CDO POSITIONS: A STUDY ON THE IMPACT OF CHIEF DATA OFFICERS ON ORGANIZATIONAL PERFORMANCE

Major Research Paper

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Table of Contents

ABSTRACT

Purpose – The purpose of this paper is to employ a strategic change view, with the appointing of a CDO, to develop theoretical links and empirically examine the association between the CDO's presence and organizational performance utilizing accounting measures.

Design/methodology/approach – Adopted for this study is the "matched sample comparison group" methodology, also known as the matched pair analysis, to empirically test the hypotheses, compare the performance of the treatment sample group with CDOs and the control sample group without CDOs, and assess the relationship between CDO presence and firm performance. The financial data for treatment firms with CDOs and control firms without CDOs was collected from the Compustat database. The Wilcoxon signed-rank test and regression analysis were used to analyze the performances for the treatment and control sample groups.

Findings – Overall, the results indicate that firms that have lower performance will be more likely to appoint a CDO and still maintain a competitive cost structure relative to firms without CDOs. Even though the cost ratios of firms with CDOs were not lower after the appointment of the CDO than before the appointment, CDOs promptly improve their profitability relative to peers who do not have CDOs, without significantly increasing cost. Finally, prior year financial performance has very great impact on current year financial performance.

Practical implications – With limited statistical confidence, due to a small sample and short period of performance measurements to analyze, as the CDO position is a quite new to Canada, the conclusion can still be made that: CDOs are hired when performance is low and excel at solutions, which they seem to bring swiftly, by improving revenues and profitability without significantly increasing costs. This research further addresses both the academic and business

communities emphasizing that, in this moment in big data history, the position of the CDO is not to be ignored or disregarded, as this role may prove to appreciably advance and elevate corporate Canada.

Originality/value – The study explores the relationship between the CDO's presence and firm performance. It is the first attempt to explore the CDO's impact on the profit and cost performances from a purely Canadian perspective, evaluating only firms listed on the Toronto Stock Exchange – TSX. Prior studies have been from a global standpoint and heavily focused on the United States of America.

Keywords Chief data officer, Firm performance, Cost ratios, Profit ratios, Organizational Adaptation, Strategic change

1.0 INTRODUCTION

Decades of discussions and debates about organizations have led to theories and concepts that have come to being with the purpose of trying to achieve efficient contracting. One of them, the agency theory (Jensen & Meckling, 1976; Fama & Jensen, 1983), studies the design of contracts to motivate a rational agent to act on behalf of a principal when the agent's interests would otherwise conflict with those of the principal. An executive compensation plan serves as an agency contract, between the firm and its manager, that attempts to align the interests of owners and managers by basing the manager's compensation on one or more measures of the manager's performance in operating the firm (Scott, 2015). This discourse is for the most part linked to the impact and business value of executive management by looking at organizational performance from an accounting and profitability perspective of the organization's stakeholders. This study investigates

some ways of determining the business value or impact of a Chief Data Officer on organizational performance.

The most prevalent executive top management positions are the Chief Executive Officer (CEO), the Chief Financial Officer (CFO) and the Chief Operations Officer (COO). Other inclusions to the ever-expanding c-suite are the Chief Marketing Officer (CMO), Chief Information Officer (CIO), Chief Technology Officer (CTO) to mention a few. However, the c-suite positions have been on the increase, with several changes and growth on a global scale and new positions have also been created (Groysberg et al., 2014). The market and primarily shareholders, therefore, would be interested in knowing that these new positions result in much desired increase in returns on the investments, especially since these appointments come at a cost including costs of the actual positions, teams, infrastructure, organizational integration and other associated peripheral costs that spring up with these offices.

In recent times, the inclusion of the position of a Chief Data Officer (CDO - or a similar title) in many large organizations is gradually becoming an emerging or growing global trend and has sparked interesting conversations. However, some would argue that only companies that can afford to take this step would do so. Conversely, based on the organizational adaption theory (Boeker & Goodstein,1991), some organizations embark on the strategic change process of appointing CDOs as a result of declining financial performance, and do so as a management step they have to take. This study recognizes the appointment of a CDO as a pivotal moment of strategic change in an organization indicative of a firm's commitment to seriously invest in data strategies, including but not limited to the onboarding of a CDO. The question that arises, therefore, is whether or not this position adds value to the performance of the organization and if there is a competitive advantage for organizations who choose to take the step towards appointing a CDO.

The rise of the Chief Data Officer position, the advancement of Big Data and Artificial Intelligence (AI) are the future of corporations and can, therefore, not be ignored. With the sheer velocity of data collected per minute, it is clear that roles to process, handle, store, manage, analyze, collect, report, secure, regulate, govern and effectively utilize data would continue to expand, evolve and be created. At the top of these roles, the CDO position needs to be better understood like other more established closely related roles like the Chief Financial Officer (CFO) or the Chief Information Technology Officer (CIO or CTO).

Following the impact of digital disruption and digital transformation, Accountants have had to stretch, learn new skills, and develop competencies to take on roles that have not been the traditional roles for Accountants - like Auditor, Management Accountant etc. Some university and specialized educational programs have done enormously well to provide Accountants with the increased capacity and capability to fit into this role. In becoming purveyors of best data practices, leveraging data to optimize business processes and organizational decision-making, the career path seamlessly connects to the pipeline of the CDO role.

Although this study would not include CDO salaries, it would still contribute to discussions around executive compensation, organizational adaptation (Boeker & Goodstein,1991), strategic change, and the agency theory (Jensen & Meckling, 1976; Fama & Jensen, 1983) by analyzing the possible value and impact of this new introduction to the c-suite positions and top management team. It would highlight performance measures in organizations with the appointment of a CDO being the point of strategic change that could propel, hinder, or have a neutral impact on the performance growth of an organization. Furthermore, this research would appeal to stakeholders in Big Data, organizations inundated with data, that have come to understand that data must be prioritized to make critical business decisions. Finally, career explorers and professionals working to bridge

the gap between information technology and business would also find this work interesting.

The subject matter has not been extensively researched with very few empirical research work done on the impact of the CDO. This is done from a Canadian perspective focusing only on Canadian public companies listed on the Toronto Stock Exchange (TSX) utilizing similar performance measures and independent variables from prior research work done on studies analyzing global organizations, predominantly public companies in the United States of America. It is an investigation of the links and examination of the relationship between the presence of the Chief Data Officer and organizational performance. The purpose of this paper is to employ a strategic change view to develop theoretical links and empirically examine the association between the CDO's presence and organizational performance utilizing accounting measures.

1.1 Research Question

This research examines the impact of the CDO's presence on the firm's performance from an accounting performance measurement perspective and aims to discover whether firms with CDOs perform better than firms without CDOs by exploring possible links between firms' performance and the CDO's presence.

The remaining sections of the paper are organized as follows: Section 2 is the literature review which is an exploratory study of the position including the significance or relevance of the position, definition, evolving roles, and an illustration of the impact on a firm's performance. This is followed by the development of the proposed hypothesis in Section 3. In Section 4 is a description of the research methodology, data sources, sampling, measures, and statistical tests. Section 5 details the empirical data analysis and procedures utilized to address the research question and hypothesis, including the results. Discussions on the findings are presented in Section 6, with the

theoretical contribution and managerial implications being the subject of Section 7. In bringing the paper to a conclusion, Section 8 explains the limitations and suggestions for future research directions.

2.0 LITERATURE REVIEW

In the ninth annual survey of C-suite executives representing mainstream companies and focused on the progress of Big Data and Artificial Intelligence (AI) initiatives; the 2021 report showed a record 76% of respondents held the role of Chief Data Officer or Chief Analytics Officer (Bean, 2021). In addition to this, the percentage of organizations reporting the appointment of a Chief Data Officer had increased from 12% in 2012 to 65% in 2021 (Bean, 2021). Another survey reported that in 2018, organizations with an appointed CDO rose to nearly 70%, and Gartner estimates that by 2025, 90% of large organizations will have a CDO (Morell, 2021).

A study examining the impact of CDO appointment, based on the pre-appointment and post-appointment performance, revealed a positive correlation of CDO's presence in an organization to the return on assets, among other positive results. Moreover, the report concluded that firms with CDOs have superior financial performance than their peers who do not have CDOs (Xu et al., 2016). In another report by (Lee et al., 2014) companies with a top executive responsible for data management, in comparison with their peers who do not prioritize data management in a similar manner, have better organizational performance. This conclusion was echoed by another research in (Nie et al., 2018). Further to this, (Noh, 2016) illustrates and explains how strategic roles around information technology can show that these investments positively impact organizational competitive position and ultimately firm value. The findings also conclude that there are positive

abnormal returns in these organizations. Various insights into diversity in the top management team have resulted in varying conclusions but Awino (2013) looked into the top management diversity theory and concluded that while other types of diversity may yield different outcomes, the diversity in functional background of the top management team had a major effect on the quality decisions which influenced the internal business processes, learning and growth perspectives of the balanced scorecard approach of organizational performance (Awino, 2013). However, the position of CDO has not been a focus of too many researchers and so, much more work needs to be done looking at both the short and long-term impact of this position.

2.1 The need for the CDO

Prior to instituting CDO positions, a great deal of attempts had been made to find lasting solutions to ever-increasing data issues and problems to harmonize data with information technology, organizational strategies, business processes etc. Due to the enormous volume, velocity, variety, and other characteristics of big data, the need for a CDO has arisen as a strategic resource for finding data patterns and deep insights about the environment, customers, businesses, and markets (Lee et al., 2014). Exploring the harmonization of data management practices, data was expressed as a reflection of what an organization was living (Schilling et al., 2020).

In handling, processing, governing, collecting, analyzing, reporting, transforming, and managing big data, several roles have emerged. However, it is one thing to be able to handle the analytical side of big data and it is another to provide leadership, strategy, business acumen and even have the relevant skills to communicate what's going on, what needs to be done, what would happen and what the organization wants to happen and use these data capabilities to achieve organizational objectives. In their paper, (Lee et al., 2014) stated that in a survey of approximately 600 global executives, most companies revealed that they are still learning how to manage big data at the

enterprise level. Each day data is left adrift and leaderless, opportunities to drive revenue growth, engage more effectively with customers and optimize process efficiencies are missed (Finch et al., 2014). IBM's Institute of Business Value (Finch, 2014) offers concrete steps organizations can take to remain competitive in the digitized corporate world. Finch's paper elaborates on the role of the Chief Data Officer, branding the CDO as the new hero of big data and analytics. The appointment of a CDO represents a formal structural change by top management and should be a part-and-parcel consequence of a data-driven vision and the CDO seems to be the heir apparent leading the data-driven transition (Zhang et al., 2017).

2.2 The definition of the CDO

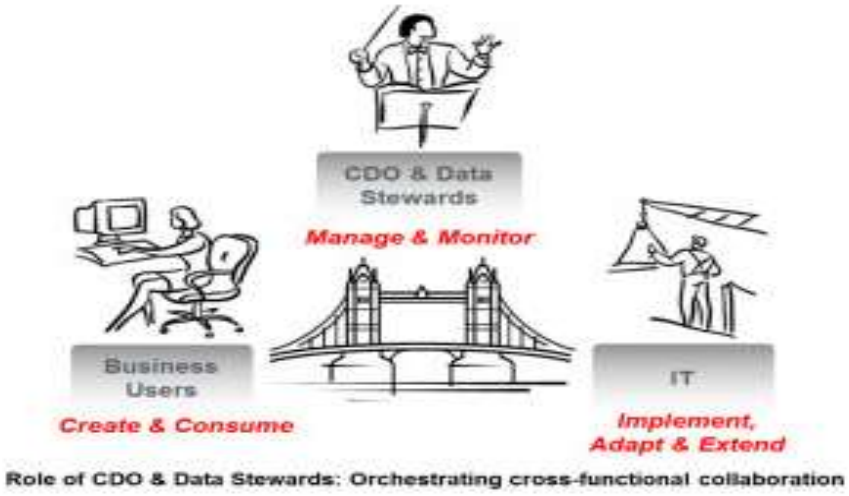
The CDO position has been intertwined with the CIO, CFO, CTO and even another CDO, the Chief Digital Officer. To understand who the CDO is, a plethora of definitions has been put forward and proposed to capture the value, essence, and totality of this new c-suite agent of strategic change.

The CDO is focused on the data—acquisition, governance, quality, management, integration, policies (including privacy, preservation, deduplication, curation), value creation, recruiting skilled data professionals, establishing a data-driven corporate culture, team building around datacentric business objectives, and acquisition and oversight of corporate data technologies (not IT in the historical sense). Core CDO duties are data governance and quality, analytics and business intelligence, data management and systems, data security and privacy, and best practices (Hill et al., 2014).

Wikipedia, as of April 2022, defines the Chief Data Officer (CDO) as a corporate officer responsible for enterprise-wide governance and utilization of information as an asset, via data processing, analysis, data mining, information trading and other means.

Knight (2021) has a profound description of the CDO that pointedly and powerfully merges business with technology stating that:

"A Chief Data Officer (CDO) helps bridge the gap between technology and business. This person evangelizes an enterprise-wide Data Management strategy at a senior level. The CDO leads Data Management initiatives, enabling an organization to leverage its data assets and gain a competitive advantage from them. A CDO tends to be part business strategist, adviser, data quality steward and all-around Data Management ambassador."



Source:https://www.linkedin.com/pulse/data-leader-cdo-chief-officer-what-why-elisabeth-fernandes-/

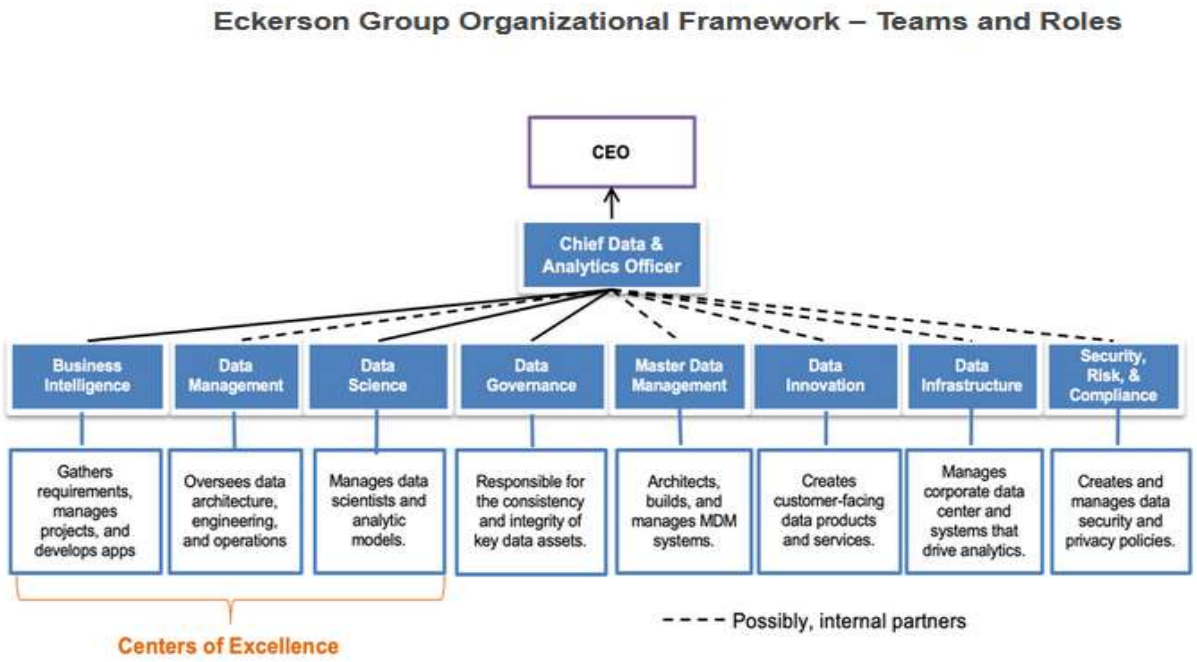
Figure 1.0 - The role of the Chief Data Officer

Another bridge, that the CDO has been acknowledged to cross, is the one between information and technology which continues to widen, giving more credence and recognition to data. In an MIT newsletter, Doug Laney, the author of 'Infonomics' was quoted to have said: "Most companies have an IT organization, but they haven't thought of the possibilities of decoupling the 'I' from the 'T'" (Stackpole, 2021). The role of the CDO goes over and beyond recognizing the decoupling

of information and technology, but bridging the gap, breaking the information silos, and doing so from a business strategy perspective.

2.3 The reporting line of the CDO

The importance of the CDO position is highlighted in the responsibilities, skills required and line of reporting. An organizational questionnaire survey reported by (Yang Lee et al., 2012) had suggestions for various lines of reporting for the CDO. Some respondents posited that the CDO was ultimately responsible to the CEO, while some suggested the CTO, a joint reporting relationship between the CEO and the CTO, and other respondents included the COO, CFO or even the Chief Risk Officer. Among the reasons the clarity of the reporting line of the CDO in many ways may be blurred or wavering is the many hats the CDO position has the capacity to wear. Several papers and articles, including top consulting firms, have recommended the CDO position report directly to the CEO with an organization similar to Figure 2.0 below:



Source: https://www.eckerson.com/articles/organizing-for-success-part-iii-how-to-organize-and-staff-data-analytics-teams

Figure 2.0 – An example of the organizational chart of the Chief Data Officer

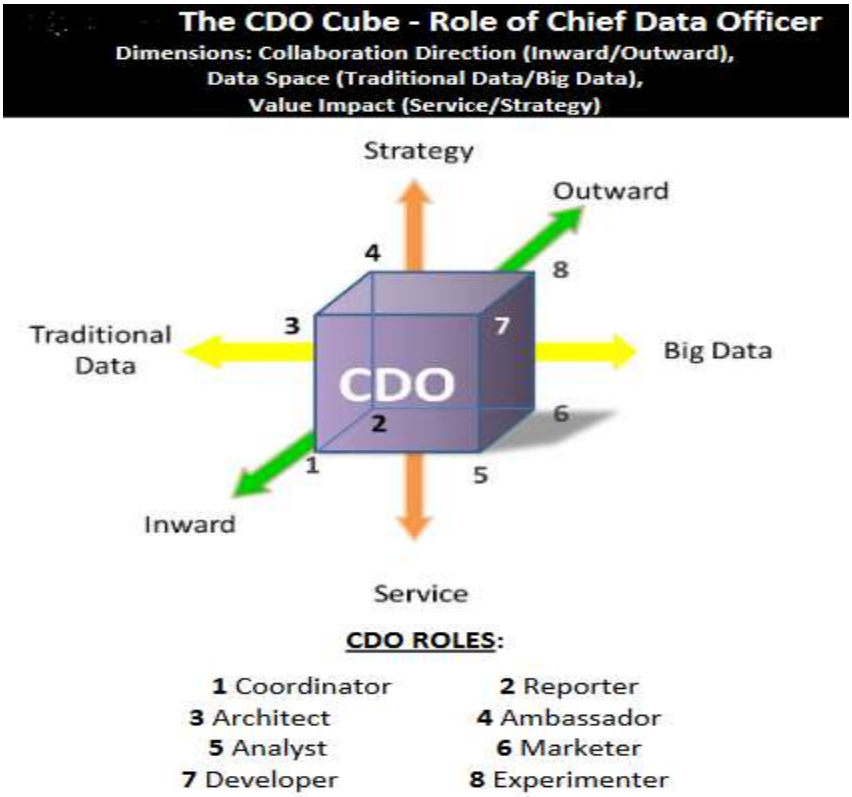
2.4 The role of the CDO

In the 90s, and before the early 2000s financial scandals, there were six CDOs on record (Nie, 2018). Known as one of the first Chief Data Officers appointed in 2002, after the Enron scandal, Cathy Doss rose to this position at Capital One (Zhang et al.,2017). The role was created mainly as a result of the financial upheaval and scandals in the early 2000s. Following these incidents was the Sarbanes Oxley (SOX) Act of 2002 which was a mandatory regulatory response. However, this was just the beginning of multiple justifications for the position of a CDO as more regulations around data governance, data security, data retention, data disclosure, etc. emerged. Table 1.0 (Nie et al., 2018) shows some known early CDO appointments, Cathy Doss of Capital One (Zhang et al, 2017) and Usama Fayyad of Yahoo (Gray, 2016) have been included in this list.

Organization name	CDO Name	Job Title	Year Appointed
M&T Bank	Allison Sagraves	Chief Data Officer & Senior Vice President	1991
University of North Georgia	Brandon Haag	Chief Data Officer	1991
Paramedic Foundation	Nicj Nudell	Chief Data Officer	1992
Charles Schwab & Co. Inc.	Andrew Salesky	Global Data Officer & Senior Vice President	1995
UBS	Jacky Osborne	Chief Data Officer	1998
Allstate Corp	Eric Huls	Chief Data Officer & Chief Data Science Officer	2000
Capital One	Cathy Doss	Chief Data Officer	2002
Yahoo Inc.	Usama Fayyad	Chief Data Officer & Executive VP	2004

Table 1.0 – Early recorded appointments of the Chief Data Officer

The role has, therefore, continued to expand and is still not the same from organization to organization. Lee et al., (2014) argue that the role of a CDO is responsible for internal and external data exchange and usage, the management of structured and unstructured data as well as the identification of opportunities for the exploitation and exploration of data. These roles include Coordinator, Reporter, Architect, Ambassador, Analyst, Marketer, Developer and Experimenter (Lee et al., 2014). Figure 3.0 shows the cubic framework of the role of a CDO (Lee et al., 2014).



Source: A Cubic Framework for the Chief Data Officer: Succeeding in a World of Big Data. MIS Quarterly Executive 13(1) (Lee et al., 2014)

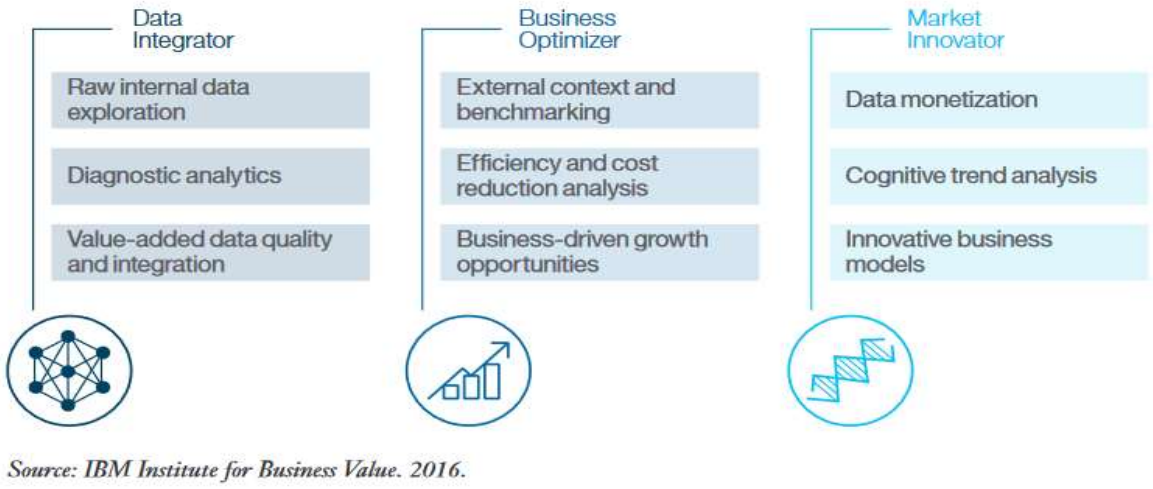
Figure 3.0 – Role of a Chief Data Officer – Cubic Framework for the CDO (Lee et al., 2014)

Source:https://www.sketchbubble.com/en/presentation-chief-data-officer.html

Figure 3.1 – More roles of the Chief Data Officer

The challenge to determine the optimal reporting structure and placement in the organizational chart persists and more duties and responsibilities (Figure 3.1) continue to be added to the CDO's portfolio – Data security, Data governance, Data privacy, Data quality, Data compliance, Data innovation, Data science, Data monetization, Data valuation, Data analytics, Data ethics etc.

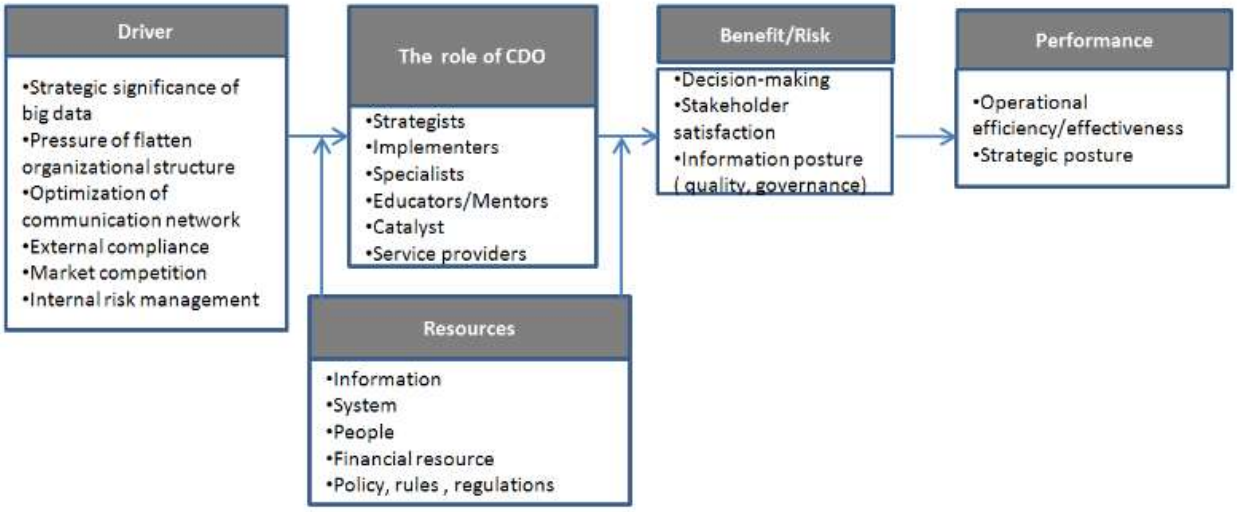
In the Chief Data Officer playbook by IBM (Tyler, 2016) discusses performance measures (Figure 3.2) of CDOs including expectations as a Data Integrator, Business Optimizer and Market Innovator with results impacting data management, organizational efficiency, business outcomes, organizational agility, profitability, and revenue.



Source: https://www.visualcapitalist.com/the-rise-of-the-chief-data-officer-cdo/

Figure 3.2 – The Chief Data Officer's mandate

Fundamentally, the CDO is tasked with being the voice of data and representing data as a strategic business asset at the executive level and must be empowered to organize, engage and lead a team which should be a multi-functional data management team known as the CDO Office (Lee et al., 2012). Figure 3.3 elaborates on the role, driver, resources, benefit, risk and performance of the CDO.



Source: http://mitiq.mit.edu/Documents/Publications/Papers/2012/Lee_et_all_2012_MISQ-E_Abstract.pdf

Figure 3.3 – A Framework for the CDO construct

In a paper by (Earley, 2017) among the responsibilities of a CDO is keeping stakeholders' interest, while conducting foundational work. The most popular skills possessed by CDOs according to a LinkedIn algorithm data retrieval carried out by (Dai, 2017) were Management; Business Intelligence; Business Strategy; Data Management – analysis, architecture, governance, integration, modeling, and quality; Business Analysis; Business Development; Information technology; Information Management; System Analysis; Financial analysis; and Policy analysis.

2.5 Impact of a CDO

In a LinkedIn job profile, a former Chief Data and Analytics Officer for Loblaw quoted that he directed his team, driving the transformational data and analytics program which will result in $500 million in incremental earnings before income tax (EBIT) and over $1 billion a year in revenue. He further stated that his work was generating over $175 million annually in benefits to the company and that his business unit had developed innovative new solutions and increased revenue by over $35 million in the last 18 months (Ballew, *retrieved* 2022).

3.0 HYPOTHESES DEVELOPMENT

Boeker & Goodstein (1991) highlight arguments for and against the type of organization that would initiate strategic changes like the appointment of a CDO, positing that performance drives strategic change. One side argues that poor performance exacerbates conservatism and inertia as organizations require resources for successful strategic changes which poor performers may lack or not be willing to expend as higher performing companies would, as they can afford and encourage organizational adaptation. Therefore, appointments of CDOs would likely occur in more successful companies that can afford them.

On the contrary, poor performance acts as a catalyst to organizational adaptation and success may breed inertia and apathy. Boeker & Goodstein (1991) predicted that organizations with lower performance will be more likely than stronger performers to modify organizational characteristics. This prediction, based on the organizational adaptation theory, explained that low performance signals a mismatch between the organization and the environment and leads to changes in business strategy including a structural change of the Top Management Team (TMT) composition. In this instance, therefore, appointments of CDOs would likely occur in less successful companies. As CDOs have been presented as solutions to performance problems, the first hypothesis in this study would follow in line with this argument.

H1: Firms that have lower performance will be more likely to appoint a CDO

Prior research has shown that CDOs increase the collaboration among TMT members, increasing quantity and quality of (data) information sharing. Initiatives conducted by CDOs include the development of data quality assessment, the implementation of the data standards and the establishment of data governance. CDOs strengthen the alignment of data practices with business

processes, helping the deployment of data-driven activities, and provide stronger alignment between data strategy and business strategy (Xu et al., 2016). The appointment of a CDO is indicative of a firm's resolve to obtain greater value from data assets and improve streamlining of business processes to yield efficient and effective business operations (Lee et al., 2014). This commitment to data optimization, that Xu et al., (2016), further describe leads to efforts in cost reduction. CDOs could also solve data problems in a shorter time, being more systematic, safe and quicker in handling data, which can help firms reduce the overall cost of operations (Nie et al., 2018; Noh, 2016). The new data-driven activities are expected to come with an incremental cost to the organization. However, due to a strong complementary effect, the efficiencies in increased collaboration, data optimization and alignment to the overall business strategy should, at least, balance out these incremental expenses. Thus, it is inferred that firms that appoint CDOs do not necessarily have a higher cost structure than firms that do not appoint CDOs. Therefore, the following two hypotheses are set forth utilizing cost ratios to understand the impacts of the CDO presence.

H2: Firms with CDOs do not have a higher cost structure relative to firms without CDOs

H3: The cost ratios of firms that have CDO positions are lower after the appointment of CDO than before the appointment

The IBM Chief Data Officer Playbook (Tyler, 2016) stipulates a mandate for the CDO as a Market Innovator with the responsibility of adding value to the organization through data monetization and as a Business Optimiser driving business growth opportunities. In agreement with this, Nie et al. (2018) refer to the position of a CDO as a solution to data-related problems and data

monetization opportunities. Furthermore, expressing that the creation of the CDO role is a strategic decision to drive new solutions and value creation by creating new data and analytics capabilities to capitalize on digital business opportunities (Nie et al., 2018). CDOs focus on leveraging data to create value and bring new revenues and are responsible for developing new economically beneficial initiatives through vast and unstructured data mining, new tools and innovation to develop strategies based on new and deep insights which would bring greater performance to firms (Lee et al., 2014). Consistent with these findings, it is expected that the CDO presence would add value and increase revenue and profit to firms. Therefore, the following hypotheses are proposed:

H4: Firms with CDOs improve their profitability relative to firms without CDOs

H5: The profit ratios of firms that have CDO positions are higher after the appointment of CDO than before the appointment

4.0 RESEARCH METHODOLOGY

This study utilizes the "matched sample comparison group" methodology (also known as the matched pair analysis) to empirically test the hypotheses, compare the performance of treatment firms with CDOs and control firms without CDOs and assess the relationship between CDO presence and firm performance (Bharadwaj, 2000).

Most of the limited research work done on the Chief Data Officer position have been qualitative in favour of the role and only a few have quantitatively explored the impact on the firm's performance. While some studies like (Nishant et al., 2020) have directed attention to the market response to CDO appointments, not too many studies have shined the light on any changes on the

financial performance of organizations with this new inclusion. This research takes a Canadian perspective borrowing a combination of concepts from empirical models of (Nie et al., 2018) studying the influence of CDO on firm's performance; (Khallaf et al., 2010) who researched the long-term performance improvement following the appointment of a CIO and (Bharadwaj, 2000) in the empirical investigation of information technology capability and firm performance from a resource-based perspective. Table 2.0 shows a summary of some prior studies that have used the matched sample comparison group methodology.

RESEARCH TOPIC	RESEARCHER(S)	YEAR
A resource-based perspective on information technology capability and firm performance	Bharadwaj	2000
Issues in linking information technology capability to firm performance	Santhanam et al	2003
Information technology capability and firm performance: contradictory findings & possible causes	Chae et al	2014
The Value of Chief Data Officer Presence on firm Performance	Xu et al	2016
The Influence of Chief Data Officer presence on firm performance: does firm size matter?	Nie et al	2018
Information technology capability and firm performance in the era of Biga Data & Analytics	Rahman et al	2020

Table 2.0 - Prior research work using Matched Sample Comparison group method

4.1 Data Sources

The focus of this research is on public companies operating in Canada and listed on the Toronto Stock Exchange (TSX). Listings of companies by industry were obtained from the official website of the Toronto Stock Exchange. The annual reports and other comprehensive financial information of these companies are public information. Financial and industry information on these companies were retrieved from Compustat database, Yahoo Finance, and the Toronto Stock Exchange (TSX) industry data. The System for Electronic Document Analysis and Retrieval (SEDAR), the official site for Canadian Securities Administrators / Regulatory Authorities, where all mandatory filings are kept, was also utilized to appropriately match and pair treatment and control firms, based on individual company's declaration of peer organizations in their proxy

circular. To establish presence, availability or appointments of Chief Data Officers, the individual company websites, online announcements through google searches, the annual reports, LinkedIn profiles and public lists of attendees with titles on CDO forums and summits were various sources utilized for this purpose. However, the primary source of pulling Chief Data Officers profiles and timing was LinkedIn.

4.2 Sample Selection

First, information of firms with established CDO or CDO-equivalent positions were retrieved by a search on LinkedIn for roles including the words "Chief" or "Data" or "Officer" in Canada which resulted in 273 current roles and 1084 past roles for a total of 1357. After eliminating 920 duplicated companies, 2 subsidiaries with group companies listed, 435 roles in unique companies were left. In order to identify which companies with CDOs pulled from LinkedIn were Canadian public companies, the Toronto Stock Exchange (TSX) companies' information was extracted, downloaded by sector and consolidated from the TSX website for a comparison. The LinkedIn results were checked against the extracted TSX companies and 387 non-TSX companies were filtered out with 48 roles remaining in TSX-listed companies. Based on Lee et al. (2014), the CDOs are executives who are carrying out enterprise-level CDO roles and so a further 21 roles were eliminated with 27 left, of which 6 were financial industry peers and did not have suitable control matches. The final 3 eliminations were due to no data in Compustat, a CDO with a start date after 2021 and a former TSX company, now private. The number of treatment firms available for matching to control firms ended up being 18 (see Table 3.0 below). The retrieval of the data was as of February 2022. Table 3.0 summarizes the steps of treatment sample selection and Table 4.0 lists the names of the CDOs and the treatment firms represented.

STEP	PROCEDURE	# OF FIRMS
1	LinkedIn roles in Canada including "Chief" or "Data" or "Officer" or similar roles - Current	273
2	LinkedIn roles in Canada including "Chief" or "Data" or "Officer" or similar roles - Past	1084
	LinkedIn roles in Canada including "Chief" or "Data" or "Officer" or similar roles - Current & Past	**1357**
3	Eliminate duplicate companies	920
4	Filter out non-TSX publicly traded companies	387
5	Subsidiary companies with group company also listed	2
6	Restrict to executive level positions	14
7	Restrict to enterprise data roles	7
	TSX Firms with CDOs or similar executive role in LinkedIn	**27**
8	Financial industry firms with CDOs & no control match	6
9	Airline TSX firm (Peer firm went private)	1
10	No data in Compustat	1
11	LinkedIn CDO date post 2021	1
	TREATMENT FIRMS	**18**

Table 3.0 – Steps for Treatment firms' selection

The matching of pairs took place in two dimensions. First, pairing firms in the same industry or sector and then quantitatively matching by similarity in firm size. To appropriately match control pairs of similar organizations for comparison with the selected treatment sample, from a qualitative perspective, the Toronto Stock Exchange Industry data and Yahoo Finance sector information of individual treatment firms were compared and matched to individual control firms. Adding another layer of assurance to the pairing of companies, the proxy circular in the individual company's data on the System for Electronic Document Analysis and Retrieval (SEDAR) was reviewed for a list of the companies considered as peers by either the treatment firm or the control firm. Table 5.1 (qualitative match) and Table 5.2 (quantitative match) lists the treatment firms and the successfully matched control firms. From a quantitative consideration and to ensure comparability, based on Bharadwaj (2000), control firms which are Canadian publicly traded companies on the TSX, without CDOs should be in the same sector and ideally range between 70% and 130% of treatment firms in commonly employed measures of firm scale such as average revenues, total assets, market capitalization or number of employees, as a proxy for size.

Thirty-six Canadian public companies paired; one group of eighteen treatment firms with CDOs and the other group of eighteen individually matched control firms without CDOs are the samples utilized for the data analysis comparing companies with and without CDOs (see Table 5.1 and Table 5.2).

The comparisons were, therefore, done with matched pairs from the same industry or sector and reasonably similar sizes based on TSX market capitalization, revenue, employee number or total assets and/or SEDAR proxy circular peer grouping, as defined and declared by the individual companies as similar companies to be compared with.

Furthermore, the *t*-test was employed to compare the firm size proxies of the treatment and control groups. Table 6.0 shows the descriptive statistics for the two groups and from the means *t*-test results and significance values, there is clearly no significant differences in firm scale which means the two groups are well-matched and acceptable for further data analysis.

Variables: 3-year average value	TREATMENT SAMPLE		CONTROL SAMPLE			
	Mean	Median	Mean	Median	*t*	*Sig.(2-tailed)*
Sales (billion $)	9.802	4.487	10.761	3.564	-0.223	0.825
Assets (billion $)	55.459	21.136	59.954	5.982	-0.105	0.917
# of Employees	19918	5261	16054	10739	0.393	0.698

Table 6.0 Descriptive Statistics of Treatment vs Control sample groups

The eighteen treatment firms were further expanded to include the six financial institutions and one airline company that did not have comparable control firms to be paired with. Therefore, for the purpose of comparing firm performance pre and post appointment of CDOs, twenty-five firms were put forward. The additional companies are in Table 4.1.

4.3 Performance Measures

The performance indicators selected to measure the impact of firm performance on the CDO's appointment or presence are similar to prior research performance measures in Nie et al. (2018) and Xu et al. (2016). Table 7.0 summarizes some prior studies that have employed similar measurements.

CATEGORY	CONSTRUCTS	DEFINITION	MEASUREMENT	SOURCES
Independent Variable(s)	IT Capability	Ability to assemble, integrate and deploy IT-based	Firms ranked information week 500 more than twice	Bharadwaj (2000) Rahman et al (2020)
	Superior Business performance	Higher profit, sales growth and market valuation	ROA, Sales growth, Market to Book ratio	Xu et al (2016)
	Chief Data Officer appointed in the firm	CDO or CDO equivalent executives	Binary variable 0 or 1	Nie et al (2018) Xu et al (2016) **THIS STUDY**
Dependent Variable(s)	Superior Business performance	Sustained higher profit and lower cost than the control group	ROA, ROS, OI/A, OI/S, OI/E, COG/S, SGA/S, OPEXP/S	Bharadwaj (2000) Santhanam et al
	Chief Data Officer appointed in the firm	CDO or CDO equivalent executives	Binary variable 0 or 1	Xu et al (2016)
	Superior Business performance	Higher profit, sales growth and market valuation, lower cost than control	ROA, ROS, OI/A, OI/S, SG, M/B	Xu et al (2016)
	Superior Business performance	Higher profit and lower cost than the control	ROA, ROS, OI/A, OI/S, OI/E, COG/S, SGA/S, OPEXP/S	Bharadwaj (2000) Nie et al (2018) Rahman et al (2020) Xu et al (2016) **THIS STUDY**

Table 7.0 – Prior research with accounting ratios as variable performance measurements

Independent of market expectations, the accounting-based measures highlight changes in firm performance (Khallaf & Skantz, 2011). Five accounting profitability ratios and three cost ratios were employed. Superior business performance is defined as higher profit and lower cost ratios.

Changes in performance evidenced by increases in business performance, higher profit and lower cost ratios, year on year are also noted as improvements. The financial performance data were collected from the Compustat database, and the ratios defined in Table 7.1.

ROA:	**Return On Assets - Income before extraordinary items – Available for common *divided* by Total Assets**
ROS:	**Return on Sales - Income before extraordinary items – Available for common *divided* by Total Revenue**
OI/A:	**Operating Income before depreciation *divided* by Total Assets**
OI/S:	**Operating Income before depreciation *divided* by Total Revenue**
OI/E:	**Operating Income before depreciation *divided* by # of Employees**
OPEXP/S:	**Total Operating Expenses *divided* by Total Revenue**
COG/S	**Cost of Goods Sold *divided* by Total Revenue**
SGA/S	**Selling, General & Administrative Expense *divided* by Total Revenue**

Table 7.1 – Definition of accounting ratio variables – performance measurements

For firms with CDOs (18 paired treatment firms and 7 additional unpaired firms), three years of performance data was collected before CDO's appointment and three years after appointment. The appointment date is defined as the LinkedIn start date on the CDO's profile. Performance data was also collected for control sample group in the same period as their paired treatment match.

4.4 Statistical Tests

This study investigates whether firms with relatively lower performance or higher performance tend to appoint CDOs. It further examines whether the firms with CDOs show superior firm performance when compared to the firms without and finally, whether the firms with CDOs show improvements after the appointment of the CDO. Comparing the mean value of variables for the treatment sample group with that of the control sample group via a standard *t*-test was one of the methods employed in testing hypothesis H1 (Rahman & Zhao, 2020).

A non-parametric test, the Wilcoxon signed-rank test, was used to test hypotheses H1 to H5. This test is preferred as the samples are not normally distributed and this removes the variance in performance influenced by differences in industry (Nie et al., 2018; Bharadwaj, 2000). The first set of tests focused on the treatment firms classified as firms with CDOs in one group, versus the corresponding paired control firms classified as firms matched with the treatment firms that do not have CDOs, in the same period. The performance differences between the pairs were measured and any improvements observed. In another pairing comparison, the second set of analysis examined only firms that have appointed CDOs and compared the three years immediately before, and the three years immediately following the appointment of the CDO. Again, the performance differences between the pre and post appointment of the CDO were measured with variations and improvements during the period also noted.

In further testing hypotheses H2 to H5, various models of the regression analysis method were adopted:

Model 1 – investigated how the prior year's performance impacts the current year's performance. Therefore, the analysis regresses previous year's performance on current (Rahman & Zhao, 2020). The model is expressed as:

$$FP_t = \beta_0 + \beta_1 FP_{(t-1)}$$

Where:

FP denotes financial performance – ROA, ROS, OI/A, OI/S, OI/E, OPEXP/S, COG/S, SGA/S.

t denotes the time period and β_0 is the intercept while β_1 is a regression coefficient.

Model 2 – adds a binary variable to model 1 to distinguish between firms with CDOs (1) and firms without CDOs (0) in the time period. The coefficient of the binary variable determines whether the presence of the CDO has a significant impact, positive or negative, on the firm's financial performance after adjusting for the effects of the prior year's financial performance on the current year's financial performance (Rahman & Zhao, 2020). The model is expressed as:

$$FP_t = \alpha_0 + \alpha_1 FP_{(t-1)} + \alpha_2 D$$

Where:

FP denotes financial performance – ROA, ROS, OI/A, OI/S, OI/E, OPEXP/S, COG/S, SGA/S.

t denotes the time period and α_0 is the intercept while α_1 and α_2 are regression coefficients. Finally, D denotes the (0 or 1) binary variable or dummy variable representing the absence or the presence of a CDO in the firm at the time period, respectively.

Model 1 and 2 utilized the current year financial performance as the dependent variable and the prior year financial performance as the independent variable.

Independent variable – CDO,	If a CDO is appointed in the firm = 1 If no CDO is appointed in the firm = 0
Dependent variables:	ROA, ROS, OI/A, OI/S, OI/E, OPEXP/S, COG/S, SGA/S

Relevant data for the independent variable was made available primarily through LinkedIn while the independent data, as mentioned above was sourced from Compustat.

Model 3 – Utilizing data from 2017 to 2021, the regression analysis goes a step further to adjust for the effects on prior years' performances by introducing dummy variables as independent

variables representing each year from 2017 to 2021 with 0s denoting the years other than the year 't' of the dependent variable and 1 denoting the year 't' of the dependent. The model is expressed as follows:

$$FP_t = \beta_0 + \beta_1 FP_{(t-1)} + \beta_2 Y_1 + \beta_3 Y_2 + \beta_4 Y_3 + \beta_5 Y_4 + \beta_6 Y_5$$

Where:

FP denotes financial performance – ROA, ROS, OI/A, OI/S, OI/E, OPEXP/S, COG/S, SGA/S.

t denotes the time period and β_0 is the intercept while $\beta_1, \beta_2 \beta_3 \beta_4 \beta_5 \beta_6$ are regression coefficients. Y_1, Y_2, Y_3, Y_4, Y_5 represent the dummy variable (0 or 1) for years 2017, 2018, 2019, 2020 and 2021 respectively.

Model 4 – As in model 2 above, model 4 adds a binary variable to model 3 to distinguish between firms with CDOs (1) and firms without CDOs (0) in the time period. The coefficient of the binary variable determines whether the presence of the CDO has a significant impact, positive or negative, on the firm's financial performance. The model is expressed as:

$$FP_t = \alpha_0 + \alpha_1 FP_{(t-1)} + \alpha_2 Y_1 + \alpha_3 Y_2 + \alpha_4 Y_3 + \alpha_5 Y_4 + \alpha_6 Y_5 + \alpha_7 D$$

Where:

FP denotes financial performance – ROA, ROS, OI/A, OI/S, OI/E, OPEXP/S, COG/S, SGA/S.

t denotes the time period and α_0 is the intercept while $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5, \alpha_6, \alpha_7$ are regression coefficients. Y_1, Y_2, Y_3, Y_4, Y_5 represent the dummy variable (0 or 1) for years 2017, 2018, 2019, 2020 and 2021 respectively. Finally, D denotes the (0 or 1) binary variable or dummy variable representing the absence or the presence of a CDO in the firm at the time period, respectively.

A discriminant analysis was also conducted to investigate any further relationships between financial performance and the CDO's presence. The CDO presence, as a binary variable, was represented as the dependent variable this time. First, the independent variables were the annual firm performances using the accounting ratios – ROA, ROS, OI/A, OI/S, OI/E, OPEXP/S, COG/S, SGA/S. Secondly, with the CDO presence as the dependent binary variable, another test was conducted with independent variables of firm size proxies – total assets, revenue, operating income before depreciation, number of employees and market capitalization value. However, both tests did not produce strong models and the findings would be excluded from the discussions of the study.

5.0 DATA ANALYSIS & RESULTS

The statistical results of the Wilcoxon signed-rank test are presented in Tables 8.1 and 8.2 and the regression analysis results are displayed in Tables 9.1, 9.2 and 9.3.

Table 8.1 summarizes the comparison results between the treatment and control sample groups. Table 8.2 summarizes the comparison results before and after the appointment of the CDO in the firms that have CDOs. The mean and standard deviation are displayed, and the test results are supported as *p* and *z* values.

Based on the results, the first hypothesis H1 is supported. According to Table 8.1, the treatment firms have relatively lower performances with profit ratios showing means with lower values at the 10% level. In the first year, the ROA of the control group is at 0.028 versus the treatment group at 0.002 at <5% level and the three-year average puts the control group over the treatment

group by 1.5%. The control group had superior performance in ROA, ROS, OI/A, and OI/E in the first year and only the OI/E maintains dominance through the second and third year, at a significant level. From an overall perspective as well, it is clear that the treatment firms were lagging behind in performance from the start. The descriptive statistics for the treatment and control sample groups also reveal that the mean of the control sample group is higher than the mean of the treatment sample group when it comes to both revenue and total assets indicating that the control group were most likely performing better than the treatment group before the appointment of the CDO. H1 which states that firms that have lower performance will be more likely to appoint a CDO is the case here and, therefore, supported.

The second hypothesis, H2, which proposes that firms with CDOs do not have a higher cost structure relative to firms without CDOs was also tested with the Wilcoxon signed-rank test and the Table 8.1 displays results in the cost ratios not showing a significant difference between the two groups with all p-values above the 10% threshold. This supports the second hypothesis as the cost ratios in the comparison of the treatment sample group and control sample group were not statistically significantly different. It can, therefore, be concluded that the treatment group with CDOs do not have a higher cost structure than the control sample group.

H3, the third hypothesis, dives deeper into the cost structure of the firms with CDOs and predicts that the cost ratios of firms that have CDO positions are lower after the appointment of the CDO than before the appointment of the CDO. The Wilcoxon signed-rank test was employed, and Table 8.2 summarizes the results, revealing that H3 is not supported and so the conclusion cannot

be made that the firms with CDOs have lower cost ratios after the appointment of the CDO than they did before the appointment of the CDO.

Leaning towards profitability, the fourth hypothesis, H4 proposes that firms with CDOs improve their profitability relative to firms without CDOs. Table 8.1 summarizes the Wilcoxon signed-rank test results reflecting that profit ratios (ROA, ROS, OI/A and OI/E) in year 1, as discussed above, were more superior within the control sample group compared to the treatment sample group. However, in subsequent years 2 and 3, with the exception of the OI/E, there is no significant difference in the comparison of both groups. This is consistent with the hypothesis, and we can conclude that firms with CDOs improve their profitability relative to firms without CDOs, and quite promptly so.

Lastly, the fifth hypothesis, H5, also probing profitability states that the profit ratios of firms that have CDO positions are higher after the appointment of CDO than before the appointment. This is partially supported in the significantly higher profit ratio OI/E for values in Year 3 and the three-year average in the treatment group. The third year shows an increase from $141,799 to $151,265 at <5% level. All other profitability results showed no significant differences in the comparison of both groups.

Overall, there was limited statistical confidence, probably due to the limited sample size. However, CDOs do appear to be hired when companies are not doing well, and the results at 10% level or less, do reflect that CDOs improve income without significant increase in cost.

In an effort to understand how much the CDO presence impacts business performance after adjusting for previous years' firm performance, regression analysis was conducted. The results are reported in Tables 9.1, 9.2 and 9.3. Models 1 and 2 are reported in Tables 9.1 (Standardized coefficient version) and Table 9.2 (Unstandardized coefficient version) while Table 9.3 summarizes the Models 3 and 4 results. The regression coefficients of the models in equations 1 and 4, and changes in *R*-squares are presented in the tables.

For models 1 and 2, as expected, the previous year's organizational performance did reflect a very solid impact on the current year's organizational performance at all performance indicators including all profit and cost ratios. However, based on the significance of the coefficient of the binary variable depicting the presence or absence of the CDO, for profit ratios, only the ROA had a positive coefficient in 2019, that was significant at the 10% level. This is consistent with Xu et al., 2016 and supports the presence of the CDO impacting profitability. It also confirms the prior results of hypotheses H4 and H5, in line with the Wilcoxon signed-rank test's findings.

At the cost ratios level, only the COG/S and the SGA/S had significant levels at 10%. The 2021 COG/S, binary variable's coefficient was negative, however, this balances out with a positive coefficient in the SGA/S of the same year consistent with a strong complementary effect of costs offsets. This may be interpreted, as being in alignment with the results that show no significant difference in cost structure of firms with CDOs and firms without CDOs. Thus, consistent with hypothesis H2.

Finally, Table 9.3 compresses the results of the regression analysis models 3 and 4. Consistent

with this and prior studies, the prior year's financial performance very strongly impacts the current year's financial performance (Bharadwaj, 2000). Nonetheless, model 4's inclusion of the CDO dummy variable, as shown in Table 9.3, resulted in no significant impact of the CDO on the current year's performance on all indicators, profit and cost ratios inclusive, therefore, the results are inconclusive.

Similar to (Chae et al., 2014; Santhanam & Hartono, 2003), studies which showed that the significant effect of IT capability, in this case CDO presence being the dependent variable, on firm performance presented in a pair-wise comparison as the matched sample analysis, became less apparent when it was measured using regression analysis.

Table 10.0 shows a summary of the hypotheses tested and the results of the statistical analysis.

	Hypothesis	Results
H1:	Firms that have lower performance will be more likely to appoint a CDO	Supported
H2:	Firms with CDOs do not have a higher cost structure relative to firms without CDOs	Supported
H3:	The cost ratios of firms that have CDO positions are lower after the appointment of CDO than before the appointment	Not Supported
H4:	Firms with CDOs improve their profitability relative to firms without CDOs	Supported
H5:	The profit ratios of firms that have CDO positions are higher after the appointment of CDO than before the appointment	Partially Supported

Table 10.0 – Summary of hypothesis results

6.0 DISCUSSION

The purpose of this study is to draw on the organizational adaptation strategic change view of the firm, and to explicate and promote studies on the potential impact of the CDO's presence in an organization, measuring performance from an accounting perspective. Acknowledging the appointment of a CDO as a pivotal moment of strategic change in the firm, the research aims to determine whether evidence exists to suggest that firms with CDOs perform better than their peers

without CDOs, by exploring possible links between firms' performance and the CDO's presence.

Not only did the study examine links between CDO's presence and firm performance but it also investigated whether or not firm performance drove the appointment of the CDO, and further assessed if there were performance improvements or consequences after CDO appointments relative to peers. Three fiscal years of firm performance following the CDO appointment relative to the three fiscal years prior to the appointment were analyzed and firms with CDOs were compared with their peers without CDOs.

For observations between the treatment sample group (with CDOs) and the control sample group (without CDOs), four (ROA, ROS, OI/A, OI/E, with the exception of OI/S) of the five profit ratios were significantly higher within the control sample group in the first year of the CDO appointment. This supported the argument that lower performing firms were more inclined to make strategic changes like the onboarding of the CDO in the top management team, in line with the organizational adaptation theory. After the first year, however, significant levels of differences between the sample groups were only recorded in the OI/E indicative of better performance improvements in the treatment sample group relative to the control sample group with reference to profitability.

On the other hand, the cost ratios of the treatment sample group and the control sample group showed no significant differences supporting the proposition that the cost structures of firms with CDOs did not necessarily have a higher cost structure than firms without CDOs. Even though the actual cost ratios of firms without CDOs were lower, they were not significantly so. In the regression analysis, it was observed that a negative coefficient of the CDO presence dummy

variable in the COG/S financial performance was offset by a positive coefficient in the SGA/S performance for the year 2021. This suggests that the increases in costs, possibly from associated overheads, IT infrastructure, human and other resources could be balanced out by savings and other means of data monetization. The findings also reflected this in the significant positive coefficient of the CDO binary variable in the 2019 ROA results, consistent with Xu et al., (2016), which may be as a result of CDOs helping enterprises improve the efficiency of sales and yielding better returns (Nie et al., 2018).

In comparing the period before and after the CDO appointment, only the OI/E had significant results supporting the proposition that CDO's brought on improvements, as the OI/E after the appointment was better than before in the third year and on a three-year average. Although no significant changes were captured in terms of cost and most of the profitability ratios, this is consistent with comparisons of treatment versus control sample groups.

The findings suggest that CDOs are appointed in response to poor financial performance and that they are successful in improving some areas of performance, consistent with CIO appointments in (Khallaf & Skantz, 2011). In addition, results suggest that the decision to create and fill a new CDO position is rewarded by a gradual improvement and the high associated costs do not necessarily translate to a higher cost structure than the peers without CDOs. These results can be attributed to the existence of a strong complementary effect. That is, the creation of this position should be aligned with other organizational capabilities in order to reap the potential advantages of the CDO (Khallaf & Skantz, 2011). Overall, in the short term, evidence both from the matched group and the regression analysis procedures suggested that CDO's presence had a positive impact

on firm performance. The results, though supported, were not with strong statistical confidence, as the majority of the analysis did not report strong significant levels, primarily due to the small sample size and short period of fiscal years' financial performances analyzed, as CDO positions are very recent and new to many organizations.

7.0 THEORETICAL AND MANAGERIAL IMPLICATIONS

7.1 Theoretical Contributions

Presenting evidence in support of arguments in favour of lower performance acting as a catalyst for strategic change, this study contributes to the growing body of literature on organizational adaption. It adds to prior work linking firm performance to executive positions. Observations from this study also serve to inform debates on the agency value of top management teams and executive compensation. Diving into an area previously scarcely explored, this paper is also aimed at advancing and encouraging future exploration and contribution to the CDO literature. A brief description and definition of the position and a summary of some of the roles and hats the CDO wears was put forward which may be useful to career explorers, data investors and researchers. In a broader sense, this work contributes to the data investment literature since it investigates the value added from hiring the chief data officer with the intent to deliver business value through data strategies (Khallaf & Skantz, 2011). There are two key differences between this study and prior studies. One is an update in the data analysis with two additional regression models (3 and 4) employed. The second is that prior research has focused on providing insight to other c-suite roles and the few that have addressed the CDO position have done so from predominantly, a United States focus. This study takes on a purely Canadian perspective.

7.2 Managerial Implications

Research, in this area, has not been extensive and so there is a need to advance and elevate discussions for more studies to better understand the Chief Data Officer position as it is a fundamental part of the big data revolution – from staffing to technologies, systems, techniques, methodologies, best practices, and applications that analyze various critical business data to enable firms better assess their business and markets, and make timely and efficient business decisions (Rahman and Zhao, 2020). Managing and connecting these various resources that work together to create organizational capabilities and business value is the CDO.

CDOs provide the expertise to launch new innovative data initiatives and leverage pre-existing systems to optimize data capabilities. The decision to hire CDOs seems to be generally taken by companies that lag in performance relative to their peers. However, after a year of the CDO's appointment the comparison of the performances between the treatment sample group and the control sample group without CDOs is no longer noticeably different. This is a positive effect of appointing a CDO. The Operating Income per employee - OI/E of the treatment group are also significantly lower than the OI/E of the control group, which could mean that the treatment group have lower skilled employees and appoint CDOs to help support the organization in automating, interpreting, analyzing and optimizing data, thereby, filling the skills gap in organizations where the average employee is less skilled than a higher performing firm, in this case identified by a much higher OI/E.

The findings, specifically, that firms with initial lower performance are more likely to appoint CDOs than firms with higher performance; that the cost structures of firms with CDOs and firms without CDOs are not significantly different; and most importantly, firms with CDO's better improve profitability relative to their peers that do not have CDOs – all indicate that CDOs do not

necessarily have a cost focus but tend to exploit data for data monetization purposes and generating superior revenues which is similar to (Bharadwaj, 2000) results on IT leader firms which have investments in data and IT which is in alignment with appointing a CDO. Therefore, like IT leader firms (Bharadwaj, 2000), CDO appointments may be developed and sustained even at higher costs if these incremental costs are offset with incremental revenues. CDOs seem to come in and make a difference after just one year in office, perhaps this may mean they excel at working on low hanging fruits. The companies with CDOs' ability to maintain a competitive cost structure is also contrary to opinions that the cost of this strategic change would be too expensive and thus, not worth it. On the other hand, relative profitability improvement, is most likely occurring through efficiency in sales. Data monetization, one of the roles of the CDO, optimizing data and analytics for sales timing, location, pricing, product mix, product discontinuation etc. could be ways accelerated profitability is accomplished. Therefore, the impact of the CDO is not necessarily to achieve better cost but to get better sales and returns, especially in a context of lower skilled labour. Lastly, CDOs tend to facilitate the rise of operating income per employee which signifies an improvement in organizational efficiency.

With limited statistical confidence, due to a small sample and short period of performance measurements to analyze, as the CDO position is a quite new to Canada, the conclusion can still be drawn that: CDOs are hired when performance is low, as solutions which they seem to bring by improving revenues without significantly increasing costs. This is also consistent with an excellent CDO LinkedIn profile previously referenced of a former Chief Data and Analytics Officer for Loblaw who quoted that he directed his team driving the transformational data and analytics program which will result in $500 million in incremental earnings before income tax (EBIT) and over $1 billion a year in revenue. He further stated that his work was generating over

$175 million annually in benefits to the company and that his business unit had developed innovative new solutions and increased revenue by over $35 million in the last 18 months. (Ballew, *retrieved* 2022).

Finally, the CDO, like the CIO in (Zafar, 2016), in the top management team would influence the firm performance in the aftermath of security breach incidents. In December 2020, Desjardins Group responded, in a press release, to a report from the Office of the Privacy Commissioner of Canada (OPC), following its privacy breach announced in June 2019. The company developed strategies in line with the OPC recommendations to apply international best practices to prevent and detect data breaches recognizing the need for a wide range of personnel, technical and procedural security measures including people, processes, and technology. The appointment of a Chief Data Officer was noteworthy on the list of recommendations Desjardins had to comply with (Desjardins, 2020).

8.0 LIMITATIONS AND FUTURE DIRECTIONS

8.1 Limitations

This research aspires to serve as a future reference for the business and academic communities to deem the position of the CDO, a part of business strategy and organizational capability that positively influences firm performance. The results of the study, however, did not come with strong statistical confidence due to some limitations and should be cautiously interpreted.

First, the sample size was small primarily due to the restrictions and focus on only Canadian companies, more so, on public companies listed and traded on the TSX. Corporate Canada, compared to the US, is still for the most part, in earlier stages of embracing and developing the

role of a CDO. Further to this point, is that the primary source of the determination of the presence and timing of the CDO in a company, which was the basis of the CDO variable, was public information in individuals' LinkedIn profiles. It is almost certain that many CDOs may not have their profiles on LinkedIn which is a voluntary social media professional platform and so this, to a greater extent, diminished the sample size. The performance measures utilized for the study were company's overall cost and profit ratios which are enterprise-wide indicators and influenced by the entire organization and not just the CDO's function. Other factors could have also been coincidental to the hiring of the CDO which could influence the firm performance, positively or negatively, which were unknown and could not be isolated from the study. With mostly recent appointments, the number of years analyzed were also restrictive. In order to observe the impact of the position, the study would have benefited from a longitudinal analysis to obtain both short-term and long-term impacts and test or confirm the sustainability of evidence gathered. In the study, the existence of probable latent variables cannot be denied (Nie et al., 2018), because there are many other factors that might impact firm performance, such as environmental or contextual variables.

8.2 Future Research

As previously mentioned, a larger sample size and a longitudinal analysis would provide more reliable and sustainable evidence. Alternate measures of financial performance that are more directly related and relevant to the impact of the CDO, if known, should be employed. With increasing awareness and growth of the position, more data would be available to control variables or other factors, identify key value drivers and add to the variables in models for analysis (Nie et al, 2018). In this paper, different description of roles of the CDO were described, future research

can evaluate the scope of these roles, and which are most profitable to organizations - for instance, the data integrator, the business optimizer or the market innovator, as defined by the IBM Chief Data Officer Playbook (Tyler, 2016). The link between measures of CDOs' experience and productivity would be an interesting subject of discussion. In addition, it would be insightful to examine the relationship at sublevels to consider the different organizational characteristics such as industry type or sector (Rahman & Zhao, 2020). It would also be useful to organizations, career explorers and future researchers to gain an insight on the competencies of the position with discussions around experience, education, qualifications, tenure and even specific results and accomplishments as they commit to improved business performance. The impact on and integration with other c-suite positions and synergies with hiring a CDO in an organization can also be explored.

Comparative studies with the United States might also produce deep insights and interesting results. Two companies, outside the sample selections, were unintentionally brought to the attention of this study. One, is Capital One of the United States and the other, Desjardins Group of Canada. Both organizations operate in the North American financial industry and have each accumulated total assets worth over $350 billion. Needless to say, these organizations are financial corporate giants. As mentioned above, Capital One appointed its first CDO, Cathy Doss, in 2002. On the other hand, Desjardins, though founded in 1900, appointed their first CDO almost twenty years after Capital One, after a security breach incident and in response to the report of the Office of the Privacy Commissioner of Canada. Although, this could arguably be one isolated case, this, and the small Canadian sample size from over 1,500 companies listed on the TSX leads this study to question whether corporate Canada is lagging decades behind. This research,

therefore, directly addresses not only the academic community but also the business community, emphasizing that, in this moment in big data history, the position of the CDO is not, at all, to be ignored or disregarded.

Further research is needed in this area and should not be limited to the above perspectives. This study hopes to be a source of inspiration for future studies that not only echo and confirm the findings of this work but also progress the advancement and elevation of corporate Canada, influence the future of work, business strategy, operational excellence and organizational growth and development, through more insights and conversations about the position of the Chief Data Officer.

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APPENDICES

Tables

S/N	TREATMENT FIRMS	TICKER SYMBOL	FIRST NAME	LAST NAME	JOB TITLE (LINKEDIN)	START DATE
1	Cenovus Energy Inc.	CVE	Don	M	Chief Data Officer	Dec-2019
2	Manulife Financial Corporation	MFC	Neil	Freyke	Global Chief Data Officer	Jan-2016
3	TELUS Corporation	TU	Pamela	Snively	Chief Data & Trust Officer	Oct-2015
4	Loblaw Companies Limited	LBLCF	David	Markwell	Vice President - Data & Analytics	Sep-2015
5	TMX Group Limited	TMXXF	Selwyn	Collaco	Chief Data Officer	Apr-2017
6	BRP Inc	BRP	David	Dadoun	Head of Data	Apr-2021
7	Thomson Reuters Corporation	TRI	Kevin	Chen	Global Head of Data & Analytics	Aug-2012
8	Ceridian HCM Holding Inc.	CDAY	Steve	VanWieren	Head of Data & Analytics	Jun-2018
9	Laurentian Bank Of Canada	LRCDF	Sarah	Hamel	AVP, Data Governance	Dec-2020
10	Canadian Western Bank	CBWBF	Stephen	Kaiser	AVP, Data Trust, Science & Information experience	Oct-2021
11	Intact Financial Corporation	IFCZF	Jean-Francois	Lessard	VP & Chief Data Officer	Dec-2016
12	LifeWorks Inc	MSIXF	Kaytek	Przybylski	Chief Data & Technology Officer	Sep-2019
13	iA Financial Corporation	IAFNF	Janine	Daoust	Director, Data Management (now Interim Chief Data Officer)	Aug-2019
14	CAE Inc	CAE	Freddy	Ntako	Head of Data & AI	Nov-2020
15	Altus Group Limited	ASGTF	Edward	Orlik	Vice President, Data/Cloud Architect	Dec-2013
16	Suncor Energy Inc	SU	Angela	Butler	Vice President, Process and Data Transformation	May-2019
17	ZoomerMedia Limited	ZUM	Yaniv	Or	VP, Technology and Data Operations	Apr-2017
18	Finning International Inc	FINGF	Alena	Godin	Global Director, Business Intelligence, Data & Analytics	May-2018

Table 4.0 – Treatment firms with Chief Data Officers (matched to control sample firms)

S/N	TREATMENT FIRMS	TICKER SYMBOL	FIRST NAME	LAST NAME	JOB TITLE (LINKEDIN)	START DATE
1	Toronto-Dominion Bank (The)	TD	Jennifer	Gibbs	VP & Head, Global Chief Data Office	May-2018
2	Royal Bank of Canada	RY	David	Graham	Chief Data Officer	Jan-2017
3	Bank of Montreal	BMO	Salima	Yala	Chief Data & Analytics Officer	Sep-2017
4	Bank of Nova Scotia (The)	BNS	Thomas	Mavroudis	Chief Data Officer	Nov-2017
5	National Bank of Canada	NTIOF	Olivier	Van Parys	VP Chief Data Office	Dec-2019
6	Air Canada	ACDVF	Richard	Hines	Head of Data & Artificial Intelligence	Jan-2018
7	CIBC	CM	Brian	O'Donnell	Chief Data Officer	Apr-2014

Table 4.1 - Additional firms with Chief Data Officers (not matched to control sample firms)

S/N	TREATMENT FIRM	TICKER	PROXY CIRCULAR	TSX SECTOR	YF SECTOR	MATCHED CONTROL FIRM	TICKER
1	Cenovus Energy Inc.	CVE	✓	✓	✓	Canadian Natural Resources Limited	CNQ
2	Manulife Financial Corporation	MFC	✓	✓	✓	Power Corporation of Canada	PWCDF
3	TELUS Corporation	TU	✓	✓	✓	Rogers Communications Inc.	RCI
4	Loblaw Companies Limited	LBLCF	✓	✓	✓	Metro Inc	MTRAF
5	TMX Group Limited	TMXXF	✓	✓	✓	E-L Financial Corporation Limited	ELFIF
6	BRP Inc	BRP	✓	×	✓	Martinrea International Inc.	MRETF
7	Thomson Reuters Corporation	TRI	✓	✓	×	BCE Inc	BCE
8	Ceridian HCM Holding Inc.	CDAY	×	✓	✓	Open Text Corporation	OTEX
9	Laurentian Bank Of Canada	LRCDF	✓	✓	✓	ECN Capital Corp	ECNCF
10	Canadian Western Bank	CBWBF	✓	✓	✓	Home Capital Group Inc.	HMCBF
11	Intact Financial Corporation	IFCZF	✓	✓	✓	Great-West Lifeco Inc.	GWLIF
12	LifeWorks Inc.	MSIXF	✓	✓	×	GDI Integrated facilities services	GDIFF
13	iA Financial Corporation	IAFNF	✓	✓	✓	CI Financial Corp	CIXX
14	CAE .Inc	CAE	✓	×	✓	Stantec Inc	STN
15	Altus Group Limited	ASGTF	✓	✓	×	Kinaxis Inc	KXSCF
16	Suncor Energy Inc	SU	✓	×	✓	Enbridge Inc	ENB
17	ZoomerMedia Limited	ZUM	.-	✓	✓	Wow Unlimited Media Inc.	WOW
18	Finning International Inc	FINGF	✓	✓	×	Parkland Corporation	PKIUF

Table 5.1 – Qualitative match of Treatment Sample and Control Sample firms

		Ratio - Control:Treatment				Ratio -Control:Treatment (if ratio is between 70% - 130%)			
	MATCHED FIRMS	Total Assets	# of Employees	Revenue	Market Value	Total Assets	# of Employees	Revenue	Market Value
A	CANADIAN NATURAL RESOURCES CENOVUS ENERGY INC	142%	164%	65%	201%	0	0	0	0
B	POWER CORP CANADA MANULIFE FINANCIAL CORP	72%	89%	119%	-	1	1	1	x
C	ROGERS COMMUNICATIONS -CL B TELUS CORP	87%	25%	87%	75%	1	0	1	1
D	METRO INC LOBLAW COS LTD	37%	42%	34%	44%	0	0	0	0
E	E-L FINANCIAL CORP LTD TMX GROUP LTD	42%	58%	237%	47%	0	0	0	0
F	MARTINREA INTL INC BRP GROUP INC	126%	585%	667%	44%	1	0	0	0
G	BCE INC THOMSON-REUTERS CORP	301%	204%	369%	103%	0	0	0	1
H	OPEN TEXT CORP CERIDIAN HCM HOLDING	134%	192%	331%	86%	0	0	0	1
I	ECN CAPITAL CORP LAURENTIAN BANK OF CANADA	3%	16%	14%	-	0	0	0	x
J	HOME CAPITAL GROUP INC -CL B CANADIAN WESTERN BANK	54%	28%	59%	-	0	0	0	x
K	GREAT-WEST LIFECO INC INTACT FINANCIAL CORP	950%	108%	367%	122%	0	1	0	1
L	GDI INTEGRATED FACILITY SVCS LIFEWORKS INC	74%	429%	157%	70%	1	0	0	1
M	CI FINANCIAL CORP IA FINANCIAL CORP	9%	29%	17%	-	0	0	0	x
N	STANTEC INC CAE INC	60%	250%	122%	75%	0	0	1	1
O	KINAXIS INC ALTUS GROUP LTD	43%	44%	40%	125%	0	0	0	1
P	ENBRIDGE INC SUNCOR ENERGY INC	202%	64%	120%	219%	0	0	1	0
Q	WOW UNLIMITED MEDIA INC ZOOMERMEDIA LTD	81%	-	125%	21%	1	x	1	0
R	PARKLAND CORP FINNING INTERNATIONAL INC	193%	48%	294%	107%	0	0	0	1

Table 5.2 – Quantitative match of Treatment Sample and Control Sample firms

		1ST YEAR					2ND YEAR					3RD YEAR					AVERAGE OF 3 YEARS				
Measure	Sample	#	Mean	Standard Deviation	#	Z-value	p-value	#	Mean	Standard Deviation	#	Z-value	p-value	#	Mean	Standard Deviation	#	Z-value	p-value	#	Mean	Standard Deviation	#	Z-value	p-value
ROA	TREATMENT	18	0.002	0.040	18	-2.373	**0.018**	14	0.019	0.028	14	-0.141	0.158	13	0.031	0.042	13	-0.454	0.650	18	0.012	0.025	18	-2.069	**0.039**
	CONTROL	18	**0.028**	0.047	18			15	0.036	0.048	14			13	0.209	0.105	13			18	**0.027**	0.057	18		
ROS	TREATMENT	18	0.039	0.107	18	-1.720	**0.085**	14	0.059	0.114	14	-0.408	0.683	13	0.079	0.100	13	-0.245	0.807	18	0.053	0.096	18	-1.328	0.184
	CONTROL	18	**0.075**	0.109	18			15	0.077	0.085	14			13	0.082	0.105	13			18	0.079	0.094	18		
OI/A	TREATMENT	17	0.769	0.067	17	-1.917	**0.055**	13	0.937	0.061	13	-1.503	0.133	12	0.097	0.066	12	-0.628	0.530	17	0.079	0.060	17	-2.154	**0.031**
	CONTROL	18	**0.970**	0.075	17			15	0.100	0.075	13			13	0.093	0.062	12			18	**0.093**	0.065	17		
OI/S	TREATMENT	17	0.219	0.143	17	-0.260	0.795	13	0.193	0.137	13	-0.454	0.650	12	0.207	0.156	12	-0.078	0.937	17	0.214	0.139	17	-0.071	0.943
	CONTROL	18	0.222	0.158	17			15	0.208	0.164	13			13	0.212	0.149	12			18	0.223	0.152	17		
OI/E	TREATMENT	16	148254	239846	16	-2.741	**0.006**	12	211854	368885	12	-2.746	**0.006**	11	148329	222368	11	-2.667	**0.008**	16	170715	220532	16	-2.689	**0.007**
	CONTROL	18	**401060**	16052118	16			14	**904299**	2234438	12			12	**6830478**	23854865	11			18	**3132284**	12219203	16		
OPEXP/S	TREATMENT	18	0.790	0.144	18	-0.196	0.845	14	0.809	0.132	14	-0.282	0.778	13	0.802	0.153	13	-0.105	0.917	18	0.791	0.137	18	-0.152	0.879
	CONTROL	18	0.778	0.158	18			15	0.792	0.164	14			13	0.788	0.149	13			18	0.777	0.152	18		
COG/S	TREATMENT	18	0.668	0.205	18	-0.240	0.811	14	0.722	0.154	14	-0.408	0.683	13	0.713	0.152	13	-0.035	0.972	18	0.668	0.198	18	-0.022	0.983
	CONTROL	18	0.666	0.228	18			15	0.680	0.239	14			13	0.693	0.236	13			18	0.666	0.229	18		
SGA/S	TREATMENT	11	0.199	0.114	6	-0.524	0.600	7	0.173	0.119	3	-0.535	0.593	6	0.193	0.130	2	-1.342	0.180	11	0.203	0.120	6	-0.943	0.345
	CONTROL	10	0.201	0.150	6			8	0.211	0.193	3			6	0.207	0.186	2			10	0.200	0.165	6		

Table 8.1 – Comparison between Treatment Sample and Control Sample groups using Wilcoxon signed-rank test

		1ST YEAR					2ND YEAR					3RD YEAR					AVERAGE OF 3 YEARS				
Measure	Sample	#	Mean	Standard Deviation	#	Z-value	p-value	#	Mean	Standard Deviation	#	Z-value	p-value	#	Mean	Standard Deviation	#	Z-value	p-value	#	Mean	Standard Deviation	#	Z-value	p-value
ROA	AFTER	25	0.005	0.035	25	-1.413	0.158	21	0.007	0.045	21	-0.226	0.821	19	0.017	0.049	19	-0.523	0.601	25	0.008	0.027	25	-0.740	0.459
	BEFORE	25	0.020	0.049	25			25	0.018	0.024	21			25	0.008	0.025	19			25	0.015	0.022	25		
ROS	AFTER	25	0.079	0.114	25	-1.278	0.201	21	0.060	0.228	21	-0.052	0.958	19	0.074	0.182	19	-0.523	0.601	25	0.069	0.146	25	-0.767	0.443
	BEFORE	25	0.094	0.108	25			25	0.091	0.091	21			25	0.080	0.103	19			25	0.088	0.865	25		
OI/A	AFTER	24	0.063	0.064	24	-1.343	0.179	20	0.062	0.069	20	-1.157	0.247	18	0.066	0.071	18	-0.370	0.711	24	0.059	0.059	24	-1.171	0.241
	BEFORE	24	0.068	0.070	24			24	0.068	0.063	20			24	0.069	0.068	18			24	0.068	0.066	24		
OI/S	AFTER	24	0.250	0.133	24	-0.486	0.627	20	0.216	0.192	20	-0.149	0.881	18	0.215	0.177	18	-0.240	0.811	24	0.234	0.153	24	-0.286	0.775
	BEFORE	24	0.245	0.122	24			24	0.244	0.116	20			24	0.239	0.122	18			24	0.243	0.119	24		
OI/E	AFTER	23	156510	200995	23	-1.065	0.287	19	194301	298921	19	-1.610	0.107	17	**151265**	190546	16	-2.430	**0.015**	23	**169258**	189385	23	-2.038	**0.042**
	BEFORE	23	173229	219429	23			23	166017	206024	19			21	141799	122964	16			23	156964	180997	23		
OPEXP/S	AFTER	25	0.757	0.136	25	-0.175	0.861	21	0.786	0.187	21	-0.122	0.903	19	0.792	0.175	19	-0.604	0.546	25	0.771	0.151	25	-0.325	0.600
	BEFORE	25	0.760	0.123	25			25	0.762	0.117	21			25	0.761	0.119	19			25	0.761	0.118	25		
COG/S	AFTER	25	0.574	0.250	25	-0.578	0.563	21	0.616	0.286	21	-0.991	0.322	19	0.626	0.257	19	-1.167	0.243	25	0.587	0.259	25	-1.144	0.253
	BEFORE	25	0.570	0.230	25			25	0.577	0.240	21			25	0.564	0.248	19			25	0.570	0.237	25		
SGA/S	AFTER	18	0.255	0.137	18	-0.344	0.586	14	0.255	0.139	14	-0.534	0.594	12	0.263	0.140	12	-1.177	0.239	18	0.256	0.134	18	-0.762	0.446
	BEFORE	18	0.264	0.131	18			18	0.256	0.146	14			18	0.274	0.145	12			18	0.265	0.139	18		

Table 8.2 – Comparison between period of pre-appointment and post-appointment of CDO using Wilcoxon-signed rank test

		2018				2019				2020				2021			
Measure	Model	#	R-square Change	2017 Financial Performance	CDO Dummy Variable	#	R-square Change	2018 Financial Performance	CDO Dummy Variable	#	R-square Change	2019 Financial Performance	CDO Dummy Variable	#	R-square Change	2020 Financial Performance	CDO Dummy Variable
ROA	1	43	0.208	0.456***		43	0.380	0.616***		43	0.117	0.342**		41	0.330	0.575***	
	2	40	0.239	0.471***	-0.035	37	0.561	0.767***	0.227*	41	0.150	0.353**	-0.177	39	0.292	0.588***	0.070
ROS	1	43	0.322	0.567***		43	0.462	0.680***		43	0.198	0.444***		41	0.545	0.738***	
	2	40	0.334	0.528***	0.159	37	0.558	0.728***	0.076	41	0.216	0.469***	-0.140	39	0.551	0.742***	0.122
OI/A	1	42	0.842	0.918***		42	0.898	0.948***		42	0.387	0.766***		40	0.658	0.811***	
	2	39	0.838	0.914***	-0.047	36	0.919	0.956***	-0.020	40	0.587	0.746***	-0.094	38	0.647	0.802***	-0.007
OI/S	1	42	0.848	0.921***		42	0.885	0.941***		42	0.635	0.797***		40	0.787	0.887***	
	2	39	0.842	0.908***	0.048	36	0.898	0.953***	-0.036	40	0.645	0.803***	-0.098	38	0.793	0.893***	0.106
OI/E	1	39	0.971	0.986***		39	0.973	0.986***		40	0.269	0.519***		40	0.599	0.774***	
	2	36	0.973	0.982***	-0.031	33	0.982	0.995***	0.026	38	0.310	0.484**	-0.208	37	0.601	0.797***	0.078
OPEXP/S	1	43	0.838	0.915***		43	0.876	0.936***		43	0.639	0.799***		41	0.790	0.889***	
	2	40	0.835	0.901***	-0.075	37	0.890	0.950***	0.060	41	0.648	0.802***	0.092	39	0.795	0.896***	-0.104
COG/S	1	43	0.917	0.958***		43	0.937	0.968***		43	0.848	0.921***		41	0.900	0.948***	
	2	40	0.912	0.948***	-0.041	37	0.937	0.977***	0.061	41	0.848	0.924***	0.054	39	0.906	0.943***	-0.093*
SGA/S	1	28	0.936	0.968***		28	0.956	0.978***		28	0.987	0.994***		26	0.989	0.994***	
	2	25	0.931	0.961***	0.013	24	0.973	0.998***	-0.070*	26	0.987	0.992***	0.016	24	0.993	0.989***	0.052*

***1% level, **5% level, *10% level

Table 9.1 – Regression Analysis results for Models 1 & 2 (Standardized Coefficients)

Measure	Model	2018 #	2018 R-square Change	2018 2017 Financial Performance	2018 CDO Dummy Variable	2019 #	2019 R-square Change	2019 2018 Financial Performance	2019 CDO Dummy Variable	2020 #	2020 R-square Change	2020 2019 Financial Performance	2020 CDO Dummy Variable	2021 #	2021 R-square Change	2021 2020 Financial Performance	2021 CDO Dummy Variable
ROA	1	43	0.208	0.389***		43	0.380	0.838***		43	0.117	0.241**		41	0.330	0.717***	
	2	40	0.239	0.416***	-0.008	37	0.561	1.131***	0.028*	41	0.150	0.249**	-0.014	39	0.292	0.731***	0.007
ROS	1	43	0.322	0.462***		43	0.462	0.647***		43	0.198	0.786***		41	0.545	0.896***	
	2	40	0.334	0.424***	0.034	37	0.538	0.760***	0.015	41	0.216	0.838***	-0.047	39	0.551	0.901***	0.050
OI/A	1	42	0.842	0.860***		42	0.898	0.927***		42	0.587	0.721***		40	0.658	0.817***	
	2	39	0.838	0.838***	-0.007	36	0.919	0.925***	-0.003	40	0.587	0.706***	-0.011	38	0.647	0.807***	-0.001
OI/S	1	42	0.848	0.854***		42	0.885	0.906***		42	0.635	0.941***		40	0.787	0.991***	
	2	39	0.842	0.837***	0.015	36	0.898	0.928***	-0.010	40	0.645	0.948***	-0.032	38	0.793	0.993***	0.039
OI/E	1	39	0.971	0.122***		39	0.973	9.251***		40	0.269	0.009***		40	0.599	1.402***	
	2	36	0.973	0.122***	-96354.851	33	0.982	0.234***	690749.887	38	0.310	0.009**	-93559.413	37	0.601	1.445***	64410.665
OPEXP/S	1	43	0.838	0.837***		43	0.876	0.913***		43	0.639	0.936***		41	0.790	0.991***	
	2	40	0.835	0.818***	-0.023	37	0.890	0.938***	0.017	41	0.648	0.939***	0.030	39	0.795	0.995***	-0.038
COG/S	1	43	0.917	0.925***		43	0.937	0.906***		43	0.848	1.014***		41	0.900	1.095***	
	2	40	0.912	0.918***	-0.020	37	0.937	0.913***	0.027	41	0.848	1.017***	0.026	39	0.906	1.083***	-0.052*
SGA/S	1	28	0.936	0.906***		28	0.956	0.975***		28	0.987	1.056***		26	0.989	1.132***	
	2	25	0.931	0.907***	0.004	24	0.973	0.959***	-0.019*	26	0.987	1.056***	0.005	24	0.993	1.124***	0.018*

***1% level, **5% level, *10% level

Table 9.2 – Regression Analysis results for Models 1 & 2 (Unstandardized Coefficients)

		Unstandardized				Standardized			
Measure	Model	#	R-square Change	Financial Performance(t-1)	CDO Dummy Variable	#	R-square Change	Financial Performance(t-1)	CDO Dummy Variable
ROA	3	212	0.210	0.407***		212	0.210	0.439***	
	4	212	0.214	0.404***	-0.006	212	0.214	0.435***	-0.062
ROS	3	212	0.342	0.604***		212	0.342	0.566***	
	4	212	0.343	0.602***	0.005	212	0.343	0.564***	0.019
OI/A	3	207	0.783	0.859***		207	0.783	0.883***	
	4	207	0.783	0.856***	-0.004	207	0.783	0.879***	-0.028
OI/S	3	207	0.801	0.936***		207	0.801	0.891***	
	4	207	0.801	0.935***	0.001	207	0.801	0.891***	0.004
OI/E	3	196	0.114	0.302***		196	0.114	0.317***	
	4	196	0.117	0.296***	-864815	196	0.117	0.311***	-0.058
OPEXP/S	3	212	0.800	0.933***		212	0.800	0.890***	
	4	212	0.800	0.933***	-0.001	212	0.800	0.890***	-0.004
COG/S	3	212	0.909	0.982***		212	0.909	0.951***	
	4	212	0.909	0.982***	-0.001	212	0.909	0.950***	-0.002
SGA/S	3	137	0.966	0.997***		137	0.966	0.982***	
	4	137	0.966	0.998***	-0.002	137	0.966	0.983***	-0.007

*****1% level, **5% level, *10% level**

Table 9.3 – Regression Analysis results for Model 3 & 4