The Impact on Firm Value from the Announcement of the Appointment of a Chief Innovation Officer

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Dynamic markets seem to be the norm today, and firms across many industries are facing disruptions for both inside and outside their industries. The Chief Innovation Officer (CINO) is a relatively new addition to the C-Suite, with a responsibility to accelerate change and increase firm value by driving innovation initiatives. The rapid rise of this position within executive ranks follows a similar pattern that has been seen with other C-Suite level positions, such as Chief Digital Officer and Chief Data Officer. Researchers are starting to explore the firm value and performance results from these "CXO" positions, but no studies have been found regarding the CINO position. We find that firm announcements result in negative market reactions, with the move of a CEO into the CINO role, firm size, intangible assets, and educational background of the individual as significant predictors of abnormal returns.

Keywords: event study, chief innovation officer

INTRODUCTION

Change is all around us and many companies are struggling to keep up. New capabilities introduced through technologies change how companies look at their customers, products, service offerings, industry landscapes, and new business models, which are creating a new concept of "big-bang" disruptions (Downes & Nunes, 2013, p. 47). Organizations recognize the need for innovation in the face of the ongoing competitive challenges, and many are realizing that change involves fundamental challenges within their organization's resources and processes (Rao & Weintraub, 2013). To address these challenges, some companies have introduced a new executive to the C-Suite, the Chief Innovation Officer (CINO).

"One of the hottest jobs in the C-suite these days is the chief innovation officer, or CINO. Twenty years ago this position was virtually unheard of, but by 2017, 29% of Fortune 500 companies had a senior innovation executive, a study by Egon Zehnder shows." (Lovric, 2019) According to ZipRecruiter's job title analysis, the title of "Chief Innovation Officer" grew 500% between 2006 and 2015 (Valuer, 2019).

While driving innovation within an organization involves changes through the organization, it is generally expected that technology will play a large role in innovation. (Vizard, 2012) suggests that the Chief Information Officer (CIO) is well suited to drive innovation. However, although the CIO's role has changed a great deal since the 1980s, many leaders within the business still view the CIO role as more focused on IT infrastructure and cost-savings (Chun & Mooney, 2009). While some CIO's view their roles

ranging from a focus on infrastructure and costs control, others see their role as helping organizations drive innovation and pursue entrepreneurial activities; yet many business leaders view the CIO as primarily a support role (Grover, Jeong, Kettinger, & Lee, 1993, p. 108). Recent issues related to privacy and fraud have placed increasing pressures on the CIO relating to governance and compliance, making it more challenging for the CIO to spend the time on strategic issues (Chun & Mooney, 2009).

The CINO is a new role that some companies are adopting with a focus on accelerating innovation, delivering value to customers, and driving growth within the business (Newswire, 2018). Success in this role requires a unique combination of skills and experience, as well as CEO support. The CINO is a role that is expected to work with and to bridge a number of more customer-facing departments, including R&D, Strategy, and Marketing, with an ability to work both at the C-Suite level, as well as throughout the organization at many levels. This person must be able to drive the innovation vision as well as set clear objectives and be accountable for driving results (Stevenson & Euchner, 2013).

When companies announce the appointment of a CINO, if this move is perceived as a signal that the company is taking action to respond to or to lead market changes and drive performance improvements, then the market is predicted to react positively. However, if the announcement indicates something is not working within the organization and the move is driven by a need to fix something within the organization, then it signals a problem for the firm. In this research, we find support for the proposition that investors view the announcement of hiring a CINO to the C-Suite as a signal that the firm has a problem with its innovation process that needs to be fixed quickly.

To better understand the influence of these roles on organizations, an analysis of the WRDS Execucomp database was conducted pulling data from 1992 through 2018. Textual analysis was performed using R-Script to identify individuals that held the roles of CIO, CTO, CDO-Dig, CDO-Data, CIO-Innovation.

FIGURE 1 in Appendix A summarizes the inclusion of CXO roles in companies as reported in the Execucomp database of highest compensated employees, with the bar graph reflecting total CEO counts and Technical role counts, and a line graph representing the percentage inclusion of CXO roles. In the line graph, one can see the track of the "S" curve reflecting some type of diffusion of these roles within these organizations over the time 1993 through 2018.

FIGURE 2 in Appendix A provides a breakdown by year of the number of individuals from the technology roles included in the Execucomp database, with a breakdown by position. The results show that CTO is the highest represented of the roles, followed closely by CIO, then a large drop to the Chief Innovation Officer, followed by the Chief Digital Officer and then the Chief Data Officer. Of these CXO beyond the CIO and CTO, the CINO represents a larger group and merits further study.

LITERATURE REVIEW

The disruptions that have been brought about by rapid changes in advanced technologies represent a new level of innovation that is catching many organizations off guard (Downes & Nunes, 2013), requiring a fresh look at their markets, customers, and vulnerabilities. In many cases, companies realize they need to enhance their technical capabilities and to offer competitive products within the new advanced technology environment (Wessel & Christensen, 2012). The challenges of advanced technology represent new skillset and organizational challenges, and companies are struggling to find success with these initiatives (Bennett, 2016). The adoption of innovations involves challenges both within the organization as well as across external markets. One study finds that timing is important, and early adopters experience better market reactions than first movers or late followers (Cummings, Dennis, Cho, & Cooney, 2018).

While the CIO has been seen as a "new breed of information manager, CIO's are businessmen first, managers second, and technologists third" (Grover et al., 1993, p. 108), it does not appear that organizations consider the CIO to be best positioned for drive Innovation. Firms have added new C-Suite roles to address unique needs, including the Chief Technology Officer (CTO), Chief Digital Officer, and Chief Data Officer/Chief Analytics Officer/Chief Data Scientist. These positions collectively will be referred to as "CXO" for this paper.

The announcement of CXO positions is starting to be investigated. Studies have explored the impact in terms of firm value and firm performance, exploring the effects of the characteristics of the individual appointed, firm, the top management team (TMT), and industry factors.

Prior research using event study methods shows investments in strategically aligned technology investments improve firm performance (Bharadwaj, Bharadwaj, & Konsynski, 1999; Sabherwal, Sabherwal, Havakhor, & Steelman, 2019). The characteristics of the individual are important for the CIO role (Khallaf & Skantz, 2007), yet for the Chief Digital Officer appointment, the market penalizes individuals with a STEM background (Drechsler, Wagner, & Reibenspiess, 2019). Additionally, strategic investments in technology and innovation not only impact firm performance measures but also enhance the firm's intangible assets (Bharadwaj et al., 1999). Further, Dos Santos et al. (1993) find that the announcements of IT investments do not have an impact on firm performance, but when the announcement involves innovative IT investments, the market reacted positively (Dos Santos, Peffers, & Mauer, 1993).

At the firm level, studies show CXO appointments produce smaller market reactions for large firms (Khallaf & Skantz, 2007; Zhan & Mu, 2016), suggesting the role can be more impactful in smaller companies, while another study finds the inclusion of the CIO in the TMT improves results in the short term (Hu, Yayla, & Lei, 2014). At the firm level, a prior poor performance produces negative market reactions (Zhan & Mu, 2016), yet prior positive performance is an indication firms would be more likely to appoint a CXO role (Xu, Zhan, Huang, Luo, & Xu, 2016). The presence of a CIO at the time of the announcement of a Chief Digital Officer produced more negative market reactions (Drechsler et al., 2019; Zhan & Mu, 2016), suggesting the potential conflict from turf wars.

The inclusion of a CIO in the TMT enhances firm performance (Hu et al., 2014; Ranganathan & Jha, 2008), suggesting that the diversity of the TMT is enhanced with the presence of this role, resulting in better decisions within the firm. In terms of reporting relationship, one study has challenged the conventional wisdom suggesting the CIO must report to the CEO, finding a reporting structure that is aligned with the strategic positioning of the firm is a better predictor of firm performance (Banker, Hu, Pavlou, & Luftman, 2011).

The industry in which a firm operates is an important factor in terms of market reactions and firm performance outcomes. High-tech firms and firms within industries impacted by IT transformations have shown positive reactions to firm CXO announcements (Chatterjee, Richardson, & Zmud, 2001; Khallaf & Skantz, 2007). Further, the inclusion of the CXO role in the TMT produces positive firm performance outcomes for companies operating in dynamic markets or with high levels of R&D (Chatterjee et al., 2001; Khallaf & Skantz, 2007). We follow this body of research by using an event study model. We extend these studies to examine the appointment of a CINO to the TMT.

DATA

To identify firm announcements for technology roles, the Nexis-Uni database is searched using terms of "new" or "created" or "announced" or "appointed" or "named" along with terms to identify the position of "Chief Innovation Officer." These searches result in 37 firm announcements for which abnormal return data is available. LinkedIn offers a good source of career and educational background data and has been successfully used in other research as a primary data source (Norris-Tirrell, Rinella, & Pham, 2018). Each appointed CINO's Linked profile is reviewed to determine if the individual possesses a STEM or Ph.D. education, indicating a more scientific/research focus, and their work experience is reviewed to determine their tenure as CINO from the time of the announcement.

The Compustat database is used to collect firm-level financial performance for the year ending before the event announcement. Table 1 provides a summary of descriptive statistics for the announcement event firms. The dataset for this event study contains 37 firm announcements between the periods between 1990 and 2019 with return data available from the Center for Research in Security Prices (CRSP) database.

Firms in this study are listed both on the New York Stock Exchange (NYSE) and NASDAQ. In this study, the firms that list on the NYSE are substantially larger than firms listed on NASDAQ. Additionally, it is recognized that firms choosing to list on NYSE may desire higher levels of visibility and have different

corporate objectives than firms listed on NASDAQ (Kedia & Panchapagesan, 2011). For these reasons, we use the value-weighted CRSP index as the market proxy in our standard market-adjusted model for the event study.

TABLE 1
DESCRIPTIVE STATISTICS

	N	Mean	Median	SD
Day 0 CAR	37	-0.008427	-0.0009	0.043
Firm Descriptives				
Total Assets	32	145,299	7,859	421,947
Intangible Assets	31	7,144	1,907	18,680
EBITDA	26	1,983	612	4,152
Market Value of Equity	26	18,789	3,149	56,000
NASDAQ / NYSE	7 / 30			
CINO Descriptives				
STEM/PhD - %	37	45.9%		
Tenure in Months	34	45.03	36	28.8
Appointed from within Firm %	37	56.8%		

METHODOLOGY

We use standard event study methods to calculate abnormal returns and cumulative abnormal returns over various event periods to measure the magnitude of the impact on firm value of the firm's announcement of the appointment of a CINO. Event studies measure the effect of an event under the assumptions of market rationality and that investor assessment of firm value is accurate and it is quickly reflected in the firm's stock price. Consequently, any abnormal returns experienced in the event window can be interpreted as a measure of the impact of the event – the announcement of the appointment of a Chief Innovation Officer – on the value of the firm. Therefore, we test the following hypothesis:

$H1_0$: *The null hypothesis is that there is no effect on firm value from the announcement of the appointment of a Chief Innovation Officer.*

$H1_A$: *The alternative hypothesis is that the announcement of the appointment of a Chief Innovation Officer is a signal that something is missing within a company, resulting in significant negative abnormal returns.*

We used Ordinary Least Squares (OLS) regression to examine firm-level and individual-level factors to predict abnormal returns from the event announcements. To manage outliers in CARs, we applied a trimming technique to replace values greater than the ninety-fifth percentile with the ninety-fifth percentile and replace values less than the fifth percentile with the fifth percentile (Ghosh & Vogt, 2012).

In the case of a firm announcement that involves moving an existing CEO into the role of CINO, the market, we propose the market will view the announcement as a signal that something needs to be fixed within the company. Therefore, we test the following hypothesis:

H2: *The firm announcement that involves a Chief Executive Officer assuming the role of Chief Innovation Officer is a signal that something must be fixed within a company, resulting in significant negative abnormal returns*

Khallaf & Skantz (2007) and Zhan & Mu (2016) have shown that other C-Suite level appointments have produced negative market reactions, suggesting that it is more difficult to impact change in larger organizations. Further, Drechsler et al. (2019) results suggest when companies are penalized when they appoint individuals with STEM background into roles that require driving change within organizations. Therefore, we test the following hypotheses:

H3: *The announcement of the appointment of a Chief Innovation Officer at firms with greater Total Assets will result in significant negative abnormal returns.*

H4: *The announcement of the appointment of a Chief Innovation Officer with a STEM educational background will result in significant negative abnormal returns.*

We propose that firms announcing the appointment of a Chief Innovation Officer signals to investors a commitment to innovative investment. Firms with higher levels of Intangible Assets on their balance sheets would suggest prior success in building innovative investments. Therefore, we test the following hypothesis:

H5: *The announcement of the appointment of a Chief Innovation Officer at firms with higher levels of Intangible Assets will result in significant positive abnormal returns.*

The regression model tested in this paper is as follows:

$$AR_i = a_0 + B_1\,(CEO \Rightarrow CINO) + B_2\,(\text{Log Total Assets}) + B_3\,(\text{DV Stem/PhD}) + B_4\,(\text{DV IntangAssets}) + e_i \quad (1)$$

where AR_i represents the abnormal return for firm $_i$, CEO=>CINO is dummy-coded 0/1, with 1 assigned to announcements where an existing CEO is moved to the role of CINO, Log Total Assets is the natural logarithm of the firm's total assets, DV Stem/PhD is dummy-coded 0/1, with 1 assigned to individuals with a STEM or PhD educational background, and DV IntangAssets is dummy-coded 0/1, with 1 assigned if the intangible assets of the firm are greater than or equal to the median value for intangible assets.

RESULTS

The date of the firm announcement of the appointment of the CINO is the event date in the study (Day 0). Table 2 provides the results for the event study for various event periods. Given the hypothesis that the firm announcement of the appointment of a Chief Innovation Officer is a signal that something is missing in the company, we find the Day 0 Average Abnormal Return is -.82%, significant at the $p<.05$ level (Patell Z statistic equals -1.751). This result supports our $H1_A$.

TABLE 2
EVENT STUDY RESULTS USING MARKET MODEL WITH CRSP VALUE WEIGHTED INDEX

Days	N	Mean CAR	Pos:Neg	StdCsect		Gen Sign Z
(0)	37	-0.82%	16:21	-1.751	*	-0.784
(-1,0)	37	-0.52%	16:21	-1.623	$	-0.784
(-1,+1)	37	-0.43%	19:18	-1.097		0.202
(-2,-1)	37	-0.12%	19:18	-0.929		0.202
(-2,0)	37	-0.94%	13:24	-2.476	**	-1.771
(0,+1)	37	-0.73%	19:18	-1.190		0.202
(0,+2)	37	-0.74%	20:17	-1.142		0.531
(+1,+2)	37	-0.07%	21:16	-0.040		0.860
(-2,+2)	37	-0.86%	17:20	-1.650	*	-0.455
Significance Symbols: $ p<0.1; * p<0.05; ** p<.01; *** p<.001						

Table 3 provides regression results for firm announcements of CINO appointments. Only 31 companies have complete information for the regression model. The results indicate investors react negatively when a firm announcement of the CINO appointment involves moving the Chief Executive Officer into the role, β = -.0615, p=.008. Thus, H2 is supported. The results indicate investors react more negatively to firm announcements for CINO appointments at larger firms, β = -.0066, p=.009. Thus, H3 is supported. Consistent with prior studies, the results indicate that investors react more negatively to firm announcements that involve an individual with a STEM educational background, β = -.0181, p=.049. Thus, H4 is supported. Finally, results indicate that firm announcements for CINO appointments at companies with higher levels of Intangible assets are more favorably received by investors, β = .0199, p=.066. Thus, H4 is supported.

TABLE 3
CARS AND FIRM SPECIFIC FACTORS

	Day 0 CAR		
	Estimate	p	
Move CEO to CINO	-0.0615	0.008	**
log-Total Assets	-0.0066	0.009	**
STEM/PhD	-0.0181	0.049	**
InTan Dummy	0.0199	0.066	$
Constant	0.0533	0.015	*
Observations	31		
R^2 / R^2 adjusted	0.313	0.207	
F-Statistic - 2.959 on 4 and 26 DF, p-value = 0.0386			
Significance Symbols: $ p<0.1; * p<0.05; ** p<.01; *** p<.001			

To investigate the theory that many CINO appointments are to fix immediate problems, thus their tenure is short, we run the event study divided by the length of tenure of the CINO's in our sample. Of the 37 companies in our sample, we have tenure data for 34 companies with CRSP data. In Table 1, the mean tenure of the CINO's in our original sample is 45 months and its median is 36 months. We divide the data by 36 months or less into the short-term CINO tenure sample (N=18) and the 36 months or longer into the long-term CINO tenure sample (N=16). The average tenure for the CINO's in the short-term sample is 24.2 months. The average tenure for the CINO's in the long-term sample is 64.5 months, more than 2.5 times longer than the short-term tenure sample. In Table 4.A the long-term tenure abnormal return on Day (0) is slightly negative, but not significantly different from zero (-0.49%, Z = -1.026). In Table 4.B the short-term tenure abnormal return on Day (0) is a much larger negative figure (-1.35%) and is significantly different from zero at the 10% or better level (Z = -1.414). These event study results indicate that the market predicts the short-term tenure of a CINO and views their appointments as a negative signal that the hiring of a CINO is required to address a significant technology problem.

TABLE 4
EVENT STUDY RESULTS USING THE MARKET MODEL WITH CRSP VALUE WEIGHTED INDEX DIVIDED BY LENGTH OF TENURE

A. Long-term CINO Tenure

Days	N	Mean CAR	Pos:Neg	StdCsect	Gen Sign Z
(0)	16	-0.49%	7:9	-1.026	-0.468
Significance Symbols: $ p<0.1; * p<0.05; ** p<.01; *** p<.001					

B. Short-term CINO Tenure

Days	N	Mean CAR	Pos:Neg	StdCsect	Gen Sign Z
(0)	18	-1.35%	8:10	-1.414 $	-0.476
Significance Symbols: $ p<0.1; * p<0.05; ** p<.01; *** p<.001					

CONCLUSIONS

The Chief Innovation Officer is a relatively new C-suite position with a goal of accelerating innovation and driving value to an organization. Little is known about this new role and extant research has not explored investor reactions to firm announcements of the appointment of a CINO. The present study examines the impact on firm value from the announcement of the appointment of a CINO and explores factors that influence investor reactions.

We find a significant abnormal return on the day of the announcement. The statistically significant negative abnormal return on the event date rejects the first null hypothesis of no impact on firm value from appointing a CINO to the C-suite of TMT. The finding of a significant negative abnormal return suggests that investors view the announcement as a signal of a problem within the firm, supporting the contentions of Stevenson and Euchner (2013). The second hypothesis is that the move of the CEO into the CINO role is an indication of a significant problem. The regression analysis supports the event study finding with its significantly negative coefficient. The finding that investors react negatively to CINO appointments from larger firms, the third hypothesis, as the coefficient on the size variable in the regression, the log of Total Assets, is significant and negative. This result supports the previous research by Khallaf and Skantz (2007) and Zhan and Mu (2016). The fourth hypothesis tests for the sensitivity of the impact on firm value from appointing an individual with a STEM or a Ph.D. educational background. Our finding is that the announcement of CINO with a STEM/Ph.D. background is significantly negative. This result supports the propositions of Drechsler, Wagner, and Reibenspies (2019). The last hypothesis looks at the Bharadwaj,

Bharadwaj, and Konsynski (1999) contention that strategic investments in technology and innovation increases intangible assets. Our significantly positive finding indicates that firms with more intangible assets benefit more from the appointment of a new CINO. This finding indicates that there is a positive link between a firm's emphasis on innovation and firm value.

Driving change within an organization takes time. There are many opportunities to extend research related to the impact of the CINO in firms. One area that merits further research is to explore the impact that CINO presence on firm accounting performance over an extended period.

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APPENDIX A

FIGURE 1
TECHNOLOGY ROLES AS REPORTED IN EXECUCOMP

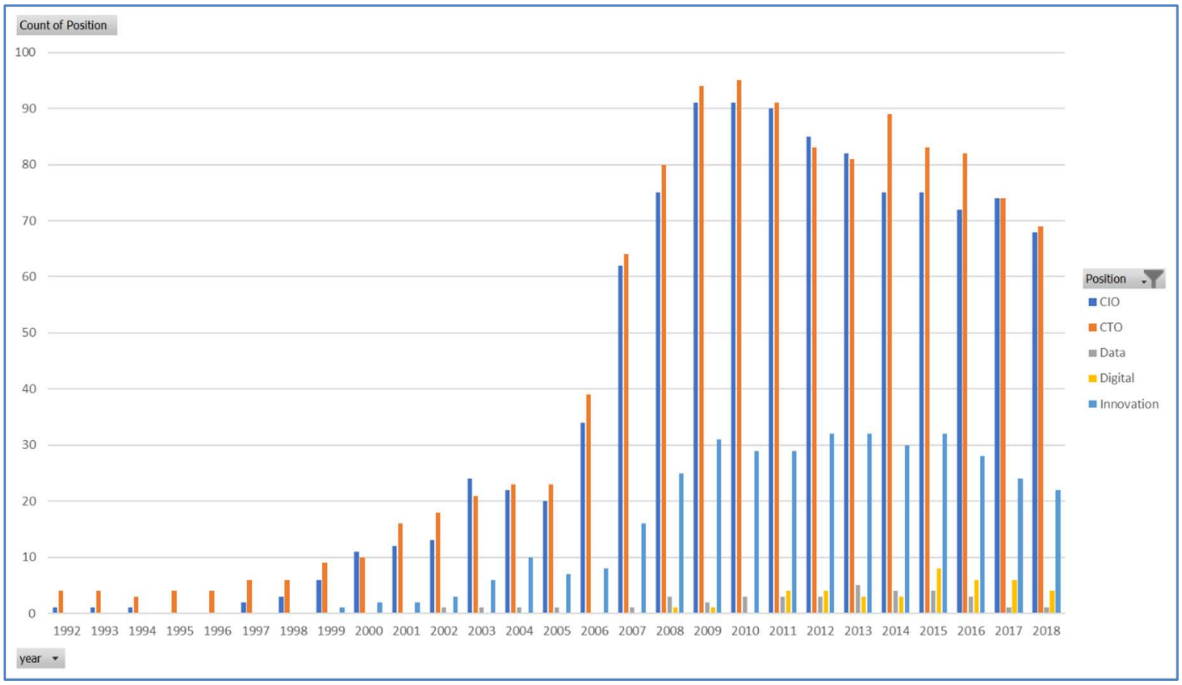
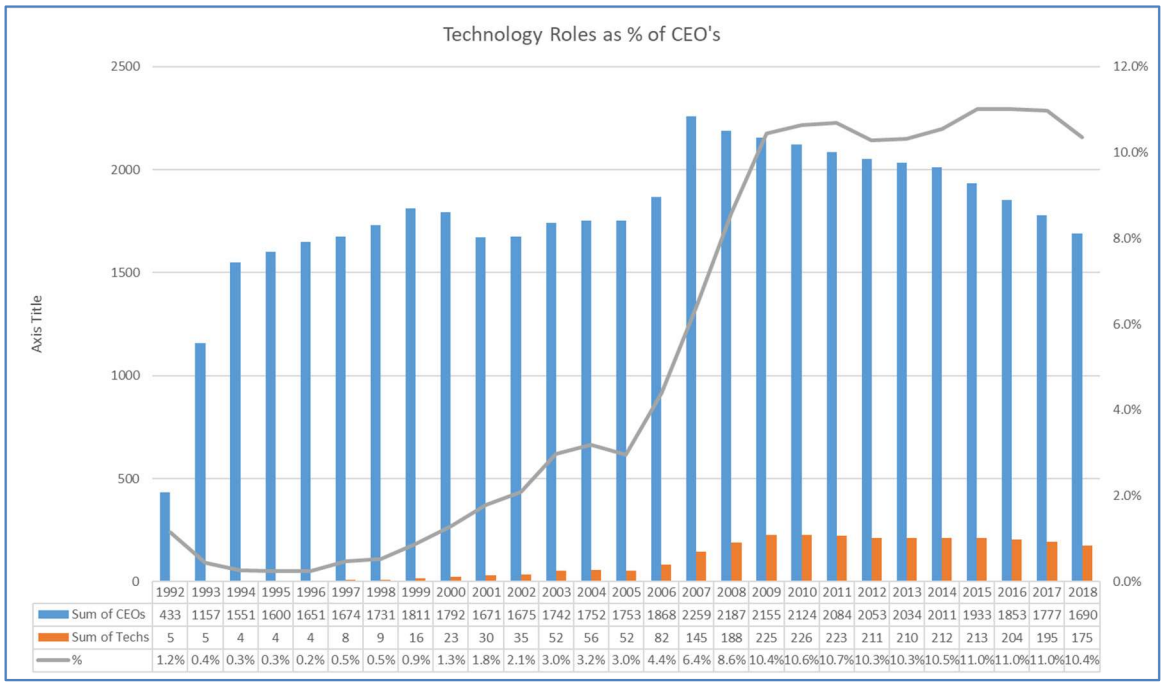


FIGURE 2
TECHNOLOGY ROLES AS REPORTED IN EXECUCOMP BY ROLE



	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Sum of CEOs	433	1157	1551	1600	1651	1674	1731	1811	1792	1671	1675	1742	1752	1753	1868	2259	2187	2155	2124	2084	2053	2034	2011	1933	1853	1777	1690
Sum of Techs	5	5	4	4	4	8	9	16	23	30	35	52	56	52	82	145	188	225	226	223	211	210	212	213	204	195	175
%	1.2%	0.4%	0.3%	0.3%	0.2%	0.5%	0.5%	0.9%	1.3%	1.8%	2.1%	3.0%	3.2%	3.0%	4.4%	6.4%	8.6%	10.4%	10.6%	10.7%	10.3%	10.3%	10.5%	11.0%	11.0%	11.0%	10.4%

APPENDIX B

To study whether an event has any impact on the market, we measure event-day cumulative abnormal returns (CARs) and test their statistical significance. We focus primarily on whether or not there is an impact on firm value from the announcement of the appointment of a Chief Innovation Officer (CINO) within a reasonable time period, called the event window. The event window is the amount of time, usually measured in a number of trading days, taken by investors to absorb the impact of a new event. According to the efficient market hypothesis, new information is incorporated very quickly into the stock price. Consequently, a short event window is likely to more reliably test the market effect of an event.

An event study methodology is used to determine the price effect of the announcement of the appointment of a Chief Innovation Officer. For similar event study methods, see for example (Conrad, 1989), (Holland & Wingender, 1997), and (Groff, 2010). Single-factor market model parameters are calculated using the estimation period of trading days before the event date to approximate one year of stock returns. The estimation period begins 275 trading days before the event and ends 26 days before it. These dates are the same as those used by (Park & Lee, 2014). We employ a generalized sign test, which differs from the simple sign test in that the fractions of positive and negative returns under the null hypothesis are determined by the fractions observed in the estimation period, rather than fixed at 0.5.

The abnormal return (ABR_{jt}) is the difference between the actual return (R_{jt}) on a specific date and the expected return ($E(R_{jt})$) calculated for the firm on that specific date. The expected return is calculated using the parameters of a single index regression model during the pre-event estimation period. The regression model parameters are determined by the following equation:

$$R_{jt} = a_j + b_j R_{mt} + e_{jt} \tag{2}$$

where R_{jt} is the return on security j for period t, a_j is the intercept term, b_j is the covariance of the returns on the jth security with those of the market portfolio's returns, R_{mt} is the return on the CRSP value-weighted market portfolio for period t, and e_{jt} is the residual error term on security j for period t. Betas (β_j) in the market model are estimated using the method of Scholes and Williams (Scholes, 1977). Ordinary Least Squares (OLS) was used to estimate the slope and intercept parameters for each security in the data set. The market model estimation is adjusted for any first-order autocorrelation with a GARCH(1,1) approach. These estimates were then used to calculate the expected return for the event window, from which the abnormal returns (AR_{jt}) can be calculated:

$$AR_{jt} = R_{jt} - (\alpha_j + \beta_j R_{mt}) \tag{3}$$

where the estimates of alpha and beta are those calculated above from the estimation period. The average abnormal return (AAR_t) is calculated as the mean AR_{jt} for all N securities:

$$AAR_t = \frac{\Sigma_{j=1}^{N} AR_{jt}}{N} \tag{4}$$

where t is the trading day relative to the event. The cumulative average abnormal return from Day T_1 to Day T_2 ($CAAR_{T_1,T_2}$) is calculated as follows:

$$CAAR_{T_1,T_2} = \sum_{t=T_1}^{T_2} AAR_t \tag{5}$$

Test statistics are calculated as in Patell (1976). Standardized abnormal returns (SAR_{jt}) are defined as follows:

$$SAR_{jt} = \frac{AR_{jt}}{S_{jt}} \tag{6}$$

S_{jt} is further defined as the square root of the security j estimated forecasted variance:

$$S_{jt}^2 = S_j^2(1 + \frac{1}{D_j} + \frac{(R_{mt} - R_m)^2}{\Sigma_{k=1}^{D_j}(R_{mk} - R_m)^2} \tag{7}$$

where D_j is the number of trading day returns (251) used to estimate the parameters for firm j, and S_j^2 is calculated as follows:

$$S_j^2 = \frac{\Sigma_{k=1}^{D_j} AR_{jk}^2}{D_j - 2} \tag{8}$$

Finally, the test statistic Z_{T_1,T_2} for the null hypothesis that the $CAAR_{T_1,T_2}$ equals zero is defined as:

$$Z_{T_1,T_2} = \frac{1}{\sqrt{N}} \sum_{j=1}^{N} Z_{T_1,T_2}^j \tag{9}$$

where

$$Z_{T_1,T_2}^j = \frac{1}{\sqrt{Q_{T_1,T_2}^j}} \sum_{t=T_1}^{T_2} SAR_{jt} \tag{10}$$

and

$$Q_{T_1,T_2}^j = (T_2 - T_1 + 1)\frac{D_j - 2}{D_j - 4} \tag{11}$$

To test the data, the null hypothesis that the impact on firm value from the announcement of the appointment of a Chief Innovation Officer event has no effect on the returns of the underlying security will be rejected if the Z-statistic is significant at the 0.10 level or better.

The generalized sign test is used as a nonparametric test of the impact of the announcements. The generalized sign test statistic controls for the normal asymmetry of positive and negative abnormal returns in the estimation period. The significance levels for the generalized sign test are calculated. The null hypothesis for the generalized sign test is that the fraction of positive returns is the same as in the estimation period. The test reports whether the difference is significant at the five percent, one percent, or one-tenth of one percent level. The actual test uses the normal approximation to the binomial distribution. For examples of the generalized sign test in the literature, see (Sanger & Peterson, 1990), (Singh, Cowan, & Nayar, 1991), and (Chen, Hu, & Shieh, 1991). Chen, Hu and Shieh (1991) refer to the test as a binomial sign test. For a more detailed explanation of the generalized sign test, see (Sprent & Smeeton, 2000) and (Cowan, 1992). Cowan (1992) reports that the generalized sign test is well specified for an event date variance increase and more powerful than the cross-sectional test.