

IMPACT OF APPOINTING A CHIEF DATA OFFICER (CDO) ON FIRM PERFORMANCE: RELATIONSHIPS AMONG CDO APPOINTMENT, TENURE, DUALITY, AND FIRM PERFORMANCE

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Abstract

As data are becoming recognized as an important asset and resource, more and more firms are appointing a Chief Data Officer (CDO) as part of their top management team (TMT). From this position, the CDO is able to influence the management structure of a firm and bring more impact on strategy and performance. The study presented in this paper focuses on the impact of appointing CDO on the firm's performance, and the relationship between CDO demographic characteristics and firm performance. Data were collected on 86 firms that had appointed a CDO. The results of the study show CDO appointment does not significantly affect firm performance. The study also conclude the tenure of the CDO has an inverse U-shaped relationship to firm performance, and CDO duality, which means the CDO has multiple duties, has a positive influence on firm performance.

Key Words: Chief Data Officer, Firm Performance, CDO Tenure, CDO Duality

1 INTRODUCTION

There are no doubts the era of Big Data has arrived. Vast quantities of data are being produced from the Internet of Things (IoT) and distributed computing environments, much greater volumes than could be imagined in the past (Kyoo-Sung Noh, 2016). While data have become a powerful strategic resource for uncovering business value, organizations are struggling to determine who should manage big data. Ongoing concerns about data issues have led a growing number of organizations to establish an enterprise-level, executive-rank role of Chief Data Officer (CDO) (Yang Lee et al., 2014).

The first recognized CDO was established in 2003 at Capital One. More CDOs have been established at global investment banks, consumer banks, consumer credit institutions, financial institutions, IT and data companies, healthcare organizations, U.S. federal and state governments, and U.S. military organizations (Yang Lee et al., 2014). The Shorenstein Center on Media, Politics and Public Policy at the Harvard Kennedy School of Government proclaimed 2015 the Year of the CDO. These full-time CDO executives, or CDO-equivalent executives (who perform the CDO role, but aren't formally titled as CDO), lead enterprise-wide initiatives on data quality and analytics, data governance, data architecture and data strategy (Yang Lee et al., 2014).

Though the number of CDO appointments has dramatically increased in recent years, the relationship between CDO and corporate financial performance has had little quantitative study until now. Previous studies on the impact of the CDO have been based on qualitative fieldwork, offering rich descriptions of the CDO role. Although firms have noted the importance of the CDO as one of the C-level executives, there is little direct evidence linking CDO presence and firm performance. Research on this relationship is severely limited (Feng Xu, 2016).

The purpose of our study is to seek empirical evidences to determine if the appointment of a CDO could influence firm performance. In the following, we propose our hypotheses and collect recent data to empirically investigate the relationship between CDO appointment, demographic characteristics, and firm performance. We present our findings and conclude with discussion and future research directions.

2 LITERATURE REVIEW

2.1 CXO and firm performance

A C-level executive (CXO) in the TMT, usually has an important impact on a firm's performance from an upper-echelons perspective. Organizational outcomes, especially the performance level, are predicted by top management team characteristics (Hambrick, D. C. and Mason, P. A., 1984).

The Chief Executive Officer (CEO) accounts for a considerable portion of the variance in firm profitability and organizational outcomes (Donald C. Hambrick, 2007). And the effect of a CEO on firm performance is related to other variables, such as CEO compensation, TMT dynamics and corporate governance structure. The CEOs at firms with greater agency problems receive greater compensation, and firms with greater agency problems would get less firm performance. Martin J. Conyon and Lerong He (2012) examined the relation between CEO turnover and firm performance in China. They documented some improvement in accounting performance following CEO turnover, but the extent of the improvement was smaller and less significant than what had been documented for U.S. and Japanese enterprises. They also showed that there was no significant relation between CEO turnover and stock price performance (Martin J. Conyon, Lerong He, 2012).

According to many scholars, the Chief Marketing Officer (CMO) would also have an effect on firm performance. Pravin Nath and Vijay Mahajan (2008) found that CMO presence in the TMT had neither a positive nor a negative impact on firm performance. But later he discussed CMO power in a highly divisional TMT and the additional CMO responsibility of sales improved sales growth (Pravin Nath and Vijay Mahajan, 2011). D. Eric Boyd (2010) argued the impact of CMO on financial performance was highly contingent on the managerial discretion available to them. Frank Germann (2015) employed model specifications with varying identifying assumptions and used data from up to 155 publicly traded firms over a 12-year period (2000–2011) to find that firms could indeed expect to benefit financially from having a CMO at the strategy table. Specifically, their findings suggested that the performance of the sample firms that employed a CMO was, on average, approximately 15% greater than that of the sample firms that did not employ a CMO.

About the Chief Information Officer (CIO), Rajiv D. Banker (2011) proposed firms that aligned their CIO reporting structure with their strategic positioning would have superior future performance. Ali Alper Yayla (2014) provided empirical support for the important role of the board-of-director's IT awareness in shaping CIO compensation and improving firm performance. Elena Karahanna (2013) explained that IS alignment significantly influenced the firm's financial performance and mediated the relationship between CIO-TMT social capital and performance. Humayun Zafar (2016) concluded that having the CIO in the TMT had a significant positive impact on firm performance in the aftermath of security breach incidents. However, the degree of impact on performance varied, depending on the type of security breach.

Except for the CEO, CMO, and CIO, Jeremy J. Marcel (2009) argued that the presence of a Chief Operations Officer (COO) may also create TMT-level information-processing benefits that could improve firm performance in certain conditions. Frank Wiengarten's study (2017) indicated that appointing a chief executive of corporate social responsibility (CSR) did under certain conditions and characteristics result in financial performance benefits. Furthermore, the greatest financial performance benefits could be achieved if the appointee was female and had a CSR functional background.

2.2 Research about CDO

CDO role and responsibility analysis is an important aspect of CDO study. Yang Lee et al. (2014) analyzed the CDO role by using a cubic framework. They used three dimensions to identify 8 different CDO roles. Julie Steele (2016) briefly characterized the CDO from the standpoint of responsibilities, challenges and reporting structures.

CDO appointment indicates firms pay more attention to data initiatives and realize the importance of data-driven decision making in the organizational top management team. Peter Aiken (2013) illustrated how to think and make decisions as a C-level officer, and focus on data management to meet organization challenges as a CDO.

The CDO, as a new position, should cooperate with other chief officers, but job overlap problem is an obstacle needed to be handled. Xinrui Zhan (2016) found the impact of a CDO on shareholder value was highly related to the presence of a CIO, and the negative effects of job overlap between CDO and CIO on the market value a CDO creates would be larger when the firm size was smaller and the firm's prior performance was lower.

A CDO will help firms to deal with big data problems and to improve competitive advantages. Yang Lee et al. (2014) showed that a CDO could help the company produce better data products before competitors could and gain strategic advantage in the market. A CDO could also maintain access to various sources of data and use them for creating new markets and identifying innovative strategies for organizational growth. In addition, a CDO could expand the organization capability to conceive and experiment with new information products to add strategic value. Feng Xu (2016) showed that firms with a CDO have superior financial performance than their peers who did not. Kyoo-Sung Noh (2016) explained that position of CDO could improve competitiveness of the companies in Korea.

3 THEORETICAL FOUNDATION AND HYPOTHESIS DEVELOPMENT

3.1 The relationship between CDO appointment and firm performance

Hambrick (1984) proposed upper echelon theory to explain how TMT composition influences organizational decision and performance. CXO appointment would influence TMT composition, change the strategic structure and decision making process, improve firm performance (Frank Germann, 2015,

Rajiv D. Banker, 2011, Humayun Zafar, 2016), CDO appointment would have the same result. Yang Lee et al. (2014) argued that the CDO could deliver consistent data across all operational units of the firm and help solve data-related problems. Through the development of data assessment protocols and the implementation of data standards, the CDO could enhance information management systems and deliver higher quality data thereby improving information sharing and decision making processes, increasing the benefit of information exchange resulting in higher firm performance.

As a C-level executive, a CDO will have more authority and power to focus on data problems and solve them. The CDO can communicate with the CEO and other C-level executives to integrate data management into business activities to solve data-related problems (Feng Xu, 2016). By aligning data practices with business processes, the CDO can promote cross-functional cooperation which helps improve the effectiveness of business operations (Smaltz, D. H., Sambamurthy, V. and Agarwal, R, 2006).

CDO appointment shows the firm is taking the first step to develop data governance and explore new business opportunities through big data analysis. The firm will derive more value from data assets and combine its data management and business more effectively (Yang Lee et al., 2014). Based on this research we made and investigated the first hypothesis

Hypothesis 1: CDO appointment has positive effect on firm performance.

3.2 The relationship between CDO tenure and firm performance

Miller Danny & Shamsie Jamal (2001) suggested an executive goes through a learning stage, harvest stage, and decline stage during his or her executive tenure, and each stage can have a different impact on firm performance. Most top managers, early in their tenures, worked at learning a strategy and the skills to implement it. In their initial efforts to "learn the ropes", leaders engaged in a good deal of experimentation. After a few years have passed, these managers typically acquired sufficient knowledge about their businesses reflected in stronger financial performance. In the harvest stage, they became more confident and felt less need to experiment with tactics and products. Finally, at the end of long tenures, many executives became stale: rigidity and overconfidence commits them to archaic product lines. In short, the executive life cycle began with a struggle to learn, progressed through increased competency, and, if leaders stayed long enough, culminated in complacency and decline. Rajeswararao S. Chaganti (2016) explained if the tenure was too long, TMT members would form cohesive networks with other members and develop a unique pattern of interactions. With time, the TMT members would accumulate deep firm-specific knowledge, and discern the value of their respective competences. Furthermore, team members with relatively long tenure might perceive a high level of personal "investment" in the firm. All of these considerations might enable them to develop a "collective mindset" and a common perspective of the firm, thereby resulting in TMT cohesion, consistent decisions and consistent behavior (Hambrick, D. C. and Mason, P. A, 1984). In this case, a long-tenured team may have inverse U shape influence on firm performance. Based on the above arguments, our hypothesis is as follows:

Hypothesis 2: CDO tenure has an inverse U-shaped effect on firm performance

3.3 The relationship between CDO duality and firm performance

Executive duality exists when the same person grasps two or more duties in a firm (Min-Tsung Cheng, 2013). An executive with dual positions has extensive power to identify and execute the data-driven transformation (Boling, J. R., Pieper, T. M., and Covin, J. G. 2016). Weisbach M.S. (1988) illustrated that CEO duality would consequently gain much dominion to advance their concerns. CDO duality has the same effect (we mainly concerned with CDO-CIO duality, because it is the most common duality in the business). The CDO with duality will have more power to allocate the resources and finish data related

work contributing to the development of data governance. Executive duality could give an executive broader authority and control, and then acquiring ample influential power to secure more personal advantages (Finkelstein and D'Aveni, 1994). A CDO with duality can carry out his/her data management ideas smoothly with more power and authority. Based upon this view, CDO duality might substantially improve firm performance in definite settings. Therefore, our hypothesis is as follows:

Hypothesis 3: CDO duality has positive effect on firm performance

4 RESEARCH METHOD AND RESULTS

This research uses correlative analysis method of publicly available observational data to empirically test the proposed hypotheses. We compare the performance of firms before and after the appointment of CDO. After that, we analyze the relationship between independent variables and indicators of firm performance.

4.1 Sample Selection

Since the first CDO was appointed in 2003, there have been many CDO appoints each year. In this study, we choose only firms which established a C-level role with the actual title Chief Data Officer, not VP, CIO or Data Analyst who are carrying out CDO roles. We started by searching for CDO titles and CDO employers on LinkedIn. Once an executive with the “Chief Data Officer” title was identified, we were able to get CDO tenure, CDO duality and related information from various publicly available sources. We excluded federal and state government organizations, and only kept publicly traded companies in our list, because of the difficulty to confirm the performance of the government entities. Most of the firms are leading companies, such as IBM, AIG, BOA. Because we needed to calculate firm performance before and after the CDO appointment, we only searched for CDO appointments made before 2013 and in 2013. This allowed us to get at least 2 years of performance data after the CDO appointment. Based on these criteria were able to identify 86 firms for our sample.

4.2 Measurements

The study collects data about the companies which appoint CDO and uses CDO tenure, CDO duality as CDO characteristics. We collected data mainly from their personal pages and LinkedIn pages. CDO tenure was operationalized as the number of months in which the CDO has been employed in his or her current position. CDO duality was operationalized as a dummy variable of 0 for a CDO without a dual position and 1 for a CDO with dual positions.

According to studies, firm performance could be measured by many different indicators (Hambrick and Cannella, 2004, Anandhi S. Bharadwaj, 2000, Radhika Santhanam, and E. Hartono, 2003, Ho-Chang Chae, 2014, Frank Germann, 2015, Ali Alper Yayla, 2014). Hambrick and Cannella (2004) chose the most important variables to reflect the firm performance and got a good result. Their paper was published in Strategic Management Journal and cited by other 197 studies until Aug, 2017. Therefore, we choose the variables similar with the research of Hambrick and Cannella (2004), which will reflect accounting-based performance and market-based performance. They are: (1) Return On Assets (ROA), (2) Average Sales Growth (ASG), (3) Market to Book Ratio (MBR). As far as CDO appointment and CDO characteristics have relationship with one of the three indicators, we can think they have effects on firm performance.

In order to identify the indicators before and after CDO appointment, we set these variables: ROAB means the ROA before the CDO appointment. ROAA means the ROA after the CDO appointment. MBRB means the MBR before the CDO appointment. MBRA means the MBR after the CDO appointment. ASGB means the ASG before the CDO appointment. ASGA means the ASG after the CDO appointment.

We collected firm performance data from Compustat¹, such as ROA, Net income, Total assets, Sales, Price and Revenue, Book value per share. After calculation, we can get the indicators ROA, ASG and MBR. The performance data we obtained was for the 2 years before and 2 years after the appointment of the CDO hired in 2013 and before. Because there were too few CDO appointed before 2012, we choose the CDO hired in 2013 and before. The reason we collect data 2 years before and after the appointment is that for many companies which appoint CDO in 2013, we only can get their 2 years data after CDO appointment from Compustat database.

4.3 Statistical Tests

The study examines whether firms with CDO tend to show superior firm performance in comparison to firm performance before CDO appointment (Hypothesis 1). We tested Hypothesis 1 using the Paired-Samples Test, to compare performance of firms before and after CDO appointment.

According to Hypothesis 2, CDO tenure has an inverse U-shaped effect on firm performance. About the quadratic relationship between CDO tenure and firm performance, we use regression analysis procedures to test Hypothesis 2. We propose it will show quadratic relationship between CDO tenure and firm performance. The model can be described as

$$FP = \alpha_0 + \alpha_1 T + \alpha_2 T^2$$

Where FP means firm performance after the CDO appointment, T indicates the CDO tenure measured in months, α_1 and α_2 are regression coefficient, and α_0 represent the intercepts. FP can be shown as ROAA, ASGA and MBRA.

According to Hypothesis 3, CDO duality has positive effect on firm performance. CDO duality is a (0, 1) binary variable, we can use ANOVA analysis method to analyze if there are significant effect between CDO duality and firm performance. And if they have significant relationship, we can use correlation analysis to get their correlation coefficient.

4.4 Results

Hypothesis 1

The results of Paired-Samples Test are displayed in Table 1. The test results are reported as a significance (Sig.) value. Because all the sig. value are greater than 0.1, the first hypothesis, that CDO appointment has positive effect on firm performance, is not supported. While the firm performance after CDO appointment didn't show any significant difference in terms of ROA, ASG and MBR. It may be because CDO focuses on data governance, data quality improvement and data management. All of these programs often need a longer time to reflect their benefit, so we are not able to see the improvement only in 2 years of performance data. Therefore, we reject Hypothesis 1.

¹ Compustat is a database of financial, statistical and market information on active and inactive global companies throughout the world. The service began in 1962. <https://wrds-web.wharton.upenn.edu/>

Table 1 Paired-Samples Test result

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	ROAB - ROAA	-.0036063	.1152081	.0142898	-.0321535	.0249409	-.252	64	.802
Pair 2	ASGB - ASGA	3.30132	23.00912	2.52558	-1.72286	8.32550	1.307	82	.195
Pair 3	MBRB - MBRA	-.02924	1.40381	.17024	-.36903	.31056	-.172	67	.864

Hypothesis 2

Hypothesis 2 supposes that CDO tenure has an inverse U-shaped effect on firm performance. We compare the linear and quadratic regression analysis. The result shows the CDO tenure to firm performance relationship has a better R Square value when the model is quadratic rather than linear. The Sig. value is 0.54 and 0.00 if the dependent variables are ROAA and ASGA. The parameter estimates show that α_2 is negative, so it will show inverse U shape between CDO tenure and ROAA and ASGA. But for MBRA, the sig. value is greater than 0.1, we can't get this kind of relationship. Therefore, we partially accept Hypothesis 2. The results are shown in Table 2, Table 3 and Table 4.

Table 2 regression analysis result between CDO tenure and ROAA

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	Sig.	Constant	b1	b2	b3
Linear	.039	2.545	1	63	.116	.026	.001		
Quadratic	.090	3.061	2	62	.054	-.046	.004	-2.584E-5	

Table 3 regression analysis result between CDO tenure and ASGA

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	Sig.	Constant	b1	b2	b3
Linear	.192	19.298	1	81	.000	-10.401	.249		
Quadratic	.195	9.670	2	80	.000	-12.500	.330	-.001	

Table 4 regression analysis result between CDO tenure and MBRA

Equation	Model Summary					Parameter Estimates			
	R Square	F	df1	df2	Sig.	Constant	b1	b2	b3
Linear	.007	.485	1	67	.488	1.342	.005		
Quadratic	.021	.713	2	66	.494	.860	.023	.000	

Hypothesis 3

Hypothesis 3 supposes that CDO duality has positive effect on firm performance. The ANOVA analysis shows that CDO duality has significant effect on ROAA. And the correlation analysis shows they have positive relationship. And their Pearson Correlation is 0.288. For ASGA and MBRA, their sig. value are greater than 0.1, we think CDO duality has no significant effect on ASGA and MBRA. Therefore, Hypothesis 3 is partially accepted. The results are shown in Table 5 - Table 8.

Table 5 ANOVA analysis result between CDO duality and ROAA

			Sum of Squares	df	Mean Square	F	Sig.
Between Groups	(Combined)		.053	1	.053	5.704	.020
	Linear Term	Unweighted	.053	1	.053	5.704	.020
		Weighted	.053	1	.053	5.704	.020
Within Groups			.583	63	.009		
Total			.636	64			

Table 6 Correlation analysis result between CDO duality and ROAA

		Duality	ROAA
Duality	Pearson Correlation	1	.288*
ROAA	Pearson Correlation	.288*	1

*. Correlation is significant at the 0.05 level (2-tailed).

Table 7 ANOVA analysis result between CDO duality and ASGA

			Sum of Squares	df	Mean Square	F	Sig.
Between Groups	(Combined)		61.085	1	61.085	.297	.587
	Linear Term	Unweighted	61.085	1	61.085	.297	.587
		Weighted	61.085	1	61.085	.297	.587
Within Groups			16678.470	81	205.907		
Total			16739.555	82			

Table 8 ANOVA analysis result between CDO duality and MBRA

			Sum of Squares	df	Mean Square	F	Sig.
Between Groups	(Combined)		.641	1	.641	.351	.555
	Linear Term	Unweighted	.641	1	.641	.351	.555
		Weighted	.641	1	.641	.351	.555
Within Groups			122.271	67	1.825		
Total			122.913	68			

Based on above analysis results, we can get Table 9 to show all the hypotheses test result.

Table 9 Hypotheses test result

No.	Hypotheses	Results
H1	CDO appointment has positive effect on firm performance	Reject
H2	CDO tenure has an inverse U-shaped effect on firm performance	Accept
H3	CDO duality has positive effect on firm performance	Accept

5 DISCUSSION

The study attempts to answer an important question: Is there the relationship between the appointment of a CDO and changes in firm performance? This study is conducted using performance data on firms that appointed a CDO in 2013 and before. However, it is premature to declare the demise of such a link. We offer two possible rationales:

- 1) As a new position, the effect of a CDO appointment on firm performance needs more time to be manifested. For example, it often takes more time for data governance program to impact performance results.
- 2) The data sample in the study may need to be enlarged. We only collected data on 86 firms making CDO appointments before and in 2013. There were companies that appointed CDOs every year, however data on the older appointments were more difficult to obtain. Though the current analysis is based on the 86 firms with CDO appointments before 2013 and in 2013, the potential sample and longitudinal history grow with every passing year.

Although we didn't find any evidences about the relationship between CDO appointment and firm performance, we did find that CDO tenure and duality have an influence on some aspects of firm performance.

As the CDO tenure increases, ASGA and ROAA will increase at first, and then they will decrease. When the CDO starts to work, they need to learn how to be as a CDO. They accumulate knowledge, experience and resources in this stage. As a result, they bring little change to firm performance in their early tenure. Later, they have more understanding about the firm and knowledge about the role, so they are able bring more profit to the firm. However, if the CDO tenure is too long, it is not good for firm performance. As shown in the Finkelstein, S. and Hambrick, D. (1990) study, firms led by long-tenured executives tend to have (1) persistent, unchanging strategies, (2) strategies that conform closely to industry averages, and (3) performance that conforms to industry averages. Long-tenured TMTs may be associated with risk averseness and fewer innovations. Therefore, the performance will show inverse U-shape as CDO tenure increases.

Also, the result shows that if the CDO take multiple positions in the company, company's ROAA is higher than the ROAA of companies their CDOs don't take dual jobs or titles.. As Boyd B.K.'s (1995) study showed, CEO duality had an independent positive effect on subsequent performance, after controlling for interactions with environmental uncertainty. He used a regression model to indicate that duality could help firm performance under the right circumstances. Finkelstein (Finkelstein & D'Aveni, 1994) also did a study to illustrate that for firms with high levels of innovative knowledge, CEO duality might bring benefits because of the support from other resources. CDO duality will bring more authorities and power to CDO, so he can combine more resource and finish his job smoothly.

6 CONCLUSION

The study uses statistics analysis to compare the firm performance before and after CDO appointment. The result shows that there is no significant difference in firm performance before and after CDO appointment as measured by Return On Assets (ROA), Average Sales Growth (ASG), and Market to Book Ratio (MBR). The study did show some CDO characteristics will have an impact on some of these same indicators. CDO tenure will have an inverse U-shaped impact on ROA and ASG, and CDO duality will positively influence on ROA.

There are some limitations of the study: (1) The sample is small. Because there are not many CDOs appointed before 2013, and the publically traded firm rule also excludes some CDO data from our sample. As a result, the study only included performance data from 86 firms. (2) The time interval is relatively short. We only collect the firm performance data from 2 years before and 2 years after the CDO appointment. This may be too short to reveal the performance brought by CDO. (3) The study only analyzes the firm with CDO appointment. A different study of CDO impact would be to compare the firms with CDO and firms which have never appointed a CDO.

In the future, the study can focus on these limitations to further the study. As time goes by, more CDO would be hired, and more CDO data could be collected, so the sample will be larger. This will also allow the time interval to be extended. The study only used 2 years of firm performance data before and after the CDO appointment. The benefit of a CDO for the firm may be manifest in a longer time. We will continue the tracking study about their effect on firm performance. Finally, a future study can select a control sample of firms without a CDO appointment and compare to a test sample of similar firms that have a CDO to investigate if there are some significant differences between test sample and control group.

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