Analyzing Costco’s supply chain responsiveness through lean and agile strategies

Major Research Paper

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Abstract

Supply chain responsiveness contributes to efficient supply chain performance. Supply chain responsiveness refers to effectively and efficiently meeting customer's needs in a timely manner. This paper considers the supply chain strategies and practices that lead to the supply chain responsiveness of Costco when compared to its major competitors, Wal-Mart and Loblaws. The evaluation and comparison of key financial performance measures as well as various statistical analyses identify the supply chain strategies that benefit Costco and its competitors. The paper presents a contribution to existing supply chain literature through the in-depth analysis conducted of different supply chain performance measures for three major retailers in Canada - Costco, Wal-Mart and Loblaws. This analysis evaluates a 23-year period from 1999 to 2021. The analysis also contributes to the existing literature on the use of supply chain strategies, such as leanness and agility in the retail industry, Costco's practices of just-in-time (JIT) inventory management and cross-docking as well as specific characteristics of Costco's supply chain practices. The findings of the analysis lead to the validation of assertions and propositions of earlier researchers. These include the importance of employing complementary supply chain practices together as well as a focus on aligning supply chain strategies with the company's corporate strategy. These understandings contribute to the achievement of supply chain responsiveness by encouraging cohesion and balance amongst supply chain strategies.

Introduction

The aim of this paper is to develop an understanding of Costco's supply chain responsiveness. Supply chain responsiveness is understood as a company's ability to satisfy customer needs effectively and efficiently. Supply chain responsiveness leads to improved overall performance. Supply chain strategies including lean and agile strategies will be used to analyse and explain the supply chain responsiveness of the company.

Costco Wholesale Corporation, hereafter referred to as Costco, began operations in 1983 in Seattle Washington (Costco Wholesale Canada, 2022). Costco operates warehouses in 12 countries globally including Canada, USA, Mexico, and Japan. Operating as a membership-based warehouse, Costco requires members to pay an annual membership fee, with this fee members can enter and shop in the warehouse. Costco's core merchandise categories are consumer-packaged goods (foods, non-foods, and sundries- small miscellaneous objects), fresh foods, warehouse ancillary (gasoline, pharmacy, optical, food court, hearing aids and tire installation), and other businesses (e-commerce, business centers, travel and other).

In order to develop the understanding of Costco's supply chain responsiveness, this paper compares Costco to some of its major competitors. Wal-Mart and Loblaws are evaluated alongside Costco to assist in providing explanations and examples of effective supply chain responsiveness. Successful supply chain practices that are identified may be able to be applied to Costco to help improve supply chain performance and responsiveness.

Firstly, Wal-Mart which is perceived as Costco's largest North American competitor, began operations in 1962 in Rogers, Arkansas. It currently conducts business in 24 countries globally including Canada, USA, Mexico, and India (Walmart Inc., 2022). Wal-Mart's strategic merchandise units are grocery, general merchandise (entertainment, apparel and home, and hardlines- appliances, tools or furniture), health and wellness and e-commerce. It also owns and operates Sam’s Club which operates in the USA. Sam’s Club has a similar business model to Costco with regards to its membership and warehouse setting. Sam’s Club is currently “representing 13% of [Wal-Mart’s] consolidated fiscal 2022 net sales…” (Wal-Mart Annual Report, 2022). Sam’s Club’s merchandise categories are grocery and consumables, fuel and tobacco, home and apparel, technology, office and entertainment, and health and wellness (pharmacy, optical, and hearing services). Figure 1 demonstrates Sam’s Club’s revenue contribution to Wal-Mart’s overall total revenue.

Next, Loblaw Companies Limited, hereafter referred to as Loblaws, began operations in 1919 in Toronto, Ontario. Today, it operates more than 2,400 stores under various banners across Canada. (Loblaws Inc., 2022). Loblaws’ two operating segments are the retail segment and financial services. The retail segment “consists primarily of corporate and franchise-owned retail food stores and Associate- owned drug stores. The Retail segment also includes in-store pharmacies and other health and beauty products, apparel and other general merchandise and supports the PC Optimum™ Program” (Loblaws Annual Report, 2021). The financial services segment includes credit card and everyday banking services, the PC Optimum™ Program, insurance brokerage services and telecommunication services. Loblaws is Canada’s top food retailer as of 2021.

There are specific supply chain strategies and approaches that are implemented by Costco, Wal-Mart and Loblaws. All three companies utilize cross-docking consolidation points (depots). The adoption of cross-docking for the retail industry began in the 1980s by Wal-Mart (Murray, 2020). Referring to Costco, “our depots receive large shipments from manufacturers and quickly ship these goods to warehouses. This process creates freight volume and handling efficiencies, lowering costs associated with traditional multiple-step distribution channels" (Costco Annual Report, 2021). Costco stores function within a warehouse setting which supports its single-step distribution channel strategy. Costco's inventory management includes just-in-time inventory (JIT) and maintaining low numbers of stockkeeping units (SKUs). Costco sells its products in larger quantities, referred to as a club-pack. Loblaws and Wal-Mart's products are mostly sold individually to consumers. Wal-Mart uses vendor-managed inventory (VMI) and maintains approximately 120,000 SKUs in its supercenter (Bokhari, 2015). Loblaws uses digitization and technology to help manage its inventory effectively.

The fiscal years of Costco, Wal-Mart and Loblaws differ. Costco reports a 52/53-week fiscal year which ends on the Sunday nearest the end of August. Wal-Mart reports a 12-month fiscal year ending January 31st. Loblaws follows a 52/53-week fiscal year which ends in the first week of January.

Figure 2 presents Costco, Wal-Mart and Loblaws' reported gross revenue, total assets, and total equity as stated in the 2021 annual reports. Table 1 describes the nature of Wal-Mart, Costco and Loblaws. Table 2 indicates the various banners operated by each company.

Figure 1: Sam's Club Contribution to Wal-Mart's Gross Revenues

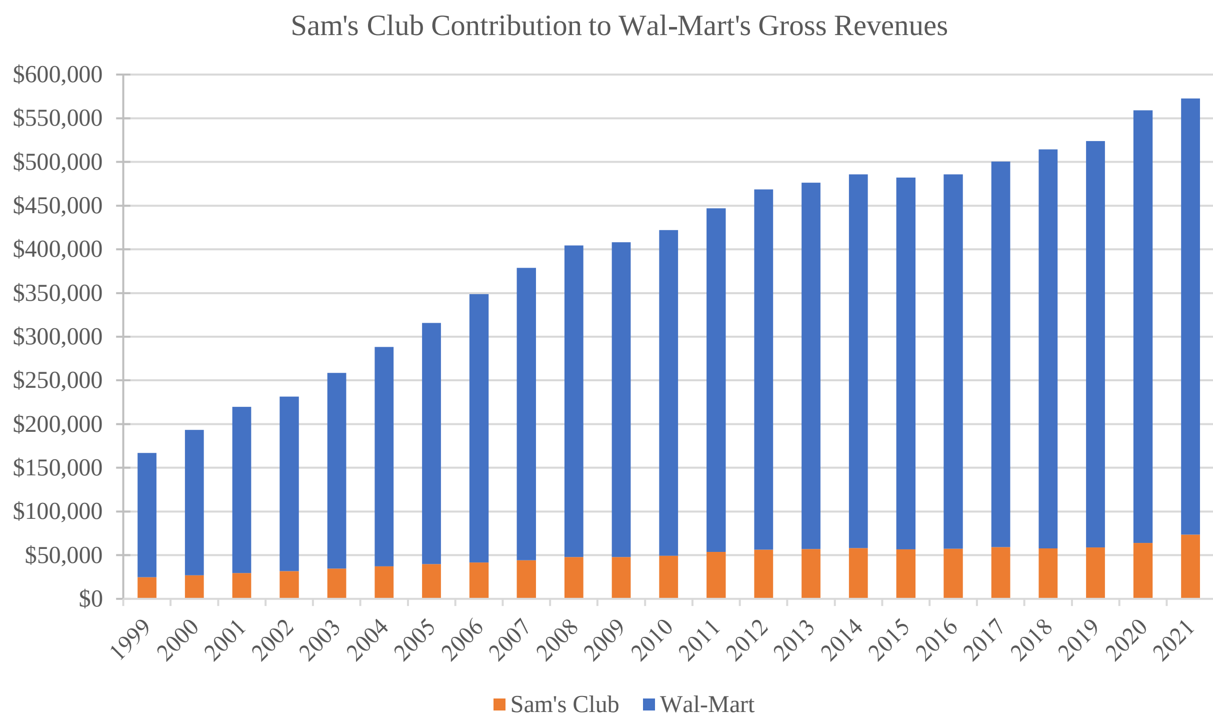


Figure 2: 2021 Financial Highlights

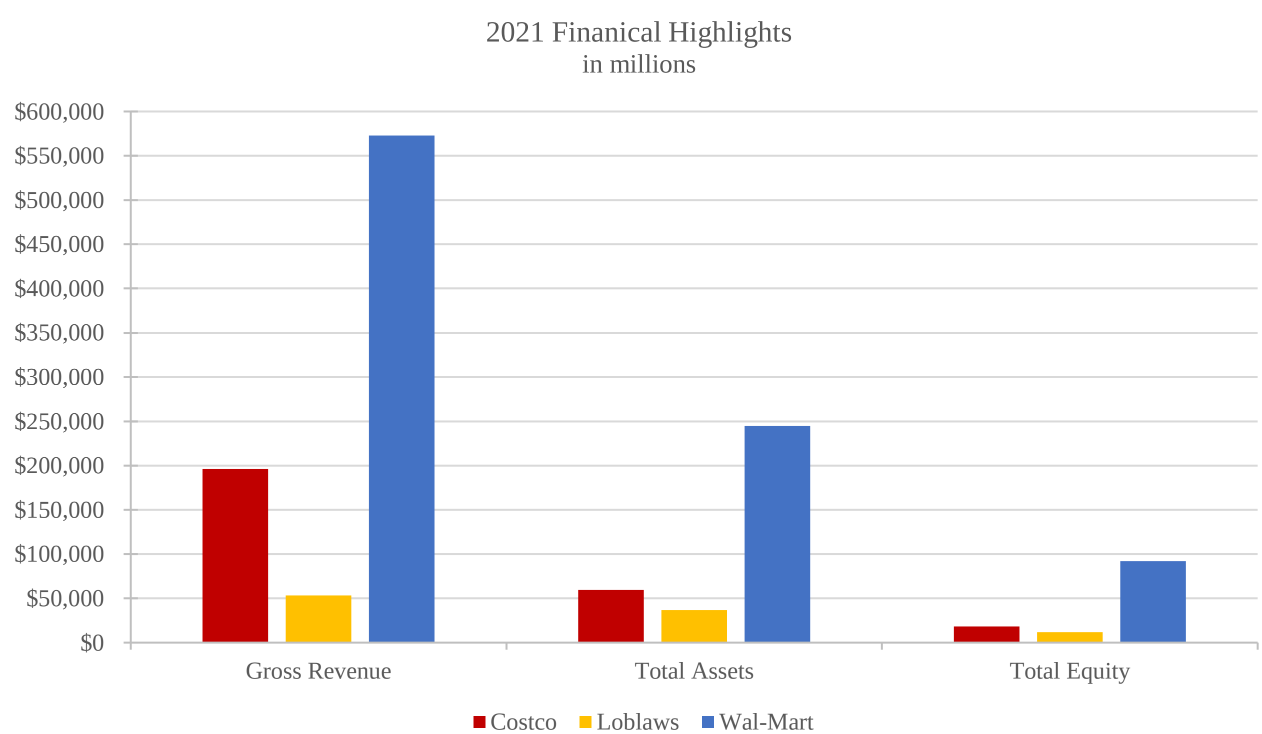


Table 1: Nature of Wal-Mart, Costco & Loblaws

Company	**Gross Revenue** (millions)	**Geography**	**Total Stores Worldwide**	**Stores in Canada**
Wal-Mart	$572,762 USD (FYE Jan 31st, 2022)	Global	10,585	402
Costco	$195,929 USD (FYE Aug 29th, 2021)	Global	837	107
Loblaws	$53,170 CAD[1] (FYE Jan 1st, 2022)	Canada	2,438	2,438

[1] $53,170CAD is equivalent to $42,062USD using exchange rate as of Jan 1st, 2022 (Exchange Rates, 2022).

Table 2: Summary of Company Banners

Wal-Mart	**Costco**	**Loblaws**
Supercenters	Costco Warehouse	Loblaws City Market
- General merchandise	Business Centers[1]	Superstore/Real Canadian Superstore
- Grocery	- Tailored items	No Frills
Discount Stores	Costco Travel	Your Independent Grocer
- General merchandise	- Online[2]	Atlantic Superstore
- Limited grocery	- Vacation packages	Zehrs
Neighbourhood Markets	- Hotel	Provigo
- Grocery	- Cruises	Provigo Le Marché
Sam's Club	- Other travel products	Real Canadian Wholesale Club
- Omni-channel		Real Canadian Liquorstore
- samsclub.com	E-commerce	Fortinos
E-commerce	- costco.ca	T&T stores
- walmart.com		E-commerce
	[1]separate locations than Costco warehouses	- loblaws.ca
	[2] costcotravel.ca	* All general merchandise and/or grocery

Research Objectives and Questions

The research objectives and related research questions presented and discussed guide the paper. They help to provide an understanding of the relationship between Costco's supply chain strategies and supply chain responsiveness, the ability to satisfy customer's needs efficiently and effectively.

Costco manages its inventory through various approaches. These include JIT as well as maintaining a low number of stockkeeping units (SKUs) within its warehouses. Utilizing these approaches allows Costco to be recognized as having the ability to effectively manage its inventory.

Objective 1: To evaluate the success of Costco's inventory management.

Research Question 1: Does an effective balance of leanness and agility exist within Costco's supply chain?

This research question involves the exploration of Costco's supply chain decisions. It looks at whether Costco best applies the characteristics of lean and agile supply chain strategies. This research question allows factors such as Costco's inventory turnover rate, supplier relationships, communication with suppliers, and so on to be analysed. The evaluation of this research question provides information into the understanding of Costco's supply chain responsiveness.

Costco's corporate strategy involves components that add to its complexity and competitive advantage. Aligning the organization's supply chain strategy with its corporate strategy is essential for creating synergy throughout the entire organization.

Objective 2: To identify the relationship between Costco's supply chain strategy and corporate strategy.

Research Question 2: To what extent does Costco's supply chain strategy support its corporate strategy? What are the core components that contribute to this relationship?

Focusing on the above objective and research question helps to determine whether Costco's supply chain strategies align with its corporate strategy. The analysis of this research question provides direct evidence to determine the alignment of Costco's strategies when tending to customers' needs. This research question involves complete awareness and explanation of Costco's corporate strategy. The use of secondary and primary data contributes to the identification and explanation of Costco's strategic alignments when achieving supply chain responsiveness.

The COVID-19 pandemic has taken a toll on many supply chains, more specifically amongst the big-box retailers and grocers. The pandemic left store shelves unstocked and brought about shortages in food, sundries, and essentials. Costco can be seen as having the ability to efficiently respond to the unexpected changes that occurred. However, this did not ring true for some of Costco's competitors.

Objective 3: To examine Costco's ability to respond to the effects of the pandemic and/or unexpected risk.

Research Question 3: How does a lean and agile supply chain strategy prepare Costco for risk responses?

The analysis of this research question relies on a balance of leanness and agility supply chain strategies that are identified in the first research question. The third research question investigates whether Costco's supply chain practices align with its supply chain strategy. This is done through gathering data on the changes that Costco had to make during an unexpected time. It also considers the risk preparation measures that Costco had taken prior to the effects of the pandemic. The result of this analysis contributes to the understanding of Costco's supply chain responsiveness during an unexpected time and how it's related to the organization's corporate strategy.

Review of Literature

The related literature to this research topic offers a variety of perspectives. The articles, journals and textbooks described in this section will outline and explain these viewpoints.

Costco's supply chain responsiveness will be assessed among others by its use of lean and agile supply chain strategies. Qrunfleh & Tarafdar (2013) provide definitions of the terms leanness and agility within the supply chain. They explain lean as referring to cost efficiency through effective inventory management as well as an emphasis on improving the quality in the supply chain. Two methods of employing a lean strategy are the JIT philosophy and developing strategic supplier relationships. JIT is described as "delivering the right material, at the right time, at the right place, and in the exact amount; and [… companies] may select suppliers based on quality to achieve its low-cost strategy" (Qrunfleh & Tarafdar, 2013). Agility in the supply chain is a strategy that is directed at flexibility and adapting quickly to customer's needs. When agility is applied to supply chain demand in the retail industry, it can refer to continuous planning. This refers to continuous real-time planning which allows a company to have products available that align with trends and seasons. This study investigates the relation between these supply chain strategies and supply chain responsiveness. Supply chain responsiveness is described by the authors as "…the supply chain's ability to effectively respond to changes that impact the focal firm's customer by reacting quickly and effectively to changing market requirements" (Qrunfleh & Tarafdar, 2013).

The relationship between supply chain responsiveness and supply chain strategies is determined by mediators. The first mediator is strategic supplier partnerships referring to the long-term relationship between the organization and its suppliers that directly impact strategic and operational capabilities. They conclude that strategic supplier partnerships mediate the relationship between a lean supply chain and the supply chain's responsiveness. The second mediator that has been outlined is the use of postponement which is delaying the differentiation of a product until demand is determined, aiding in the response performance to changes in demand. However, this mediator cannot be seen as relevant to this paper.

Chopra & Meindl (2013) provide an in-depth look at the contributors of an organization's lean and agile supply chain strategies. First, they explain key financial performance measures that will be used to analyze the supply chain strategies of Costco and its competitors. They explain that the key financial performance measures outlined are necessary for gauging the performance of logistical drivers and cross-functional drivers. The logistical drivers are given as facilities, inventory, and transportation while the cross-functional drivers are information, sourcing, and pricing. It is understood that the structuring of these key drivers is meant "to achieve the desired level of responsiveness at the lowest possible cost" (Chopra & Meindl, 2013).

The key financial performance measures are given as return on equity (ROE), return on assets (ROA), return on financial leverage (ROFL), accounts payable turnover (APT), accounts receivable turnover (ART), inventory turnover (INVT), property, plant, and equipment turnover (PPET), and cash-to-cash (C2C) cycle. Chopra & Meindl (2013) use the following calculation of ROFL:

$$\mathrm{ROFL} = \mathrm{ROE} - \mathrm{ROA}$$

The C2C ratio is calculated using APT, INVT and ART (Chopra & Meindl, 2013) as follows:

$$\mathrm{C2C} = -\left(\frac{1}{\mathrm{APT}}\right) + \left(\frac{1}{\mathrm{INVT}}\right) + \left(\frac{1}{\mathrm{ART}}\right)$$

C2C is generally multiplied by 52 to assess the ratio in a weekly value.

The evaluation of these key financial performance measures helps to determine the role that supply chain strategies take on when assessing the supply chain responsiveness of Costco, Wal-Mart, and Loblaws.

Lean and agile supply chain strategies can have varying effects and uses in the retail and grocery industry. Lukić (2012) describes the uses of lean strategies in retail. Lean strategy is referred to as eliminating waste which can be caused by excess inventories, movement, time, and labour. The author suggests that a lean strategy can be achieved in a few ways; “(1) bar codes, which allow retailers to control the sale of each of the ten thousand products in stock, (2) electronic data interchange, a computer system network that allows retailers to quickly and inexpensively communicate with suppliers, and (3) modern distribution center which is a fast channel of goods from suppliers to sales locations” (Lukić, 2012). These steps allow for goods to be moved faster from the supplier to sales locations and when implemented effectively, lean supply chain strategies offer a competitive advantage. Noda (2015) suggests that “successful lean implementation will be able to promote operational flow efficiency and achieve effective cost reduction.” This is possible when the “integration of lean operation system [is] incorporated in a corporate strategy” (Noda, 2015). The integration of lean operations must be done simultaneously with EDLP, “a pricing principle that reduces daily sales fluctuation. Reducing sales variation will enable lean operation to be introduced easily” (Noda, 2015). In addition, the retail industry can benefit from deploying the lean six sigma (LSS) methodology, “LSS identifies opportunities to eliminate waste, unwanted variation, and errors in retail business processes, all of which cost money, add no value for customers, and do not contribute to the bottom line” (Madhani, 2020). Madhani (2020) implies that adopting a lean supply chain strategy such as LSS, allows a company to dominate the “fast-paced and dynamic competitive retail environment.”

The first method of executing a lean and agile supply chain strategy is JIT. “The JIT philosophy advocates the elimination of waste by simplifying production processes. Reductions in setup times, controlling material flows, and emphasizing preventive maintenance are seen as ways by which excess inventories can be reduced or eliminated, and resources utilized more efficiently” (Kannan & Tan, 2004). “A good lean/JIT implementation produces high-quality products at the pace of customer demand with little waste. It allows customers to be served with less inventory investment and a higher level of responsiveness” (Ward & Zhou, 2006). It is necessary to focus not only on quality, but also to understand supply chain relationships. “Whether it is by coordination and integration of activities throughout the supply chain or by recognizing the capabilities of immediate suppliers, understanding supply chain dynamics has a significant impact on performance” (Kannan & Tan, 2004). The JIT approach along with IT integration – “IT integration refers to information systems that electronically transmit information within firms and between firms.”- can effectively reduce customer lead times (Ward & Zhou, 2006).

Another method when employing a lean and agile supply chain strategy is the concept of cross-docking. Belle et al. (2012) describe cross-docking as “the process of consolidating freight with the same destination (but coming from several origins), with minimal handling and with little or no storage between unloading and loading of the goods”. There are some advantages to cross-docking in the retail industry. “It reduces inventory costs, storage space and handling costs. It also accelerates cash flow and minimises cycle times due to the elimination of a storage point in the supply chain” (Benrqya, 2019). It is important to note that the design of the cross-docking distribution centre as well as an understanding of the retail distribution network can be used to recognize cross-docking performance improvements (Buijs et al., 2016). “Cross-docking corresponds with the goals of lean supply chain management: smaller volumes of more visible inventories that are delivered faster and more frequently" (Belle et al., 2012).

Other related published articles and websites highlight some characteristics of Costco's strategies and competitive advantage. Costco limits its stockkeeping units to approximately 3,700 in its warehouses which contributes to lean supply chain strategies. Secondary services such as gas stations and pharmacy services are used to help promote traffic in the warehouses (Singh, 2019). Costco sells its products in larger bulk quantities. The bulk products are shipped from the distribution centre to the warehouses to be sold in the same manner which eliminates the need for repackaging or complex expansive operations (Cuofano, 2019). Britt (2020) describes that Costco presents its products to consumers on the pallets that it is received on. The company works with its suppliers to ensure that pallets are specifically stacked and wrapped to maintain this process.

An important aspect of this paper is testing Costco's supply chain responsiveness by its risk response, a perfect example is the most recent unexpected risk of the COVID-19 pandemic. Published literature provide insight as to how the retail industry was affected, "several grocery retailers are diffusing messages about the availability of food and limiting the number of items to buy per consumer, implementing new types of on- line services, and home delivery…" (Pantano et al., 2020). The changes that took place, pushed consumers to alter their usual buying habits. And consumers were forced to switch retailers based on product availability. The scarcity of necessities pushed the idea of stockpiling which impacted consumers' price sensitivity, accepting some price increases of up to 300% (Pantano et al., 2020). "While most retailers are re-thinking their supply chain anticipating disruptions, some do so by cutting advertising expenditures and increasing prices […] Others have switched to a local-only supply chain" (Pantano et al., 2020). More specifically, Hobbs (2020) suggests that a JIT strategy is "efficient and effective under normal circumstances” but may be vulnerable to short-run disruptions in the early stages of the pandemic. Once the initial shock lessens, this supply chain strategy has shown to be responsive and resilient. “Collaborative buyer–seller relationships build trust among supply chain partners and flexibility in responding to unexpected shifts in demand or unanticipated supply disruptions” (Hobbs, 2020). In the case of Costco, the number of suppliers were strategically increased to satisfy the increase in demand of some products. Also, Costco had to modify its strategy by storing some of its seasonal products for the following year (Thier, 2020).

Through the above literature review this paper aims to understand how key financial performance measures contribute to lean and agile supply chain strategies. This paper also aims to identify the ways in which JIT and cross-docking approaches work together to support Costco’s supply chain responsiveness.

The secondary data will be analyzed using the key financial performance measures outlined by Chopra & Meindl (2013), which are identified as relevant to supply chain performance. These key financial performance measures are ART, APT, INVT, C2C, ROE, ROA and ROFL. The INVT and C2C ratios are emphasized throughout the paper since they tend to portray the overall supply chain performance of a firm. On their own, APT and ART are not indicative of supply chain performance, however these measures are evaluated as they represent 2 out of the 3 components used when calculating C2C. The ROE, ROA and ROFL measures are indicative of overall financial performance which contributes to the evaluation of supply chain performance.

Data and Methodology

The paper utilizes both primary and secondary data to examine the guiding research objectives and questions. The key financial performance measures are evaluated to compare the supply chain performance of Costco, Loblaws and Wal-Mart. Statistical analyses have also been performed using the secondary data. Costco is further compared with Wal-Mart and Loblaws through statistical tests of differences of means and simple linear regression.

Secondary Data

The secondary data that is collected and analysed throughout the report has been accessed from public company records. First, the annual reports from 1999 to 2021 for Costco, Wal-Mart and Loblaws are retrieved and utilized for data analysis. The quantitative secondary data that has been collected is then used in this report to compare Costco's key financial performance measures with those of its major competitors.

It is important to note that Costco and Wal-Mart's financial figures are reported in U.S. dollars and Loblaws's financial figures are reported in Canadian dollars. Also, the financial figures reported throughout the secondary data are reported in millions.

There are various challenges with the secondary data that are addressed to ensure that accurate comparisons have been analysed. The first challenge is differing fiscal years for each companies' annual reports. In order to rectify this challenge, the annual reports that have been used are those which are most representative of the year being analysed. For example, when analysing the year of 2021, Costco's 2021 annual report is used even though the ending values are reported from the end of August. Therefore, the 2021 values are representative of majority of the year (8 out of 12 months). For the same year when analysing Wal-Mart, the 2022 annual report is used because the ending values are reported in January of 2022 which suggests that the report is mostly based off financial information from 2021. In the case of Loblaws, the company's fiscal year coincides with the calendar year which implies that the 2021 annual report is used when reporting the 2021 ending values for analysis.

Another challenge that was addressed prior to data analysis was whether to report on the ending values as stated in the annual report or to calculate the average values when evaluating the key financial performance measures. For instance, ROE is calculated as:

$$\text{ROE} = \frac{\text{net income}}{\text{average shareholder equity}}$$

where

$$\text{Average shareholder equity} = \frac{(\text{beginning shareholder equity} + \text{ending shareholder equity})}{2}$$

Initially, it is simpler to make use of the ending values when calculating the key financial performance measures. However, to adhere to the theoretical conception and definition of the key financial performance measures, the average values are used in the calculations. The remainder of the report including the data analysis section will refer to the variables in the key financial performance measures as their average. Specifically, average shareholder equity, average total assets, average accounts payable, average inventory and average accounts receivable.

The third challenge to address was the difference in the figures used when calculating INVT. INVT is calculated as:

$$\text{INVT} = \frac{\text{Cost of goods sold}}{\text{Inventories}}$$

However, it is important to understand that the inventory stated on any given annual report is the ending inventory while the value for the cost of goods sold is representative of the entire fiscal year. To rectify the disconnect, the average inventory value is used to calculate INVT.

$$\text{Average inventory} = \frac{(\text{beginning} + \text{ending inventory})}{2}$$

The data analysis of this calculation is representative of the average inventories.

The data represented in the next section of the paper take all these challenges into consideration and follow the above understandings.

Primary Data

The intended use of the primary data that has been collected is to validate as well as compare and contrast both the information that has been gathered in the literature review about Costco's supply chain practices and strategies and the observations discussed in the results of the secondary data. The collection of primary data for this research paper has been reviewed and received ethics approval by the Delegated Research Ethics Review Committee for the School of Administrative Studies at York University. Primary data in the form of interviews have been conducted with team members of one of Costco's Distribution Center's in Canada. Interview questions have been formulated with the intended purpose of gaining a deeper understanding of Costco's supply chain practices, refer to Appendix C. The participants for the interviews were selected based on their position within the organization. Their role suggests their knowledge and experience of the research topic. Appendix D provides a summary table of the 5 respondents that participated in the interviews.

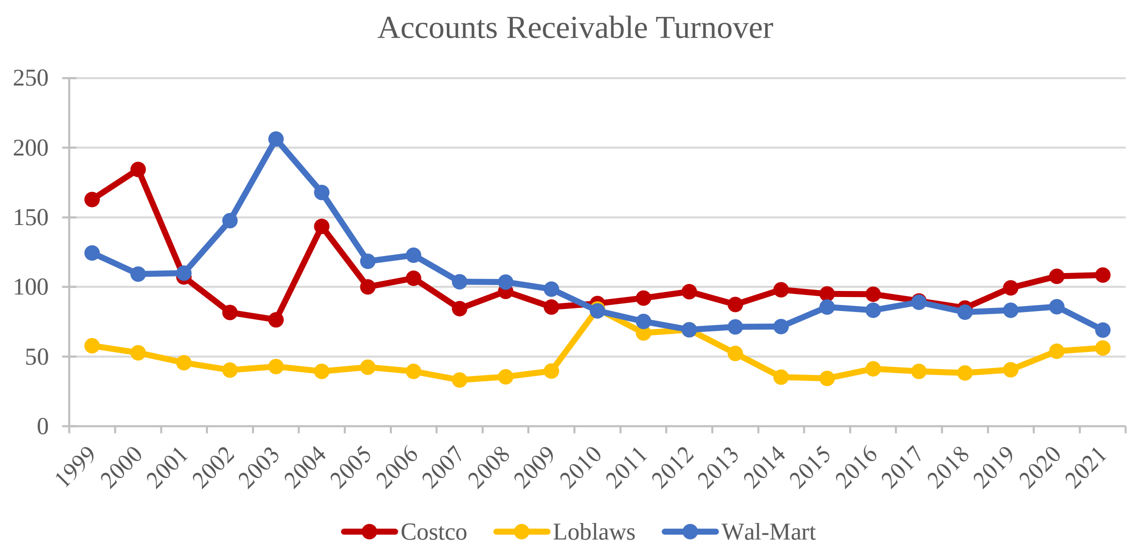
An important limitation of the primary data is the restricted knowledge and understanding of the individual participants on the research topic. This has been addressed by conducting multiple interviews amongst Costco's management team to gather as much data as possible.

Data Analysis

The secondary data is first collected and organized into key financial performance measures for Costco, Wal-Mart, and Loblaws. The calculated key financial performance measures are organized into individual time series graph analyses. The following graphs present a comparison of Costco to its major competitors in terms of the supply chain performance indicators.

The following Figures (Figures 4-10) compare Costco, Loblaws and Wal-Mart over the 23-year time period. Figure 3 compares the ART ratios. The ART ratio describes how quickly a company is collecting its short-term debt. This is also an important measure when calculating the C2C because it represents how quickly the company is being paid for its merchandise. In this case, a higher ART ratio is desired since it indicates that the company "collected its money from sales relatively quickly… after it made a sale" (Chopra & Meindl, 2013).

Figure 3: Accounts Receivable Turnover (ART)



Costco and Wal-Mart display larger ART values than Loblaws except in 2010 and 2012, but Costco does report the highest ratio since 2010.

Figure 4 compares the APT ratios. APT is a ratio that indicates financial leverage of a company. "A small APT indicates that [the company] was able to use the money it owed suppliers to finance a considerable fraction of its operations… A low value of APT helps [the company] improve its financial performance" (Chopra & Meindl, 2013). The APT ratio is an important value when calculating the company's cash-to-cash cycle (C2C). Therefore, the APT is significant to the supply chain's cost efficiency.

Since 2008, Loblaws has had the lowest APT value while Costco reports the highest value since 2003.

Figure 4: Accounts Payable Turnover (APT)

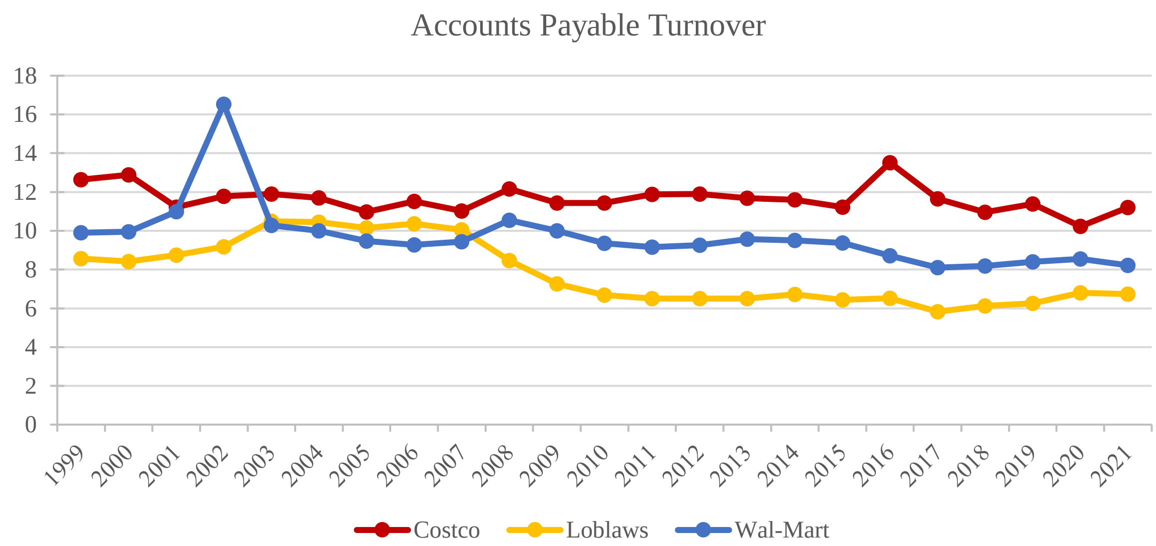


Figure 5 compares the INVT ratios. INVT depicts the number of times that the average inventory is converted into sales per year. A higher INVT ratio is ideal because it suggests that the company is converting their inventory into sales more often throughout the fiscal year. INVT is one of the three measures that is involved in calculating the C2C. The inverse (1/INVT) describes how long on average the company holds its inventory until it is sold to the customer. It is important to note that INVT is a crucial performance indicator when explaining a company's supply chain responsiveness. A high INVT ratio is achieved when the supply chain has lean characteristics such as effectively managed inventory.

Costco has maintained a steady INVT ratio and has had the highest value since 2008. Loblaws experienced an overall decline throughout the analysed years while Wal-Mart's INVT is the lowest value from 2002 to 2014.

Figure 5: Inventory Turnover (INVT)

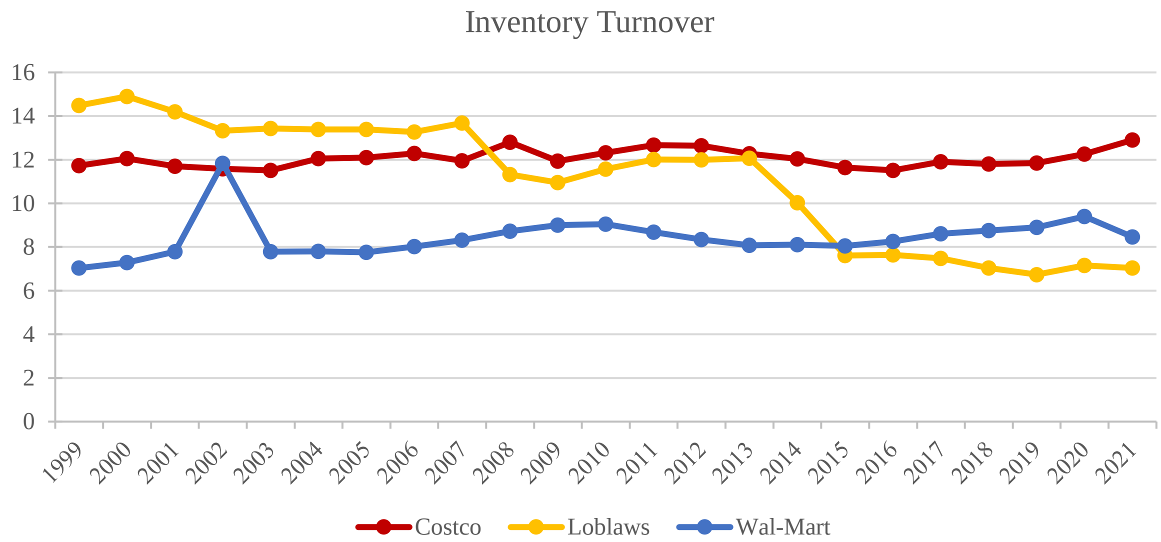
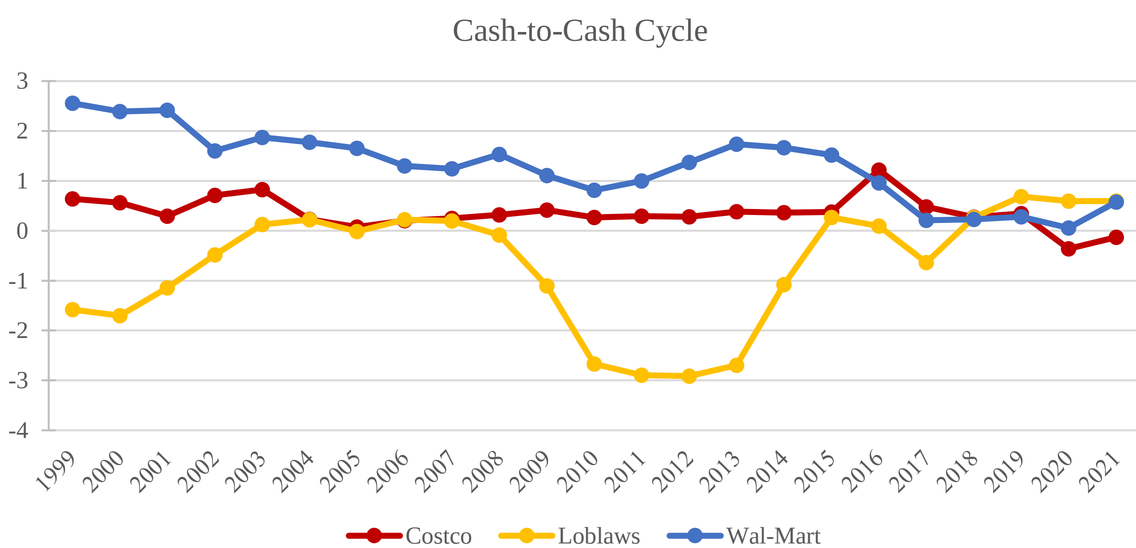


Figure 5 shows that Loblaws had a significant decrease in INVT from 2013 to 2015. This decline resulted from closures and restructuring costs that were incurred. The annual report mentions "during 2015, the Company recorded $124 million of restructuring and other related costs in operating income associated with the announced closures of approximately 52 unprofitable retail locations across a range of banners and formats" (Loblaws Annual Report, 2015). The decrease was reflected in the cost of merchandise inventories sold which directly impacts the INVT ratio, refer to appendix A.

Figure 6 compares the C2C ratios. The C2C values reported in Figure 6 are represented in terms of weeks. The C2C cycle "[…] roughly measures the average amount of time from when cash enters the process as cost to when it returns as collected revenue" (Chopra & Meindl, 2013). When interpreting the C2C cycle ratios, a lower value is desired because it indicates that the company is receiving payment for its inventories in a shorter amount of time. Ideally, a company should aim for a negative C2C cycle ratio since this would imply that the company is receiving payment for its inventory prior to paying its suppliers. The C2C cycle ratio is a key indicator when analysing and comparing supply chain responsiveness. This ratio takes into consideration lean and agile supply chain characteristics. A negative or low C2C cycle ratio is evidence of a company's effective inventory management, high quality within the supply chain including established supplier relationships as well as the ability to adapt to customer's needs. When a company can convert its inventories into sales before paying its suppliers, the company is highly efficient within its supply chain.

Figure 6: Cash-to-Cash Cycle (C2C)



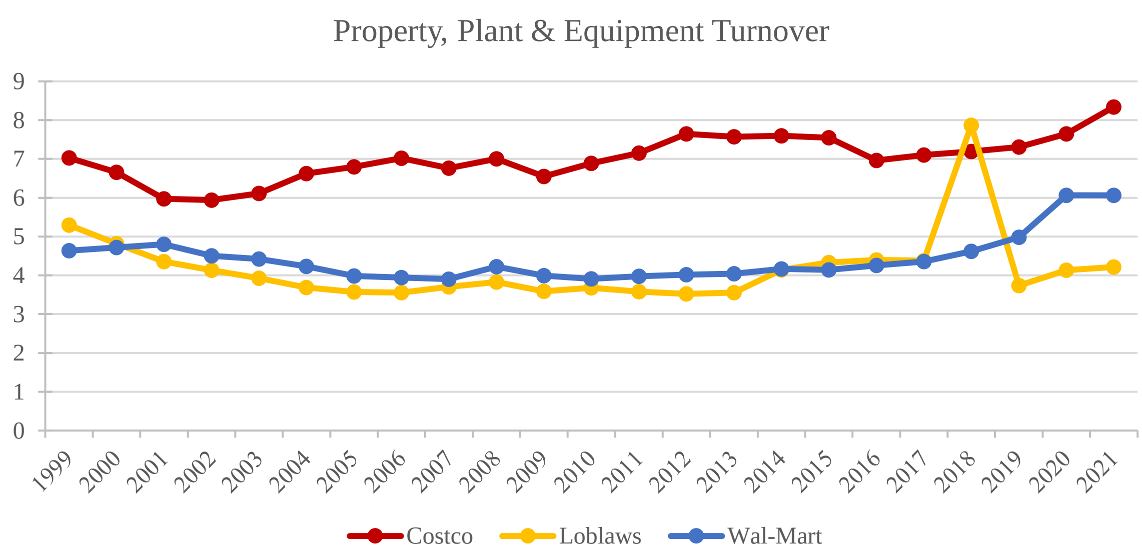
Over the 23-year period, Loblaws has had the most C2C cycle ratios below its competitors. Costco's ratios are relatively low when compared to Wal-Mart.

In 2013-2015, Loblaws displays a significant rise in its C2C cycle ratio. This is in connection with the acquisition of Shoppers Drug Mart. The acquisition increased the reported inventories for Loblaws as well as increasing the stated accounts receivables. These changes directly increased the value of the C2C cycle ratio for this period, refer to appendix A.

Figure 7 compares the PPET ratios. Property, plant, and equipment are seen as fixed assets of a company. PPET looks at how efficiently revenue is being generated from a company's fixed assets. When taking this into consideration, a higher PPET value is desired because it also suggests supply chain efficiency.

Figure 7 explains that Costco has maintained a PPET value higher than its competitors every year except in 2018 when Loblaws has a visible spike. The 2018 Loblaws Annual Report mentions that Loblaws had undergone a reorganization with Choice Properties- Loblaws' landlord and the Weston family- owner of Loblaws. This reorganization was reflected by a -$8932 million discontinued operations cost under its fixed assets, directly impacting the PPET ratio, refer to appendix A.

Figure 7: Property, Plant & Equipment Turnover (PPET)



Figures 8, 9 and 10 compare the ROE, ROA and ROFL ratios, respectively. "[…] ROE measures the return on investment made by a firm's shareholders, return on assets (ROA) measures the return earned on each dollar invested by the firm in assets… ROFL captures the amount of ROE that can be attributed to financial leverage (accounts payable, debt, etc.)" (Chopra & Meindl, 2013). Essentially, the ROE is a measure of the company's profitability while the ROA indicates how well the company is utilizing its assets. When comparing the ROE and ROA, a higher value is desired. These performance measures are an important indicator of a company's supply chain efficiency. A highly efficient supply chain has the ability to effectively manage its network which is an important characteristic of leanness.

Figure 8: Return on Equity (ROE)

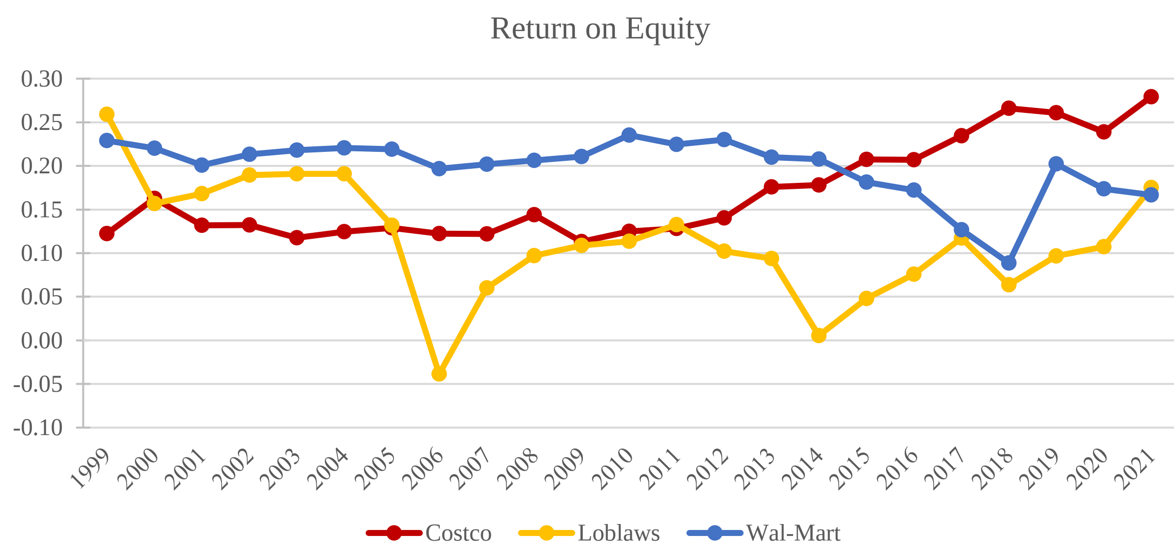


Figure 9: Return on Assets (ROA)

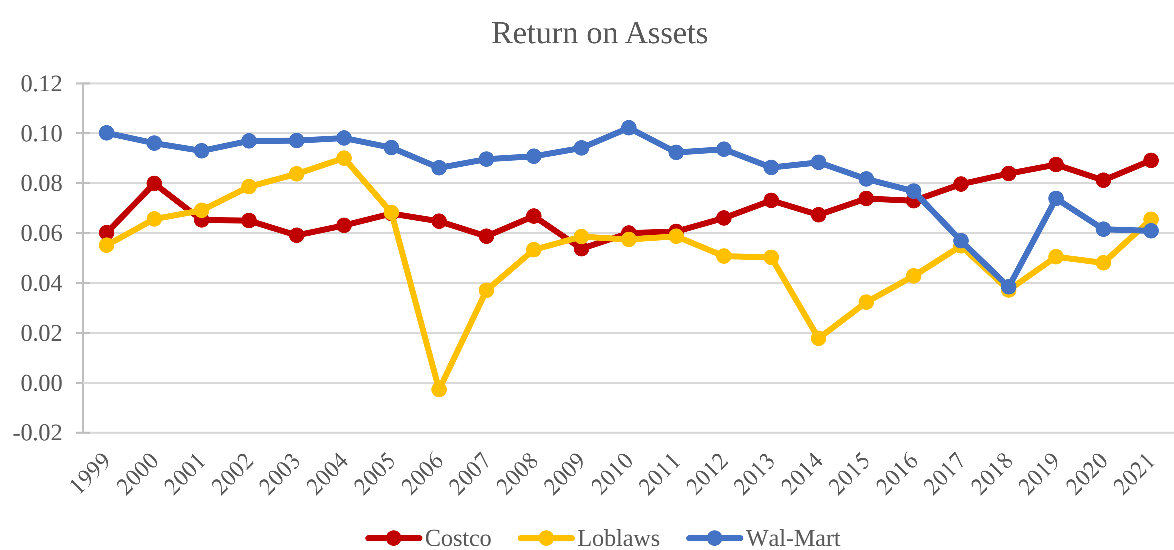
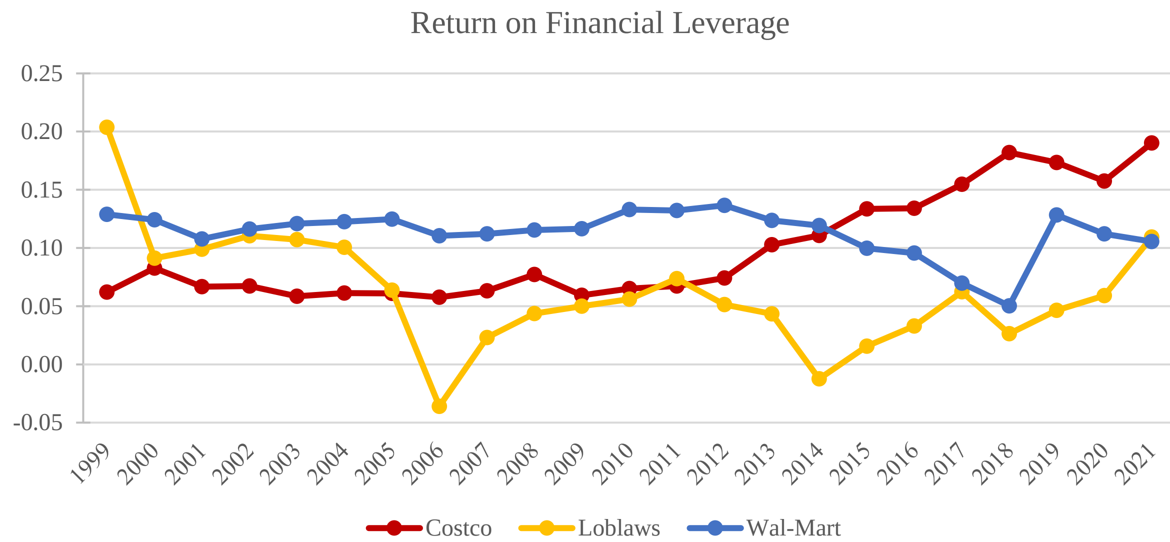


Figure 10: Return on Financial Leverage (ROFL)



Between 2015 and 2021, Costco displays an overall positive upward pattern while attaining ROE and ROFL values above its competitors. [1]

The comparison of the key financial performance measures provides an explanation of the changes that occurred over the analysed years for the three companies. It also represents how those changes affected supply chain performance.

Next, statistical tests of differences are performed to provide a statistical analysis of Costco's supply chain performance. To understand how Costco's supply chain responsiveness

[1] Figures 8, 9 & 10 highlight a significant decrease for Loblaws in 2005 – 2006 which was a result of the acquisition of Provigo Inc. Loblaws reported a goodwill impairment charge of $800 million. "A goodwill impairment charge is recognized to the extent that, at the reporting unit level, the carrying value of goodwill exceeds the implied fair value" (Loblaws Annual Report, 2006). This was reflected in the 2006 operating income as a non-cash goodwill impairment charge resulting in a negative net income value.

compares to its competitors, two sets of statistical tests are completed. The first comparison is done between Costco and Wal-Mart and the second is between Costco and Loblaws.

A two-sample F-Test for variances is carried out to determine whether the population variances being compared are equal or not. The F-test hypotheses are:

$$H_0: \frac{\sigma_1^2}{\sigma_2^2} = 1 \text{ and } H_1: \frac{\sigma_1^2}{\sigma_2^2} > 1 \text{ (or } H_1: \frac{\sigma_2^2}{\sigma_1^2} > 1\text{).}$$

If the F-test results provides enough evidence to reject the null hypothesis, then a Two-Sample t-Test: Assuming Unequal Variances is conducted.

If the F-test results does not provide enough evidence to reject the null hypothesis, then a Two-Sample t-Test: Assuming Equal Variances is conducted.

The t-Tests are used to compare the means of the samples for each key financial performance measure.

Table 3 presents the summary of the test of differences of means for Costco vs. Wal-Mart. Table 3 indicates that Costco demonstrates significant to highly significant larger means for the APT, INVT, PPET ratios than Wal-Mart. Also, Costco's mean C2C ratio is better than Wal-Mart's which is indicative of better supply chain performance. The ROE and ROA ratios respectively demonstrate significant and highly significant results that Wal-Mart is better than Costco. There is not enough evidence to suggest that the means of Costco and Wal-Mart's ART and ROFL ratios differ.

Table 3: Test of Differences of Means - Summary of Costco vs. Wal-Mart

Costco vs. Wal-Mart	Hypotheses	p-value	Significance
Accounts Receivable Turnover	H_0: μ_1-$\mu_2 = 0$	0.4783	-
	H_1: μ_1-$\mu_2 > 0$		
Accounts Payable Turnover	H_0: μ_1-$\mu_2 = 0$	0.0000	**
	H_1: μ_1-$\mu_2 > 0$		
Inventory Turnover	H_0: μ_1-$\mu_2 = 0$	0.0000	**
	H_1: μ_1-$\mu_2 > 0$		
Cash-to-Cash Cycle	H_0: μ_1-$\mu_2 = 0$	0.0000	**
	H_1: μ_1-$\mu_2 < 0$		
Property, Plant & Equipment Turnover	H_0: μ_1-$\mu_2 = 0$	0.0000	**
	H_1: μ_1-$\mu_2 > 0$		
Return on Equity	H_0: μ_1-$\mu_2 = 0$	0.0158	*
	H_1: μ_1-$\mu_2 < 0$		
Return on Assets	H_0: μ_1-$\mu_2 = 0$	0.0002	**
	H_1: μ_1-$\mu_2 < 0$		
Return on Financial Leverage	H_0: μ_1-$\mu_2 = 0$	0.0803	-
	H_1: μ_1-$\mu_2 < 0$		

* p-value < 0.05, significant

** p-value < 0.01, highly significant

\- p-value > 0.05, not significant

Note: p-values are rounded off to the 4th decimal place.

Table 4 presents the summary of the test of differences of means for Costco vs. Loblaws. This Table highlights that Costco displays better ART, APT, PPET, ROE, ROA, and ROFL ratio means than Loblaws with either significant or highly significant results. Loblaws' mean C2C ratio is better than Costco's with highly significant results. There is not enough evidence to suggest that Costco and Loblaws' mean INVT ratios differ.

Table 4: Test of Differences of Means – Summary of Costco vs. Loblaws

Costco vs. Loblaws	**Hypotheses**	**p-value**	**Significance**
Accounts Receivable Turnover	H_0: μ_1-$\mu_2 = 0$	0.0000	**
	H_1: μ_1-$\mu_2 > 0$		
Accounts Payable Turnover	H_0: μ_1-$\mu_2 = 0$	0.0000	**
	H_1: μ_1-$\mu_2 > 0$		
Inventory Turnover	H_0: μ_1-$\mu_2 = 0$	0.0550	-
	H_1: μ_1-$\mu_2 > 0$		
Cash-to-Cash Cycle	H_0: μ_1-$\mu_2 = 0$	0.0002	**
	H_1: μ_1-$\mu_2 > 0$		
Property, Plant & Equipment Turnover	H_0: μ_1-$\mu_2 = 0$	0.0000	**
	H_1: μ_1-$\mu_2 > 0$		
Return on Equity	H_0: μ_1-$\mu_2 = 0$	0.0024	**
	H_1: μ_1-$\mu_2 > 0$		
Return on Assets	H_0: μ_1-$\mu_2 = 0$	0.0008	**
	H_1: μ_1-$\mu_2 > 0$		
Return on Financial Leverage	H_0: μ_1-$\mu_2 = 0$	0.0060	**
	H_1: μ_1-$\mu_2 > 0$		

* p-value < 0.05, significant
** p-value < 0.01, highly significant
\- p-value > 0.05, not significant

To add to the statistical analysis and understanding of Costco's supply chain performance, simple linear regression models are generated, refer to Appendix B. The linear regression identifies the relationship that exists between the company's key financial performance measure over a period of time. The linear regression equation is:

$$y = \alpha + \beta t$$

where time (t) is the independent variable, and the key financial performance measure is the dependent variable.

The linear regression hypotheses are:

$$H_0: \beta = 0 \text{ and } H_1: \beta > 0 \text{ (or } H_1: \beta < 0\text{).}$$

Table 5 is a summary of the linear regressions highlighting the slopes and p-values. Loblaws displays a positive slope for ART, but there is no statistical significance to indicate that it is improving. Loblaws has the most effective slope for APT. Costco and Wal-Mart have a positive INVT slope, but there is no statistical significance to prove that it is improving. The C2C ratio for Wal-Mart presents a highly significant negative slope which as previously mentioned is desirable for a company. Costco presents a highly significant positive slope PPET slope and Wal-Mart presents a significant positive PPET slope. The positive ROE, ROA and ROFL slopes for Costco, describe a trend in the desired direction which suggests increasing levels of supply chain efficiency.

Table 5: Summary of Linear Regression Analysis

Key Financial Performance Measure	**Hypotheses**	**Slope**	**p-value**	**Significance**
Accounts Receivable Turnover				
Costco	H_0: $\beta = 0$ and H_1: $\beta < 0$	-1.6289	0.0224	*
Loblaws	H_0: $\beta = 0$ and H_1: $\beta > 0$	0.0137	0.4870	-
Wal-Mart	H_0: $\beta = 0$ and H_1: $\beta < 0$	-3.4518	0.0001	**
Accounts Payable Turnover				
Costco	H_0: $\beta = 0$ and H_1: $\beta < 0$	-0.0344	0.0584	-
Loblaws	H_0: $\beta = 0$ and H_1: $\beta < 0$	-0.1855	0.0000	**
Wal-Mart	H_0: $\beta = 0$ and H_1: $\beta < 0$	-0.1462	0.0015	**
Inventory Turnover				
Costco	H_0: $\beta = 0$ and H_1: $\beta > 0$	0.0153	0.1174	-
Loblaws	H_0: $\beta = 0$ and H_1: $\beta < 0$	-0.3927	0.0000	**
Wal-Mart	H_0: $\beta = 0$ and H_1: $\beta > 0$	0.03018	0.1582	-
Cash-to-Cash Cycle				
Costco	H_0: $\beta = 0$ and H_1: $\beta < 0$	-0.0146	0.0693	-
Loblaws	H_0: $\beta = 0$ and H_1: $\beta > 0$	0.0427	0.1336	-
Wal-Mart	H_0: $\beta = 0$ and H_1: $\beta < 0$	-0.0890	0.0000	**
Property, Plant & Equipment Turnover				
Costco	H_0: $\beta = 0$ and H_1: $\beta > 0$	0.0650	0.0000	**
Loblaws	H_0: $\beta = 0$ and H_1: $\beta > 0$	0.0179	0.2755	-

Wal-Mart	H_0: $\beta = 0$ and H_1: $\beta > 0$	0.0325	0.0423	*
Return on Equity				
Costco	H_0: $\beta = 0$ and H_1: $\beta > 0$	0.0067	0.0000	**
Loblaws	H_0: $\beta = 0$ and H_1: $\beta < 0$	-0.0043	0.0164	*
Wal-Mart	H_0: $\beta = 0$ and H_1: $\beta < 0$	-0.0031	0.0011	**
Return on Assets				
Costco	H_0: $\beta = 0$ and H_1: $\beta > 0$	0.0010	0.0003	**
Loblaws	H_0: $\beta = 0$ and H_1: $\beta < 0$	-0.0011	0.0451	*
Wal-Mart	H_0: $\beta = 0$ and H_1: $\beta < 0$	-0.0019	0.0000	**
Return on Financial Leverage				
Costco	H_0: $\beta = 0$ and H_1: $\beta > 0$	0.0058	0.0000	**
Loblaws	H_0: $\beta = 0$ and H_1: $\beta < 0$	-0.0032	0.0161	*
Wal-Mart	H_0: $\beta = 0$ and H_1: $\beta < 0$	-0.0012	0.0244	*

* p-value < 0.05, significant

** p-value < 0.01, highly significant

- p-value > 0.05, not significant

Results

The data analysis emphasizes significant trends for Costco, Wal-Mart and Loblaws over the 23-year period. The comparing time series analysis graphs can be used to explain the statistical significance of the linear regressions and t-Tests of each key financial performance measure.

Costco and Wal-Mart's ART display a negative significant and highly significant linear regression slope, respectively. On the other hand, Table 3 shows that the means of Costco and Wal-Mart are not significantly different. Figure 3 proves that over the 23-year period, both companies show a downward trending slope, but the overall trendlines don't vary much from each other. There is not enough evidence to prove that either company's ROE is superior.

The APT linear regression describes a highly significant negative slope for Loblaws and Wal-Mart. Both t-Tests comparing Costco and Loblaws and Costco and Wal-Mart explain that Costco's mean APT is greater than both Loblaws and Wal-Mart. Figure 4 explains these statistical situations. Loblaws and Wal-Mart display an overall downward trending line while Costco displays an overall stable trendline that is superior to both Loblaws and Wal-Mart.

The INVT linear regression describes a highly significant negative slope for Loblaws, which indicates that its INVT ratio is becoming worse over time. In Figure 5, Loblaws demonstrates an overall decrease throughout the 23-year period while Costco remains mostly consistent. More specifically, the Figure indicates that from 1999 to 2007, Loblaws' INVT ratios are greater than Costco's and from 2008 to 2021, Costco's INVT ratios are greater than Loblaws'. To further examine this comparison, two sets of t-Tests of differences of means are performed. The first t-Test compares Costco and Loblaws' INVT from 1999 to 2007. The second t-Test compares Costco and Loblaws' INVT from 2008 to 2021. Table 6 provides a summary of the additional INVT t-Test comparisons. The results given in Table 6 statistically support the trendlines in Figure 5. From 1999 to 2007, Loblaws' presents higher INVT ratios. From 2008 to 2021, Costco presents higher INVT ratios. Both tests have highly significant results. When comparing Loblaws and Costco over the entire 23-year period there is no statistical evidence to prove that Costco's INVT ratios are superior to Loblaws. However, the second set of INVT t-Tests between Costco and Loblaws shows that there is statistical evidence to prove that in the last 14 years, Costco's INVT is superior to Loblaws.

Table 6: INVT Test of Differences of Means - Summary of Costco vs. Loblaws

Inventory Turnover	Hypotheses	p-value	Significance
1999 - 2007	H0: μ_1-μ_2 = 0	1.38E-06	**
	H1: μ_1-μ_2 < 0		
2008 - 2021	H0: μ_1-μ_2 = 0	0.00018	**
	H1: μ_1-μ_2 > 0		

** p-value < 0.01, highly significant

Wal-Mart presents highly significant for both a negative C2C slope and t-Test comparison to Costco. The t-Test comparing Costco and Wal-Mart specifies that Costco's mean C2C ratio is better than Wal-Mart's. Referring to Figure 6, Wal-Mart shows an overall decrease while Costco is more constant throughout the years, but for most years Costco's ratios are lower than Wal-Mart. This provides evidence that Costco's C2C is superior to Wal-Mart's, but Wal-Mart is displaying a desirable downwards trend.

The PPET linear regression portrays a highly significant positive slope for Costco. Table 3 and 4 support the regression model by explaining that Costco's PPET mean is greater than both Loblaws and Costco with high significance. This consistency is further proved in Figure 7.

The ROE linear regression indicates a significant and highly significant negative slope for Loblaws and Wal-Mart, respectively. It also indicates a highly significant positive slope for Costco. The t-Test comparing Loblaws, and Costco reports high statistical significance that Costco's mean ROE is greater than Loblaws'. This consistency is further proved in Figure 8, where Costco has a superior desirable upwards slope. The t-Test comparing Costco and Wal-Mart reports with statistical significance that Costco's mean ROE is less than Wal-Mart's. Figure 8 demonstrates that in most of the earlier years Wal-Mart had a greater ROE while Costco was slowly trending upwards. This provides evidence that Costco's ROE is not superior to Wal-Mart's.

Costco presents a highly significant positive ROA slope while Wal-Mart presents a highly significant negative ROA slope. Table 3 explains that Wal-Mart has a greater mean ROA than Costco with high significance. Figure 9 further provides evidence that Wal-Mart's ROA is superior to Costco, but Costco's ROA is currently trending in a desired upward slope.

Finally, when examining the ROFL linear regression, it is evident that Costco has a highly significant positive slope while Loblaws and Wal-Mart have significant negative slopes.

According to Table 3, there is not enough statistical evidence to prove that either Wal-Mart or Costco's ROFL mean is greater. Table 4 highlights that Costco's ROFL mean is greater than Loblaws' with high significance. Figure 10 justifies both t-Test observations. Costco's ROFL trendline is superior to Loblaws, but is not superior to Wal-Mart.

Discussion

To evaluate Costco's supply chain responsiveness, we have specifically considered the INVT and C2C ratios. The data analysis results explain that Costco's INVT is superior to its competitors, Loblaws and Wal-Mart. Figure 5 shows Costco's ratios to be higher than both its competitors from 2008 to 2021 which is supported by the tests of differences of means. Costco does report higher INVT ratios, but there is no statistical evidence to indicate that its INVT is improving over time. A high INVT ratio contributes to supply chain responsiveness because it suggests that Costco can convert its inventory into sales more often throughout the fiscal year. Costco's INVT creates a competitive advantage over its competitors. The interviews emphasized the concept of a high INVT which is made possible through a lower number of SKUs in the Costco warehouses, approximately 3,800 SKUs. This is seen as an important characteristic of Costco's supply chain strategy.

The data analysis resulted in the understanding that Costco's C2C ratio is superior to Wal-Mart's. Costco doesn't have a significant downward trending slope, but when its C2C mean is compared to Wal-Mart, Costco presents lower values. As discussed previously, a low or negative C2C ratio is favourable. C2C is an effective measure of inventory management because it indicates that Costco is selling its merchandise quickly, implying less handling time. In this case, Costco's C2C creates an advantage over its competitors. Information from the primary data suggests that this advantage can be traced back to the use of cross-docking. The cross docking allows for products to be received and shipped to warehouses in the same day. Majority of merchandise is shipped on a certain type of pallet with height specifications so that it can be sold in the warehouses from the same pallets. This understanding between Costco and its vendors allows for the company to streamline its cross-docking usage. The result is less time between receiving merchandise to the merchandise being sold to customers. Merchandise is being invoiced simultaneously with it being sold.

Costco utilizes lean and agile practices such as JIT and adapting quickly and effectively to customer needs. The information discovered in the interviews support the literature review in this situation. Costco uses JIT to manage its inventory. Inventory replenishment is done by the reordering department. Here, inventory control specialists monitor the inventory levels of each SKU and then reorder as required from the various vendors. The JIT strategy removes the need for Costco to hold any inventory prior to it being shipped to warehouses for sale.

Costco also creates supplier relationships based on the understanding that suppliers will be successful as well. The lower SKU count allows Costco to purchase in larger volumes from its suppliers, which assumes to be beneficial to both suppliers and Costco. Supplier relationships are also selected by the value of products that can be purchased in high volumes at a low cost.

The secondary data analysis explains that the addition of subsidiary companies can help companies to adapt to changing customer needs. In the case of Loblaws acquiring Shoppers Drug Mart, Loblaws was able to diversify its products and services to better serve customer’s needs and realize an increase in sales revenue. Although Costco’s key performance financial measures didn’t indicate significant positive trends as the result of acquisitions, the 2021 annual report provides insight about how Costco best utilizes acquisitions. “We have made and may continue to make investments and acquisitions to improve the speed, accuracy and efficiency of our supply chains and delivery channels” (Costco Annual Report, 2021). Costco strategically manages acquisitions and investments to help develop the quality of its supply chain.

Costco’s corporate strategy is in line with its company mission statement “to continually provide our members with quality goods and services at the lowest possible prices” (Costco Wholesale Corporation, 2022). The conducted interviews indicated that Costco’s code of ethics to carry out its mission statement highlights five main points. The first is to obey the law, second is take care of our members, third is to take care of our employees, fourth is to respect our supplier and fifth is to reward our shareholders. Costco’s supply chain strategy takes into consideration these main points. Costco aims to provide value to its customers with high quality products at a lower price. Costco also respects its suppliers by prioritizing a long-term loyal relationship and emphasizing fairness towards its suppliers. Costco rewards its shareholders by turning a profit. In order for Costco to do so, it must invest in constantly improving supply chain practices.

To understand Costco’s supply chain responsiveness in unexpected circumstances its necessary to evaluate the company’s risk response. Information gathered from interviews support the literature review about the COVID-19 pandemic while also providing new information about Costco’s actions. Costco maintained its methods of cross-docking for domestic freight and JIT inventory throughout the pandemic. Initially, there was a major impact on the JIT inventory due to delays of imported merchandise coming from various overseas countries. There were late shipments of containers which forced Costco to hold some merchandise in storage. To eliminate some of the shipment delays, Costco decided to lease some ships to exclusively bring its own containers that were backlogged in Asia. Moving into steadier times and away from the immediate effects of the pandemic, these changes are correcting themselves. Costco ensures constant communication with its suppliers prior to and especially during unprecedented times.

Theoretical and Managerial Implications

Decision makers aiming to achieve supply chain responsiveness often focus on adopting lean and agile supply chain strategies. The analysis supports the claims and propositions made by earlier researchers that the appropriate application of supply chain practices leads to supply chain responsiveness resulting in improved overall performance. More specifically, this paper indicates some managerial insights about the role of supply chain practices in effective supply chain management.

The research and analysis show that it is necessary to employ multiple supply chain practices together. From 2008 onwards, Costco’s INVT ratios are superior to both Wal-Mart and Loblaws. These higher INVT ratios contribute to Costco’s better C2C ratios, which proved to be superior to Wal-Mart. This is also supported by Costco’s effective use of cross-docking and JIT. The data analysis and results express the importance of having supply chain practices that work together. Costco creates strategic supplier relationships to facilitate cross-docking and JIT inventory which results in a high INVT ratio. This then positively impacts the company’s C2C, measuring the success of its inventory management. In achieving supply chain responsiveness, it is necessary to create an effective balance of lean and agile supply chain strategies.

Another conclusion that has been outlined throughout the research is the importance of aligning the supply chain strategy with the corporate strategy. Costco’s corporate strategy highlights the significance of the mission statement’s code of ethics. Using this code of ethics on how to interact with the most valuable stakeholders allow Costco to prioritize them at every step in the supply chain. The code of ethics ensures that each stakeholder will receive what they desire from Costco. For Costco to effectively achieve this, it must improve the quality of the supply chain. Costco’s equally beneficial agreements with suppliers allow the company to take care of members, respect the suppliers and reward the shareholders. Perfecting supply chain management guarantees that the corporate strategy will be fulfilled.

Limitations and Future Directions

A limitation of this paper is that it mostly focuses on lean and agile supply chain strategies, but not other supply chain practices. There is a possibility that other unidentified practices contribute to evaluation of supply chain responsiveness. Some other practices may be necessary along with the lean and agile practices to achieve effective supply chain responsiveness. To add to this, the research doesn't explore the process of implementing lean and agile strategies. The practices are defined, and evidence is gathered to recognize their presence. However, the steps for implementing or switching to a lean and agile supply chain are not discussed.

Another limitation of this paper is that Costco is compared to Loblaws and Wal-Mart. These competitors were selected due to the nature of the business. Loblaws and Wal-Mart and seen as the top competitors of Costco in Canada. However, it is important to note two limitations with this comparison. First, Wal-Mart and Loblaws sell to individual customers while Costco sells to other businesses as well. Costco's sales in larger volumes may contribute to better turnover ratios. Second, it is possible that the selected competitors are not representative of the entire competitive market. Although other competitors may have insights to provide to this study, Loblaws and Wal-Mart were strategically chosen to compare and contrast Costco's supply chain practices. The data analysis and results yield substantial evidence to draw conclusions about Costco's use of lean and agile supply chains strategies. Therefore, it is expected that the conclusions hold value and a new perspective into the topic.

The findings point to at least two future directions of the research. The first is to explore effective ways on implementing lean and agile supply chain strategies. The research emphasizes the importance of adopting lean and agile strategies to achieve supply chain responsiveness. Investigating the process of implementation may be able to add to the understanding of how leanness and agility support supply chain responsiveness. Recognizing techniques to include in the development of effective supply chain management may indicate how to best align corporate strategy with supply chain strategy.

The second possible future direction of this paper is to extend the research to include a comparison of Costco to other competitors on a global scale. This type of comparison may lead to in-depth insights of supply chain practices and how they are best being used by competitors. Global competitors may also shed light on unidentified practices that may be overlooked by Costco and other companies.

References

Belle, J. V., Valckenaers, P., & Cattrysse, D. (2012). Cross-docking: State of the art. *Omega,* Vol. 40, No. 6, 827-846. DOI: https://www.sciencedirect.com/science/article/pii/S0305048312000060

Benrqya, Y. (2019). Costs and benefits of using cross-docking in the retail supply chain: A case study of an FMCG company. *International Journal of Retail & Distribution Management,* Vol. 47, No. 4, 412-432. DOI: https://www.emerald.com/insight/content/doi/10.1108/IJRDM-07-2018-0119/full/html

Bokhari, S. M. Z. (2015, October 27). Supply Chain News: Here we go again - walmart once again moves to reduce skus counts in stores. *Supply Chain Digest.* [Online] Retrieved from https://www.scdigest.com/ASSETS/ON_TARGET/15-10-27-1.php?CID=9861

Britt, H. (2020, July 29). How the Costco Supply Chain thinks outside the big box. [Online] Retrieved August 13, 2022, from https://www.thomasnet.com/insights/costco-supply-chain/

Buijs, P., Danhof, H. W., & Wortmann, J. H. C. (2016). Just-in-Time Retail Distribution: A Systems Perspective on Cross-Docking. *Journal of Business Logistics,* Vol. 37, No. 3, 213-230. DOI: https://onlinelibrary.wiley.com/doi/abs/10.1111/jbl.12135

Chopra, S., & Meindl, P. (2013). *Supply Chain Management: Strategy, planning, and Operation*. Pearson Education.

Costco Wholesale Corporation. (2022). Welcome to Costco Customer Service. [Online] Retrieved August 15, 2022, from https://customerservice.costco.com/app/home/session/

Costco Wholesale Canada. (2022). The Costco Story. *About us|Costco*. Retrieved August 27, 2022, from https://www.costco.ca/about-us.html

Cuofano, G. (2019, December 2). Business strategy lessons from Costco Business Model. [Online] Retrieved from https://fourweekmba.com/costco-business-model/

Exchange Rates UK. (2022). Canadian dollar to US Dollar Spot Exchange rates for 2022. *Exchange Rates UK*. Retrieved August 27, 2022, from https://www.exchangerates.org.uk/CAD-USD-spot-exchange-rates-history-2022.html

Hobbs, J. E. (2020, April 15). Food supply chains during the COVID-19 pandemic. *Canadian Journal of Agricultural Economics*, Vol. 68, No. 2, 171-176. DOI: https://onlinelibrary.wiley.com/doi/abs/10.1111/cjag.12237

Kannan, V. R., & Tan, K. C. (2005). Just in time, Total Quality Management, and Supply Chain Management: Understanding their linkages and impact on business performance. *Omega*, Vol. 33, No. 2, 153-162. DOI: https://www.sciencedirect.com/science/article/pii/S030504830400060X

Loblaws Inc. (2022). Live Life Well®. *Loblaw Companies Ltd.* Retrieved August 27, 2022, from https://www.loblaw.ca/

Lukić, R. (2012, June). The Effects of Application of Lean Concept in Retail. [Online] Retrieved from https://www.researchgate.net/publication/254449285_The_Effects_of_Application_of_Lean_Concept_in_Retail

Madhani, P. M. (2020, September). Lean Six Sigma Deployment in Retail Industry: Enhancing Competitive Advantages. [Online] Retrieved from https://www.researchgate.net/publication/357577481_Lean_Six_Sigma_Deployment_in_Retail_Industry_Enhancing_Competitive_Advantages

Murray, M. (2019, January 25). Warehouse Logistics: Cross-Docking. *The Balance Small Business.* [Online] Retrieved from https://www.thebalancesmb.com/cross-docking-in-the-warehouse-2221394

Noda, T. (2015, April). Integration of Lean Operation and Pricing Strategy in Retail. [Online] Retrieved from https://www.pomsmeetings.org/confpapers/051/051-0239.pdf

Pantano, E., Pizzi, G., Scarpi, D., & Dennis, C. (2020). Competing during a pandemic? Retailers' ups and downs during the COVID-19 outbreak. *Journal of Business Research*, Vol. 116, 209-213. DOI: https://www.sciencedirect.com/science/article/pii/S0148296320303209

Qrunfleh, S., & Tarafdar, M. (2013). Lean and agile supply chain strategies and supply chain responsiveness: the role of strategic supplier partnership and postponement. *Supply Chain Management*, Vol. 18, No. 6, 571-582. DOI: https://www.emerald.com/insight/content/doi/10.1108/SCM-01-2013-0015/full/html

Singh, A. (2019, December 31). How Costco manages its inventory and Supply Chain. [Online] Retrieved from https://marketrealist.com/2019/12/analyzing-costcos-inventory-supply-chain-management-strategies/

Thier, J. (2020, October 1). Costco CFO keeps close eye on working capital, inventory. [Online] Retrieved from https://www.cfodive.com/news/costco-Richard-Galanti-working-capital-inventory/586169/

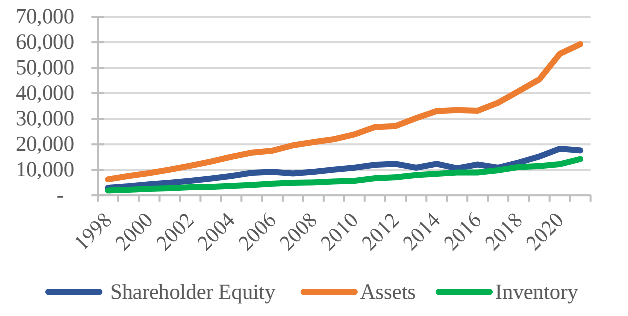
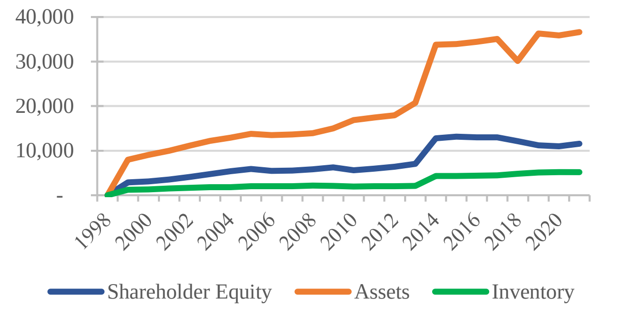
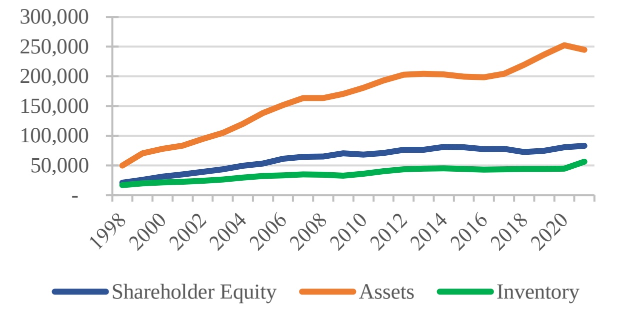
Walmart Inc. (2022). Location facts. *Walmart*. Retrieved August 27, 2022, from https://corporate.walmart.com/about/location-facts

Ward, P., & Zhou, H. (2006). Impact of Information Technology Integration and Lean/Just-In-Time Practices on Lead-Time Performance. *Decision Sciences*, Vol. 37, No. 2, 177-203. DOI: https://onlinelibrary.wiley.com/doi/10.1111/j.1540-5915.2006.00121.x

Appendix A

The graphs depict an overview of the changes in shareholder equity, assets and inventory that were recognized by Costco, Loblaws and Wal-Mart over the 23-year period. These changes are explained in the data analysis section of the paper.

Ending Values (as stated in annual report):

		
Costco	Loblaws	Wal-Mart

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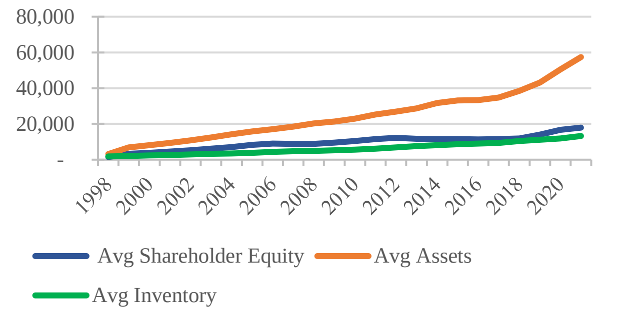	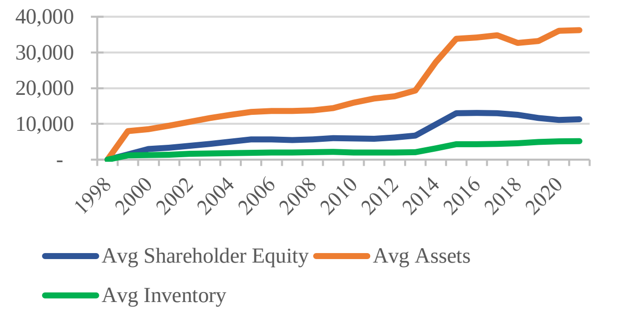	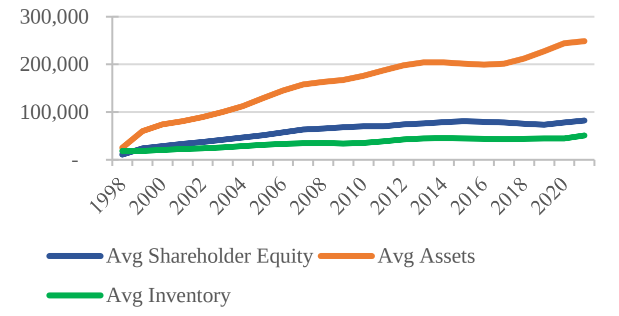
Costco	Loblaws	Wal-Mart

Appendix B

Graphical representation of individual linear regressions.

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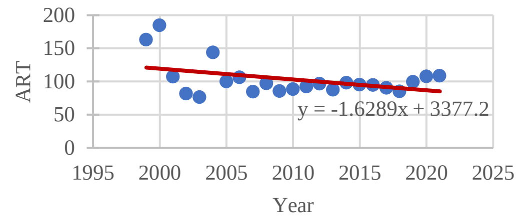
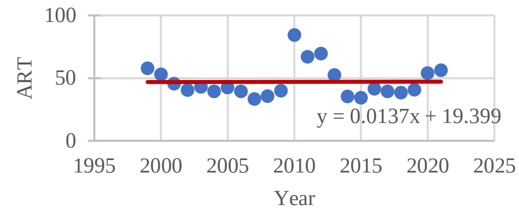
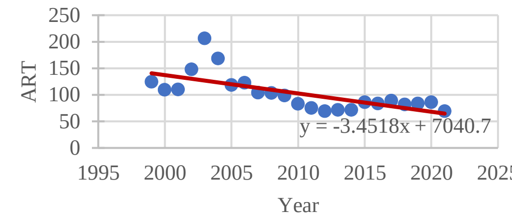
<td></td>
<td></td>
<td></td>
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Accounts Payable Turnover:

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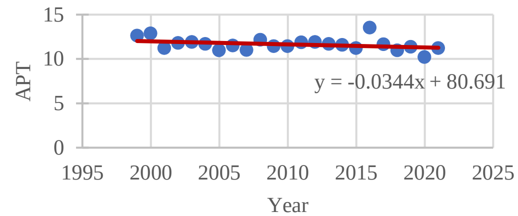
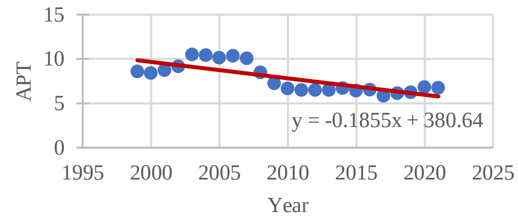
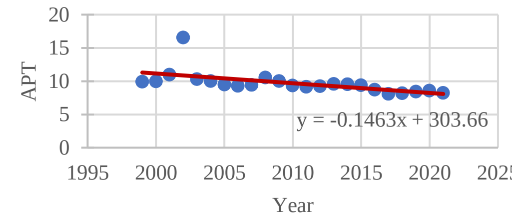
<td></td>
<td></td>
<td></td>
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<tr><td>p-value > 0.05</td><td>β < 0, highly significant</td><td>β < 0, highly significant</td></tr>
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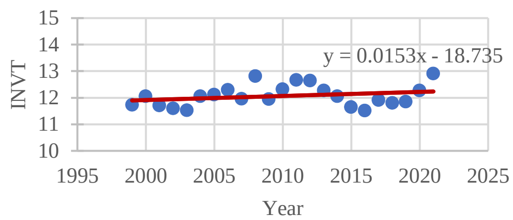
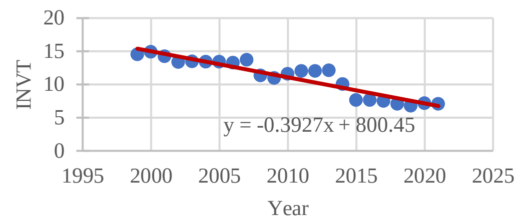
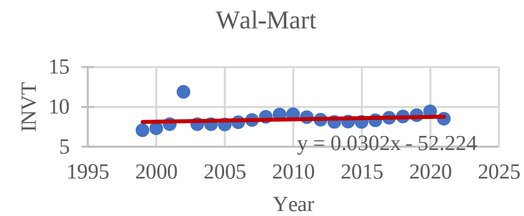
Inventory Turnover: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Costco	Loblaws	Wal-Mart

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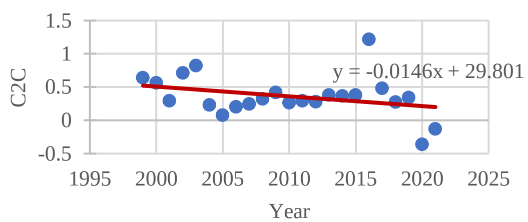
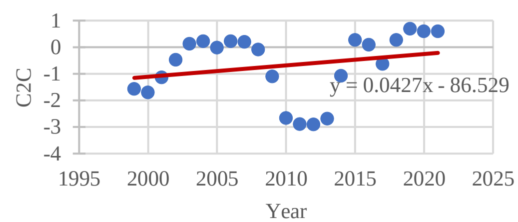
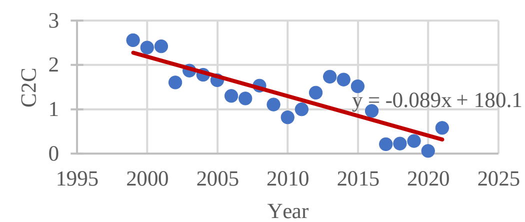
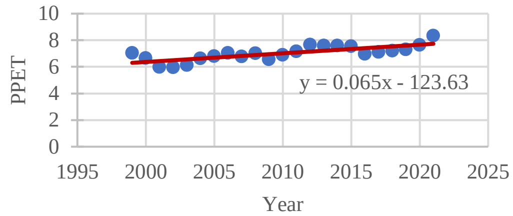
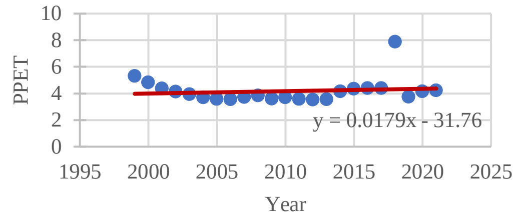
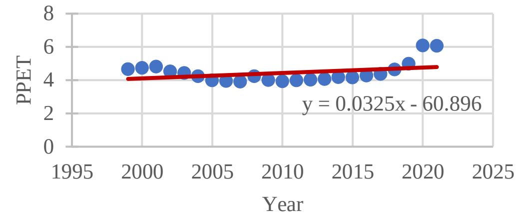
		
p-value > 0.05	p-value > 0.05	β < 0, highly significant
Costco	Loblaws	Wal-Mart

Property, Plant & Equipment: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Costco	Loblaws	Wal-Mart

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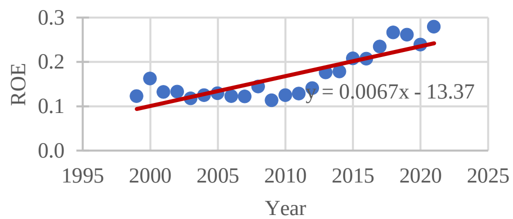	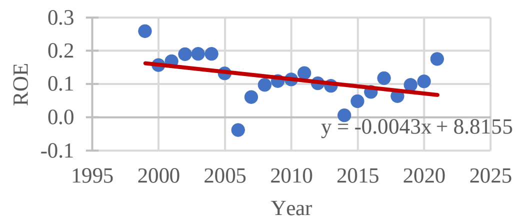	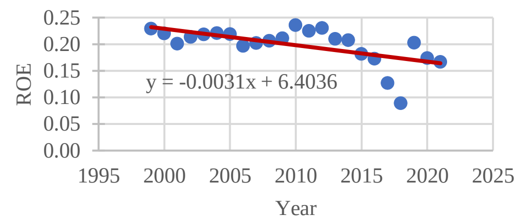
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Costco	Loblaws	Wal-Mart

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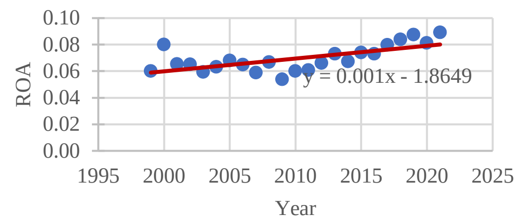
<td>
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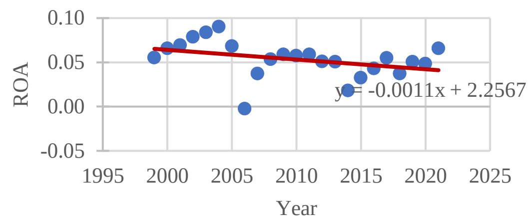
<td>
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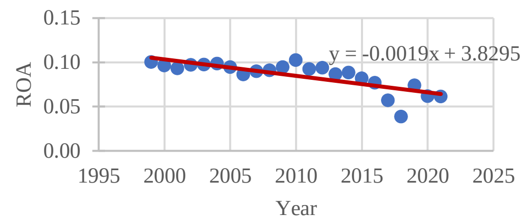
<td>
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Return on Financial Leverage:

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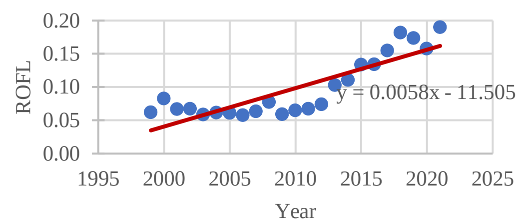
<td>
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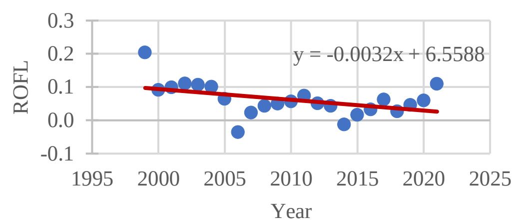
<td>
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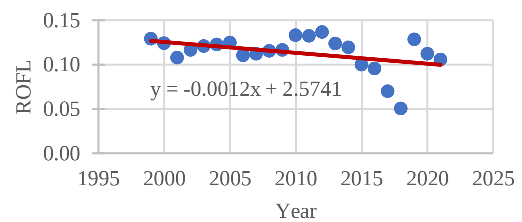
<td>
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<tr><td>Costco</td><td>Loblaws</td><td>Wal-Mart</td></tr>
</table>

Appendix C

Interview questionnaire used in primary data collection. Prior to data collection, interviewee was under the impression that Costco operated vendor-managed inventory. The completion of interviews clarified that Costco operates just-in-time inventory.

1. Please provide your name and job title for the purpose of this interview.
2. How long have you been an employee of *Costco Wholesale*?
3. Have you changed job roles within your employment at *Costco Wholesale*?
4. How would you describe Costco's corporate strategy?
5. Can you describe how Costco manages its inventory?
6. How does Costco manage its inventory? Is it vendor-managed?
    a. If its vendor-managed, do suppliers have access to Costco's real time inventory data?
7. Are you familiar with the concept of cross-docking?
    a. If no, cross-docking will be explained to interviewer as: *cross-docking involves consolidation points where the products are received from suppliers and then directly shipped to corresponding warehouses.*
8. Can you describe how Costco utilizes the concept of cross-docking?
9. Have changes been made to Costco's inventory management since the pandemic?
    a. If yes, what changes have been made Costco's use of cross-docking since the Covid-19 pandemic?
        i. Has Costco been forced to hold some of its inventory?
10. What are the most effective characteristics of Costco's supply chain strategy?
11. What does Costco prioritize most when developing supplier relationships? Trust? Long-term? Low prices? Ability to vendor-manage? Loyalty?
12. Please describe the nature of the contracts that are drawn between Costco and its suppliers.
    a. What clauses are involved to ensure that Costco is paid for its merchandise before paying suppliers.
13. What protocols and procedures do suppliers have to follow in order for their merchandise to be prepared for cross-docking?
    a. Do the vendors have to set up their merchandise in a particular way so that Costco has less contact with the product?
    b. How do vendors deliver their goods to Costco?
    c. How do vendors replenish their stock? So does Costco know or communicate with vendors in order to for the vendors to know to replenish their stock?
14. Can you please provide contact information for other employees who can take part in this interview?
15. Do you have any questions or further comments that you would like to provide?

Appendix D

Summary of the interview participants. The table provides information of the respondents' role within Costco's Distribution Center.

	Job Title	Principal Responsibilities	Years of Employment
1	General Manager	- Oversee daily operations - Manage budgets and improve expenses - Manage individual departments	27
2	Gatehouse Clerk	- Receiver of merchandise - Manage the inbound and outbound trucks	32
3	Runner	- Offload merchandise from inbound trucks and move it to shipping lanes	25
4	Sorter	- Sort merchandise from LTL[1] trucks to fulfill warehouse inventory demands	7
5	Shipper	- Move merchandise from shipping lanes - Load the outbound trucks for designated warehouses	1

[1] LTL refers to less-than-truckload shipments