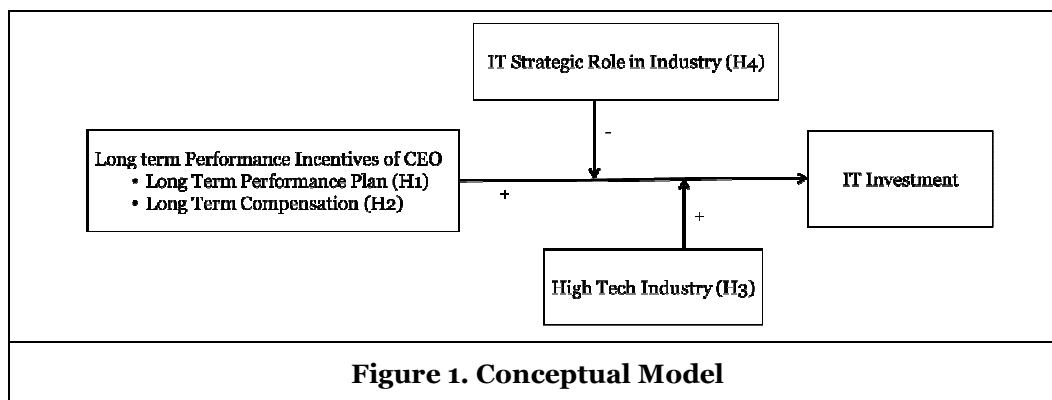
The linkage between compensation plans and risk-taking behavior of executives has been a topic of interest for academics and practitioners alike. In recent times, Wall Street firms are facing renewed scrutiny from U.S. financial regulators regarding compensation plans that could encourage excessive risk-taking (Wall Street Journal 2015). Early research provides empirical evidence that long-term compensation and performance plans motivate managers to make capital investments (Larcker 1983), merger and divestiture decisions (Tehraniyan et al. 1987a; Tehraniyan et al. 1987b) that are more in line with stockholders' long term interests. Long-term performance plans are defined as those plans that "reward corporate managers when accounting numbers-based performance goals (e.g., EPS, return on

equity (ROE)) are achieved over performance cycles that generally encompass three to five years” (Kumar and Sopariwala 1992)(p. 562). At the same time, firms have been criticized in the past for relying too much on short-term bonus compensation, which may lead managers to reduce investments such as research and development (R&D) and capital expenditures in order to increase their bonus (Rappaport 1978). For instance, there is evidence that Chief Executive Officers (CEOs) spend less on discretionary investments like R&D in order to improve short-term earnings performance (Dechow and Sloan 1991).

Information Technology (IT) expenditures are investments that benefit firms in the long term. For example, IT investments have been shown to improve a firm’s market value, future performance, profitability and other financial and accounting measures of success (Bharadwaj et al. 1999; Kohli et al. 2012; Mithas et al. 2012). Prior research argues that IT investments have a long term impact on profitability and future performance and show that IT spending can have a three- to four-year impact on future performance and profitability (Anderson et al. 2003). Firms with only short term bonus plans may have a short term decision making horizon and may look to cut back on IT investments, capital expenditures, and R&D in order to increase the company’s profits and thus the bonus of managers. Prior compensation research notes that the adoption and use of long term performance plans is associated with an increase in capital expenditures (Larcker 1983; Richardson and Waegelein 2002). It is therefore an interesting empirical question as to whether the existence of a long term performance plan is associated with higher IT investments.

Despite the importance of IT investments and executive incentive plans, there is scarce academic research to enhance our collective understanding of the executive incentive factors that can influence IT spending. To help bridge this knowledge gap in the extant literature, we investigate whether firms with long-term performance plans and a greater percentage of long-term compensation to total compensation for the CEO invest more in Information Technology. More specifically, we examine the research question: *How is the relationship between the use of long term incentives for CEOs and a firm’s IT investment influenced by the strategic role of IT (or the role of IT in industry)?*

Drawing on agency theory, we propose that long term performance plans encourage greater IT investments in firms. Furthermore, we propose the firms for which CEOs have a greater component of their compensation derived from long term sources are likely to have greater IT investments. We also posit that these relationships are contingent upon the high tech (i.e., a measure of technology intensity used in the firm) nature of the industry and the IT role within the industry. Figure 1 illustrates our conceptual model. We empirically test our hypotheses using data from a sample of 173 firms in the United States. The principal findings are the following. First, we find that the use of a long term performance plan and a greater percentage of long term compensation to total compensation of the CEO are positively associated with greater IT investments. Second, we find that high tech industries witness stronger associations between long term performance plans and IT investments, whereas a transform role of IT within the industry negatively moderates these relationships. These results suggest that the use of long term performance plans and long-term compensation of CEOs can be drivers of IT investments, contingent upon the nature of the industry and the role of IT within it. The study contributes to research and practice by applying agency theory and executive compensation research to the context of IT investments, and provides new insight on the relationship between organizational factors and IT investments.



Background and Theory

Most companies compensate their executives with short term bonus plans and one or more types of long term plans. During the 1970's and 1980's, corporate boards of directors adopted long term performance share and unit plans to increase managers' decision-making horizon and to better align the interests of managers and stockholders. In the late 1980's and 1990's, companies moved away from long term performance plans in favor of stock option plans, partly because stock option plans were not recorded as an expense on the income statement.

Long term performance plans have four characteristics. First, the compensation committee of the board of directors set accounting performance targets (in terms of earnings per share, return on assets, return on stockholders' equity) for a multiple years (usually three to five years). Gaver et al. (1992) note that the overwhelming majority of performance plans use the growth in firm earnings per share as the primary long term performance measure. In addition, many earnings per share growth plans also specify minimum return on assets or return on equity hurdles (in addition to earnings per share goals) which must be met before an award can be paid. Second, long term performance plans allow firms to allocate a fixed number of shares or units to each participating executive at the beginning of the period. Third, each unit has a fixed dollar value and each share's value is the market price accrued at the end of the award period. Finally, the number of shares or units earned is based on whether the performance goals are met. The key difference between units and shares is that a share is valued at the market price at the end of the performance award period whereas a unit plan fixes the value of a unit at the beginning of that period, and is thus unrelated to the ending share price.

In 1978, Rappaport called on corporations to make use of long term performance plans in their corporate compensation packages. Back in 1978, there was no evidence on whether or not these plans would motivate more long range decisions. Since that time there has been significant research that has examined the relationship between long term performance plans and corporate decision making. Empirical evidence suggests that these performance plans motivate CEOs to make capital investment (Larcker 1983) and merger and divestiture decisions (Tehraniyan et al. 1987a; Tehraniyan et al. 1987b) that are more in line with the stockholders' interests and greeted with a more favorable stock market reaction. Gaver et al. (1992) suggest that since long term performance plans are based on long term accounting targets, performance plans may distract CEO attention from the maximization of share price. Rappaport (1978) indicated that managers focus on short term earnings to achieve share price maximization. Kumar and Sopariwala (1992) find an association between the adoption of long term performance plans and subsequent growth in profitability, suggesting that long term performance plans may have been successful in motivating an enhancement in the accounting measures of profitability used to reward managers.

Richardson and Waagelein (2002) find evidence consistent with the hypothesis that firms with long term performance plans in their incentive profiles, engage in less earnings management portfolios. This is in contrast to firms that have only short term bonus plans because these plans are usually between three and five years and the plan periods overlap, or in other words, a new long term target begins each year. They suggest that the length of the compensation contract is related to a manager's incentive to manage earnings. In addition, they find evidence that suggests that firms with long term performance plans have significantly higher annual returns and performance than firms that have only short term bonus plans.

Short term bonus plans may exacerbate the horizon problem because the CEO's remuneration is tied to yearly accounting numbers and accordingly their resulting decisions may be heavily influenced by short term effects of their investment decisions on their annual bonuses. More formally, Smith and Watts (1982) argue that a compensation package which consists of an annual salary and bonus payments may cause a horizon problem; that is, this type of compensation package motivates managers to reject positive net present value (NPV) projects with long payback periods in favor of projects that have earlier positive cash flows in spite of having an overall negative NPV. Narayanan (1985) developed a model examining the horizon issue and concludes that managers select projects yielding short term profits to improve the perception of their ability early and hence earn higher wages. The potential advantage to managers outweighs the fact that, from a long term point of view, the selected project is not the one with the highest net present value and therefore not the project that maximizes long term shareholder value. This horizon problem could result in lower levels of investment in capital expenditures, advertising, and research and development expenses. As a consequence of this lower level of investment, over the long run, companies

using only short term bonus plans for their CEOs would have poorer profitability and performance. Long term performance plans incentivize managers to extend their horizon and therefore managers are more willing to make investment decisions that will have higher long term payoffs. In line with prior literature, IT is one of those investments (Loh and Venkatraman 1992), and therefore, we posit that long term performance plans of CEOs are likely to make them support greater IT investment. Previous studies by Larcker (1983) and Richardson and Waagelein (2002) show that the adoption of long term performance plans is associated with an increase in capital expenditures. In line with these arguments, we hypothesize,

H1: The existence of a long-term performance plan is positively associated with the firm's information technology investments.

In addition, the amount of long term compensation might motivate CEOs to engage in more investments in IT, capital expenditures, advertising, and research and development expenses. The presence of a plan alone might be insufficient to motivate a longer term horizon in CEOs. The expected payoff from a long term performance plan may need to be significant relative to the managers overall compensation package for it to have an effect on IT investments. Hence we posit,

H2: A greater percentage of CEO compensation derived from long-term sources is positively associated with the firm's information technology investments.

We expect that the above relationships will be stronger in industries that are classified as high tech. High tech industries are characterized by relatively short business cycles that are exacerbated by high technological and competitive turbulence. Their product plans need to adhere to the technology changes in the industry. Thus firms in high-tech industries are replete with high information and knowledge intensity. Therefore investments in IT, which can result in better management of information and knowledge, are likely to generate better returns in the long run. Thus, CEOs are more likely to receive promised long term payouts if they support investments in IT. Hence we posit that:

H3a: The relationship between existence of a long-term performance plan and the firm's information technology investments is stronger in high-tech industries.

H3b: The relationship between percentage of CEO compensation derived from long-term sources and the firm's information technology investments is stronger in high-tech industries.

Prior literature identifies three primary strategic roles of IT in industries, namely, automate, informate, and transform. Automate IT indicates whether IT's primary role is to automate manual tasks. Informate IT is the avenue to provide information to empower management. Transform IT is the impact of IT that fundamentally alters ways of doing business (Chatterjee et al. 2001, p. 49; Mooney et al. 1996). IT investment depends on the role of IT in the industry sector (Armstrong and Sambamurthy 1999; Chatterjee et al. 2001). We posit that IT's strategic role in a specific industry is another key factor upon which the relationship of long term performance plans and IT investments is contingent due to two reasons. First, in an industry in which IT plays a more transformative role (IT Transform), executives are likely to face mimetic pressures to invest in IT. Failure to do so may result in the firm being unable to adapt to new business models and paradigms and therefore fail. Despite IT investments being long-term investments, this would be counter-balanced by CEOs need to support investments in IT in the case of industry wide transform IT presence. Second, compared to industries in which IT plays an automate or informate role, industries in which IT plays a transform role would witness lower marginal returns due to IT investments compared to other long term capital investment such as research and development, and advertising. CEOs would thus be less incentivized to support investments in IT as compared to other avenues of long term capital investment such as research and development, and advertising. Therefore, in sum, the presence of a long term performance plan and the percentage of CEO compensation derived from long term sources will have a weaker relationship with the firm's investments in IT in industries where IT plays a more transformative role. Hence, we draw the hypotheses:

H4a: The relationship between existence of a long-term performance plan and the firm's information technology investments is weaker in industries with a more Transform IT strategic role.

H4b: The relationship between percentage of CEO compensation derived from long-term sources and the firm's information technology investments is weaker in industries with a more Transform IT strategic role.

Method

We collected and matched data for this study from multiple secondary sources, such as InformationWeek (IWeek), Standard and Poor's Compustat database, and SEC filings, and U.S. Census Bureau. Table 1 provides a summary description of the variables used in this study, their sources, and references to related prior literature.

Variable	Variable Name and Type	Computation	Citation	Source
Long-term Performance Plan	Plan (dummy)	1 if the company has a long term performance plan and 0 otherwise. Long-term performance plan was defined based on accounting-based performance measure on a 3-5 year time period.	Larcker 1983; (Kumar and Sopariwala 1992)	Corporate Proxy Statements
Percentage of CEO Compensation derived from long-term sources	LongTerm Comp (ratio)	Ratio of the CEO's Long-term Compensation to Total Compensation of the CEO. I.e., (total compensation – salary – bonus)/total compensation	Larcker 1983	Corporate Proxy Statements
IT Investment	ITInv (percentage)	Firm's IT budget as a percentage of annual sales revenue	Bardhan et al. 2006	InformationWeek
Firm Age	Firm Age	Logarithm of the number of years since the firm was founded	Chen et al. 2010	Websites and public sources
Industry Concentration Ratio	Industry Concentration (percentage)	Four-firm concentration ratio	Melville et al. 2007	2007 U.S. Census
High tech/Low tech Industry	Hightech, Lowtech (dummies)	Indicator of whether the firm's industry is classified as high tech, low-tech or neither, based on the classification scheme identified and used in prior research.	Banker et al. 2011	U.S. Census Bureau
IT-Orientation of Industry	Strategic Role of IT in industry	1 = Automate, 2 = Informate, 3= Transform role. This variable captures nature of IT role in the firm's industry.	Chatterjee et al. 2001; Enns et al. 2001; Mooney et al. 1996	U.S. Census Bureau
Industry Sector	Indxx (dummies)	Dummy variables that represent the primary industry sector of the firm.	Veugellers and Cassiman 1999	U.S. Census Bureau

Table 1: Description of Variables

We collected IT investment data from InformationWeek (IWeek), a leading, widely circulated IT publication in the United States; and used extensively as a reliable data source in prior studies (Bharadwaj et al. 1999). IWeek collected this data in the 2007-2008 timeframe by surveying Chief Information Officers (CIOs) and senior IT managers at large U.S. firms across industries. The respondents were encouraged to consult with other executives for the most updated information. The survey contained questions related to IT practices, and IT strategies and investments of the firms. We augment this data with firm-level variables from Standard and Poor's Compustat database and SEC filings, and industry-level data from the U.S. Census Bureau. Proxy statements were examined for all firms to determine if a long term performance plan was in place, as well as to collect information on CEO compensation. After matching the datasets and dropping incomplete responses, we got a cross-sectional sample of 173 firms.

IT investment (ITInv) is our dependent variable, representing a firm's IT budget as a percentage of its annual sales revenue (Banker et al. 2011; Han and Ravichandran 2006; Mithas et al. 2005). The independent variable Long Term Performance Plan indicates whether a long term performance plan exists in the company. We gathered this data by examining corporate proxy statements for the year prior to the IT data. Consistent with prior research, we concluded presence of a long term performance plan if the proxy statement of the firm contained mention of a performance plans based on some accounting numbers-based performance goals (e.g., EPS, return on equity ROE) which encompassed a three to five year time period (Kumar and Sopariwala 1992). The second independent variable, CEO Compensation from Long term sources (LongTermComp) is a ratio of the long term component of the CEO's salary to the total salary of the CEO. Long-term compensation of the CEO was calculated as (total compensation – salary – bonus)/total compensation. We collected this data from online proxy statements of SEC filings of the firms.

Our industry level moderating variables are constructed as follows. First, the firm's industry is classified as high tech, low tech, or neither, based on the classification scheme identified and used in prior research (Banker et al. 2011; Francis and Schipper 1999). This variable is coded as two dummy variables, Hightech Industry and Lowtech Industry. For constructing a variable corresponding to the strategic role of IT within an industry, we follow prior research convention (Banker et al. 2011) and adopt Chatterjee et al.'s (2001) classification scheme that captures the 'informate' and 'transform' IT roles in the industry. Accordingly, we define a variable "ITRole" which takes value of 1 for firms in 'automate' industry, 2 for firms in "informate" industries, and 3 for firms in 'transform' industries.

We control for several factors that can influence IT expenditures. As larger firms may have more resources to invest in IT, we control for firm size (Size), which is the natural log of the annual revenue of the firm for its most recent fiscal year (Mithas et al. 2005). Following prior research, we control for firm age (measured as the logarithm of the number of years since the firm was founded) (Chen et al. 2010; Huergo 2006) to capture any other scale and learning effects. To account for potential positive and negative effects of competition on IT investments, we control for industry concentration ratio, a commonly used inverse measure of competition (Melville et al. 2007; Porter and Sakakibara 2004). As in prior research, we use the 'four-firm concentration ratio' defined as the sum of the market shares of the top four market share leaders of the firm's industry (Bharadwaj et al. 1999; Melville et al. 2007; Ray et al. 2009). We obtained the ratios at the 6-digit (or most detailed available) North America Industry Classification System levels from the 2007 U.S. Census. Furthermore, IT investment may likely vary by industry sector. Hence, following prior research, we include industry dummy variables which represent the primary industry sector to which the firm belongs (Scherer 1965; Veugelers and Cassiman 1999). These dummies account for potential industry-specific idiosyncrasies beyond those accounted for by the high tech/low-tech variables, the IT orientation variables and the industry concentration ratio.

For our empirical analysis, we use Ordinary Least Squares to estimate the following equation:

$$ITInv = f(Plan, LongTermComp, HighTech, ITRole, Plan \times HighTech, Plan \times ITRole, LongTermComp \times HighTech, LongTermComp \times ITRole, controls) \quad (1)$$

We accounted for heteroskedastic error distribution and used robust standard errors for estimation.

Results

Descriptive statistics and correlations are shown in Table 2.

Variables	Min	Max	Mean	SD	1	2	3	4	5	6	7	8	9
1 IT Investment	0.05	30	5.32	4.92	1								
2 Plan	0	1	0.46	0.50	0.14	1							
3 LongTermComp	0.05	0.94	0.61	0.22	0.24*	0.23*	1						
4 Firm Size	5.85	12.11	8.54	1.22	0.16*	0.33*	0.19*	1					
5 Firm Age	1.61	5.41	3.64	0.89	0.16*	0.14	0.04	0.18*	1				
6 Industry Concentration	5.5	94	38.61	19.54	0.17*	-0.11	0.12	0.18*	0.10	1			
7 High tech Industry	0	1	0.23	0.42	0.32*	-0.24	0.13	-0.08	-0.18	0.19*	1		
8 Low-tech Industry	0	1	0.11	0.31	-0.12	-0.02	0.01	-0.05	-0.07	0.21*	-0.19*	1	
9 ITRole in Industry	1	3	2.08	0.77	0.28*	0.04	-0.02	0.11	0.04	0.02	-0.08	-0.04	1

Note: N = 173. * indicates significance at $\alpha = 0.05$

Table 2: Descriptive Statistics and Correlations

Results are provided in Table 3. Consistent with hypothesis H1, we find that Plan is positively associated with IT investment (column 1, $\beta = 0.12$, $p < 0.05$). Similarly, H2 is supported (column 1, $\beta = 0.37$, $p < 0.01$). These findings are consistent with our theory that long term compensation and the existence of a performance plan for CEOs stimulates support for IT investments.

	(1)	(2)
	ITInv	ITInv
Plan	0.12** (0.06)	0.50*** (0.17)
LongTermComp	0.37** (0.16)	0.25** (0.12)
Plan x HighTech		0.60*** (0.13)
LongTermComp x HighTech		0.42** (0.21)
LongTermComp x ITRole		-0.22*** (0.07)
LongTermComp x ITRole		0.09 (0.17)
High tech Industry	0.49*** (0.11)	0.12 (0.14)
Low-tech Industry	0.25 (1.42)	0.70 (1.28)
ITRole	0.18*** (0.05)	0.17 (0.12)
Industry Concentration	0.01 (0.02)	0.01 (0.02)
Firm Size	0.68** (0.26)	0.60** (0.26)
Firm Age	0.87** (0.39)	0.62* (0.32)
F-statistic	6.31***	8.32***
F-test of interactions		13.96***
R-square	0.53	0.64
Observations (N)	173	173

Robust standard errors in parentheses. Significant at *10%, **5% and ***1% level. Industry dummies were also included but in interest of space, their estimates are not shown. We also introduced the interaction terms one at a time, and found similar results (omitted for brevity).

Table 3: Parameter Estimates

Column 2 introduces the interactions. In column 2, we find that the interaction of Plan x HighTech is positive and significant ($\beta = 0.60$, $p < 0.01$), providing support for H3a. Likewise, we find that the interaction of LongTermComp x HighTech is positive and significant ($\beta = 0.42$, $p < 0.05$), supporting H3b. Thus H3 is fully supported. We find that the interaction of Plan x ITRole is negative and significant ($\beta = -0.22$, $p < 0.01$), consistent with H4a. However, we find that the interaction of LongTermComp x

ITRole is non-significant ($p > 0.10$), providing no support for H4b. Thus H4 is partially supported. We also introduced the interaction terms one at a time and found similar results (omitted for brevity).

The control variables are generally in expected directions. Firm Size and Firm Age are positive and significant, consistent with the argument that larger and well-established firms may have more slack resources for IT investment and are more capable of taking on the risk associated with IT investment (Mithas et al. 2013). The directions of the controls further validate our model.

We performed several robustness tests. First, we checked for multicollinearity by examining the variance inflation factors (VIF). The mean VIFs are well below the limit of 10, suggesting that multicollinearity is not a serious issue in our data (Greene 2008). Second, White's test failed to reject the null of constant variance, suggesting that heteroskedasticity is not a serious problem in the data (Long and Freese 2006).

Third, although common method bias is not of significant concern in this study because we collected the data from multiple sources (Podsakoff et al. 2003), we performed Harman's one-factor test and the marker variable test (Lindell and Whitney 2001) to assess common method bias. Both these tests indicated that common method bias is not a significant concern. Taken together, the robustness tests suggest the robust nature of our results.

Discussion

Our objective in this research was to examine the influence of long term performance plans on the firm's IT-expenditures. Our results show that a greater percentage of IT investment to sales is associated with the use of long term performance plans and a greater percentage of long term compensation to total compensation. We also find that the associations between long term performance plans and IT investments are stronger in high tech industries and weaker in industries where IT plays a transformative strategic role. This study extends prior work by showing strong, general association between firms using long term performance plans and IT investments and how these relationships are contingent on the nature of the firm's industry. The findings add to knowledge of the relationship between executive compensation practices and the firm's IT-investments. Results suggest that long term performance plans are an effective mechanism in aligning the interests of managers and stockholders and in promoting increases in investment of capital expenditures. Overall, the study suggests that compensation policies are a factor that should be looked at when trying to understand how firms make IT investment decisions, and executive compensation practices and plans should be part of those mechanisms examined to explain IT investment strategies.

The question of what determines IT investments and digital strategies has been an enduring topic in the literature (Mithas et al. 2013). Our study contributes to the literature on IT investments in two ways. First, it sheds light on how compensation schemes to CEOs may help explain variation in IT investments in firms. Second, it shows how the links between CEO compensation schemes and IT investments are contingent on the firm's contextual industry conditions.

Our study also contributes to managerial understanding of the impact of the incentive designs schemes for CEOs on investments such as IT. Previously, Rappaport (1978) called on firms to make more use of long term performance plans in their compensation packages. This is to better align the interests of managers and stockholders and to reform and reconsider incentive systems and search for ways to improve the long term performance of companies and the economy as a whole instead of calling for government initiatives, such as investment tax credits, to improve investment. The challenge, he indicates, is to design incentive systems so that executives make decisions congruent with the long term economic interests of the company and eventually the economy. As organizations seek to reform their governance structures and change the composition of their audit and compensation committees in light of the corporate scandals and the recent economic crisis, new opportunities exist for reforming executive compensation practices and to move away from stock option plans in favor of long term performance plans. However, one must also consider the nature of the industry and the IT strategic role within the industry while designing such plans.

This study should be viewed in light of its limitations, some of which can be starting points for future research. First, the sample firms may not be representative of the population of firms in their use of IT. Despite our use of control variables to account for related differences in firms and industries, the lack of a

perfectly random sampling frame hinders the generalizability of our results. Second, the cross-sectional analysis design limits inferences to association and not causality. Third, our data on IT investment was not sufficiently granular to disaggregate IT investment into more detailed categories (e.g., directed at specific initiatives), therefore we are unable to distinguish the impact of CEO incentives on specific types of IT investment. Future research can examine effects of CEO incentive schemes on more fine-grained IT investments.

In conclusion, this study provides exploration into the interplay between IT investments and executive compensation practices, specifically in realm of industry wide IT impact, such as being a transformative impact of IT or industry being oriented toward higher intensity of technological breakthroughs.

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