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Original Article

Supply Chain Responsiveness in the Internet Retailing Industry: Applying the Supply Chain Responsiveness Ratio

[1]Kevin Forehand, [2]Juan Roman, [3]Thomas Schaefer
[1]*Department of Business Administration, American Public University, United States.*
[2]*Department of Business Administration, Daytona State College, United States.*
[3]*Department of Business and Technology, Chipola College, United States.*

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Abstract: *The importance of supply chain responsiveness in retailing is significant. The COVID-19 pandemic demonstrated how issues within the supply chain can negatively impact retailers of all sizes and in all areas of the retail industry. The current body of literature lacks an overall theoretical framework and does not explore supply chain responsiveness measurement and comprehension enough. In order to evaluate the supply chain responsiveness ratio for the chosen firms in the Internet retail industry from 2004 to 2020, this article will investigate the relationship between supply chain responsiveness and the developed supply chain responsiveness ratio. It was discovered through multiple regressions that the supply chain responsiveness ratio has predictive value of supply chain responsiveness of supply chain responsiveness p< .05, indicating that supply chain responsiveness can be utilized as an indication of organizational responsiveness in the Internet retail industry.*

Keywords*: Supply Chain Responsiveness, COVID-19, Internet Retail.*

I. INTRODUCTION

Supply chain responsiveness (SCR) is critical in retailing. The COVID-19 pandemic demonstrated how issues within the supply chain can negatively impact retailers of all sizes. For example, food supply chains were significantly altered due to the global COVID-19 pandemic (Charlebois et al., 2021). The supply chain impact was felt in all aeras of the retail industry, whether the retailer was online or brick and mortar, and regardless of if the retailer was a small mom and pop company or a mega retailer like Walmart or Amazon.

According to Handfield and Bechtel (2002), increased supply chain responsiveness is positively correlated with buyer dependence, supplier human asset investments, and confidence. According to Williams, et al. (2013), a supply chain organization's internal integration competence offered the complementary information processing skills necessary to produce the desired responsiveness from improved supply chain visibility. For a return on investment in the form of increased flexibility and more consistent and timely deliveries, supply chain managers should concentrate on integration inside the supply chain, first internally and then externally (Fuentes, et al., and 2016).

Gilal et al. (2017) conducted research that demonstrated SCR mediated the relationship between supply chain management practises and product development. They also found that organisational structure moderated the mediation for supply chain management practises and supply chain responsiveness, but not for supply chain responsiveness and product development. According to Sandberg and Jafari (2018), there are concerns about how comprehensive established models of responsiveness are. They also made the case that the general literature on supply chain responsiveness currently in existence offers little direction or structure for the particular role and involvement of retailers in the supply chain. The role supplier's play in the use of IT, inventory management, and coordination are the key factors in the retail supply chain's responsiveness, according to Rana (2019), who also found that an agile supply chain strategy moderates the relationship between suppliers' roles and IT use in relation to retail supply chain responsiveness.

Despite advances in the literature, more research is still recommended in the areas of supply chain responsiveness and its impact on firm financial performance because operational costs, cost of goods sold, and accounts payable are related (Sandberg & Jafari, 2018). The current body of literature lacks a comprehensive theoretical framework and insufficient exploration for measuring and comprehending actual supply chain responsiveness (Richey et al., 2022).

This study will be the first to address how responsiveness of the supply chain affects business success in the online retail sector. This essay aims to assess the evolved SCRs ratio for the chosen organisations in the Internet retail sector from 2004 to 2020, as well as the relationship between supply chain responsiveness and it.

II. LITERATURE REVIEW

There may be multiple organisations involved in the supply chain process. Supply chain management (SCM) encompasses the transportation and storage of raw materials, inventory of work-in-progress, and finished goods from the point of origin to the site of consumption, as shown by previous study (Singh & Raghuvanshi, 2014). In retailing, SCR is essential. This still holds true in the context of online or Internet retailing. Retailers are aware of the supply chain's strategic importance because it provides them with a competitive edge (Singh & Raghuvanshi, 2014). It is crucial for the retail sector to increase distribution efficiency and continue to be responsive to client needs. This paper aims to be the first step in filling the empirical research gap in the domain of supply chain responsiveness and its impact on firm financial performance in Internet retailing. As a result of the COVID-19 global pandemic, supply chain responsiveness and organisational performance have been difficult across most sectors and industries.

A) Consumer Purchases and Satisfaction

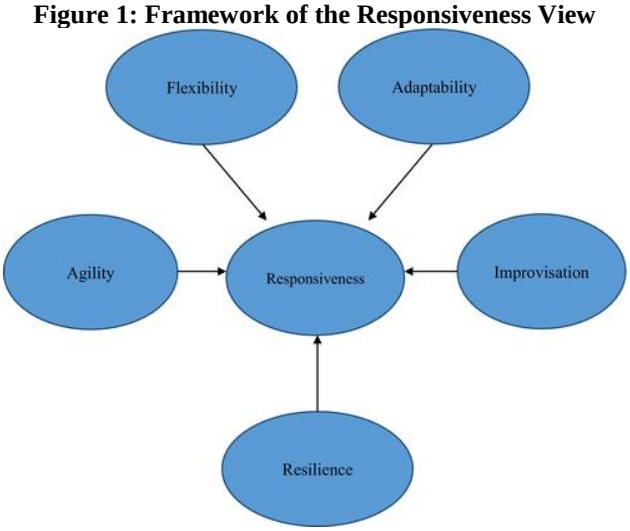
Consumers shop for products to satisfy both needs and wants. In terms of consumer behavior and many other aspects of our daily lives, the COVID-19 pandemic has changed the world (Milakovic, 2021). The pandemic has altered how consumers shop, meaning many items often purchased from a brick-and-mortar store were ordered online through an Internet retailer's site for home delivery. Milakovic (2021) claims that the COVID-19 pandemic can be viewed as an unfavourable environment that renders people vulnerable or resilient, which in turn affects how they make purchasing decisions. According to Milakovic (2021), research findings on consumer resilience show that resilience is a crucial consideration when making purchases during tumultuous times, which obviously includes a global pandemic. Additionally, a greater incapacity to make a transaction has a negative impact on consumer purchase satisfaction. As a result, the effect of purchase capacity on repurchase intention is moderated by purchase satisfaction. Finally, Adabayo (2022) asserts that there is a strong correlation between the operational responsiveness of reverse logistics in retailing and consumer happiness. Results showed that customer satisfaction is highly influenced by operational responsiveness in the reverse logistics process. Therefore, one can postulate that a similar relationship can be associated with supply chain responsiveness in Internet retailing.

B) Supply Chain Responsiveness (SCR)

When examining SCR, one should consider this as a function of an organization's ability to deliver their product to the end user (Sandberg & Jafari, 2018). Therefore, one must assume an Internet retailer must strategically make a strong effort to maintain a robust and responsive supply chain. Charlebois et al., (2021) concluded, no matter the company location, their part in e-commerce needs to be strategic and responsive. The opportunity and need for clear and attentive e-commerce planning is vital. With that said, questions persist as to whether established SCR models provide the guidance necessary in the Internet retail industry. As previously mentioned, Sandberg and Jafari (2018) challenge the thoroughness of recognised models for responsiveness and contend that the general literature on supply chain responsiveness currently in existence offers little direction and structure to retailers' particular role and involvement in the field.

According to Richey et al. (2022), the idea of responsiveness appears simple at first. According to Richey et al. (2022), responsiveness is anchored in organisational changes undertaken by individual organisations within a supply chain to reposition the supply chain and its members in a favourable position to generate customer value. A conceptual foundation for the responsiveness approach is shown in Figure 1:

Figure 1: Framework of the Responsiveness View



Source: *Richey et al (2022)*

The responsiveness approach of logistics and supply chain management is still a relatively new concept, according to Richey et al. (2022), who argue that it will assist anchor future research and give academics a tangible and measurable consequence that can be simply articulated in terms of practicality. In light of the foregoing, the aim of this new study is to address three important concerns pertaining to supply chain operations and supply chain responsiveness in the online retail sector.

III. METHOD

The supply chain efficiency model developed by Forehand et al., (2021) is the foundation for a supply chain responsiveness (SCRs) model. Forehand et al.'s (2021) model was the first attempt to quantify supply chain efficiency from an external users' perspective. Models quantifying supply chain responsiveness are limited, although several theoretical articles have been written on the topic. In addition, empirical research on the impact of COVID-19 on global supply chains is urgently needed along with contemporary assessments of supply chain operations in the Internet retail industry.

Forehand et al.'s (2021) supply chain efficiency model provided impressive results but lack a solid theoretical foundation. By tying the ratio to the Supply Chain Operations Reference (SCOR) metrics, the de facto industry standard for supply chain measurement, the SCRs model seeks to strengthen the theoretical foundations of supply chain efficiency models. The SCOR measures were developed in 1996 by the PRTM management company. The measurements were subsequently adopted as supply chain efficiency indicators by the Supply-Chain Council and the Association for Supply Chain Management (APICS).

One of the criteria in the SCOR metrics is supply chain responsiveness, which is the focus of this investigation. The SCOR metrics have become a cornerstone of supply chain literature. As such this investigation looks to contribute to the scarce literature on supply chain responsiveness models and extend the analyses begun by Forehand et al. (2021) on supply chain efficiency by developing a Supply Chain Responsiveness (SCRs) ratio based on the SCOR metrics,

The SCRs ratio makes an important contribution to the existing supply chain literature by providing a measurement tool of supply chain efficiency to the external analyst. A shortcoming of the SCOR metrics is that it's focused on internal stakeholders. Therefore, many of the data inputs (i.e., which are confidential and privileged) needed to assess supply chain efficiency are not available to external users (e.g., academics, auditors, government officials, investors, etc.). The SCRs model addresses this flaw by using publicly available information from organizational financial statements as the inputs for the ratio. The model ties accounts found in the varying financial statements that have an impact on the supply chain to develop an indicator on responsiveness.

The SCOR variables are an extension of indicators on the management of assets, costs, flexibility, reliability, and responsiveness. The responsiveness metric, which is the focus of this investigation, has an association with the following accounts: operational expenses, cost of goods sold, and accounts payable. The Supply Chain Responsiveness variables can be organized into the following function:

$$f = (Operational\ Expense, Cost\ of\ Goods\ Sold, Accounts\ Payable)$$

Taking the SCOR Level 1 Metric for responsiveness as a foundation in conjunction with Forehand et al.'s (2021) Supply Chain Efficiency (SCE) model, the process output (i.e., days sales in inventory ratio) and process input (i.e., days payable outstanding) variables can be identified. SCRs ratio results will also shed light on the level of organizational responsiveness to customer demands. The SCRs formulae is detailed on below Table 1.

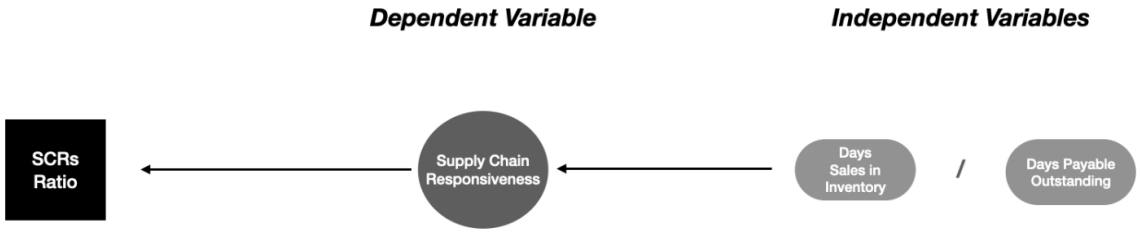
Table 1: Supply Chain Operations Reference (SCOR) Responsiveness Metrics

Attribute	Performance Attribute Definition	Level 1 Metric	Chart of Accounts	Ratio	Financial Statement
Supply Chain Responsiveness	The velocity at which a supply chain provides products to the customer.	Order Fulfillment Lead Times	Operational Expenses Cost of Goods Sold Accounts Payable	Days Sales in Inventory / Days Payable Outstanding	Income Statement Balance Sheet

Source: *Supply Chain Council (2017).*

The conceptual map of the SCRs ratio is presented in Figure 2. The map details the model variables along with the relationship and estimate.

Figure 2: SCRs Ratio



Source: *Authors Research Model,* Conceptual map of the SCRs Ratio.

The SCRs ratio's interpretation is the opposite of the SCE model. A high SCE ratio result suggests increased levels of supply chain efficiency. However, lower SCR ratios suggest better supply chain responsiveness. The divergence in interpretation is due to how inventory and payables are the core of determining the SCRs ratio and supply chain responsiveness. In practical terms, lower levels of inventory and times between payment receivables are seen as favorable from the company's perspective. As such, low SCRs figures indicate the company can deliver their product to the consumer in timely fashion.

A) Research Questions

RQ1: What connection exists between the SCRs ratio and supply chain responsiveness?

RQ2: Is there a statistically significant difference in each company's supply chain responsiveness for the period between 2004 and 2020 according to the SCRs ratio?

B) Research Hypothesis

Null Hypothesis ($H1_o$): There is no statistically significant relationship between Supply Chain Responsiveness and the SCRs ratio.

Null Hypothesis ($H2_o$): There are no statistically significant difference in supply chain responsiveness based on the SCRs ratio for the 2004 – 2020 time frame for each company analyzed.

The objective of this study is to further the work on supply chain efficiency begun by Forehand et al. (2021). The aim is to solidify the theoretical foundations of the supply chain responsiveness ratio by tying to the SCOR metrics. The contribution of this study to the supply chain literature is to determine if the SCRs ratio is a suitable predictor of supply chain responsiveness. Information gathered and used in the ratio are publicly available and found in various corporate reports (e.g., annual reports, 10-k, 20-F, etc.). The ease of data access is useful for results testing and validation along with conducting analysis by combining the independent variables.

The SCRs ratio's resulting score allows for cross-sector, cross-industry, and comparative analysis, akin to those used in financial ratio analysis. Multiple regression was used to establish hypothesis significance along with categorical scrutiny of the ratio results and predictors. Research data from corporate reports for each assessed company were gathered and codified using MS Excel® 2010 with the SCRs ratio serving as the research instruments.

The regression model used the three financial indicators needed for the SCRs ratio with a .05 significance for the used time intervals. The research instrument looks to measure the independent variables along the time span used for each company. Biases were minimal due to the secondary nature and public available sources of the data. Research objectivity was maintained throughout the process.

IV. RESULTS

Hypothesis 1 examines if there is a statistically significant relationship between supply chain responsiveness and the SCRs ratio. Multiple regression was used to test the hypothesis and evaluate the validity of the SCRs ratios results. The results of the model suggest the SCRs ratio is an adequate predictor of supply chain responsiveness in the Internet retail industry. Hypothesis testing indicates a p-value of less than 0.05 suggesting the statistical significance of the results and the rejection of the first null hypothesis.

Identifying whether there is there a statistically significant difference in supply chain responsiveness based on the SCRs ratio for the 2004 – 2020 time frame for each company analyzed was Hypothesis 2. Model results suggest a statistically significant link among the SCRs ratio variables for the examined time frame. Hypothesis test results show a p-value of less than 0.05 suggesting a rejection of the second null hypothesis.

Table 2: Regression Results for the Investigation's Hypotheses

	Variables	Coefficients	t Stat	P-value	F-value	R Square	H1	H2
Amazon.com, Inc.	Days Sales in Inventory	0.04136822	22.9179092	4.5217E-07	483.32	0.9938	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.06481566	-29.0553745	1.1012E-07				
Alibaba Group Holding Limited	Days Sales in Inventory	0.06853536	4.0510569	0.01546224	13.82	0.8736	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.22363813	-5.05644107	0.00719848				
JD.com, Inc.	Days Sales in Inventory	-0.00016891	-1.39866479	0.00022078	13.91	0.8477	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.00037458	-2.56417781	0.00503902				
Pinduoduo Inc.	Days Sales in Inventory	0.0822783	13.0825339	0.04856737	356.70	0.9986	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.58420121	-6.70469671	0.00942565				
Sea Limited	Days Sales in Inventory	0.04331849	7.26129584	0.01844278	28.23	0.9658	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.01030469	-3.53224522	0.00716426				
MercadoLibre, Inc.	Days Sales in Inventory	0.14706538	21.1497736	2.9316E-10	228.29	0.9765	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-3.8919E-05	-18.5744796	1.1796E-09				
Coupang, Inc.	Days Sales in Inventory	Not enough data for regression model to generate results.						
	Days Payable Outstanding							
eBay Inc.	Days Sales in Inventory	0.02229914	90.3815923	8.9841E-08	4401.49	0.9995	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.03908623	-58.4474763	5.1315E-07				
Chewy, Inc.	Days Sales in Inventory	Not enough data for regression model to generate results.						
	Days Payable Outstanding							
Etsy, Inc.	Days Sales in Inventory	0.03319398	2.35101534	0.00078428	13.64	0.8722	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.02975803	-3.48779897	0.02517307				
Vipshop Holdings Limited	Days Sales in Inventory	0.00989781	8.37904448	0.00015724	35.55	0.9222	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.28872109	-3.25293995	0.01740208				
Wayfair Inc.	Days Sales in Inventory	0.07840284	18.037499	0.0030595	979.87	0.9990	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.08989197	-39.57372	0.00063793				
Carvana Co.	Days Sales in Inventory	0.26859115	5.26654145	0.03421405	50.47	0.9806	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-6.00038303	-5.18533665	0.03523764				
Global-e Online Ltd.	Days Sales in Inventory	Not enough data for regression model to generate results.						
	Days Payable Outstanding							
Farfetch Limited	Days Sales in Inventory	-0.00998252	-0.35010301	0.00078561	15.01	0.9678	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.31416934	-2.45245623	0.00246482				
Dada Nexus Limited	Days Sales in Inventory	Not enough data for regression model to generate results.						
	Days Payable Outstanding							
Revolve Group, Inc.	Days Sales in Inventory	Not enough data for regression model to generate results.						
	Days Payable Outstanding							
Poshmark, Inc.	Days Sales in Inventory	Not enough data for regression model to generate results.						
	Days Payable Outstanding							
Baozun Inc.	Days Sales in Inventory	0.0098825	1.45495653	0.00219374	39.04	0.9513	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.01105379	-8.06996785	0.00128075				
Jumia Technologies AG	Days Sales in Inventory	Not enough data for regression model to generate results.						
	Days Payable Outstanding							
Liquidity Services, Inc.	Days Sales in Inventory	0.09371065	8.58324008	1.2562E-05	46.76	0.9122	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.22747949	-8.80027092	1.0255E-05				
CarParts.com, Inc.	Days Sales in Inventory	0.08161433	9.49964472	1.7574E-07	45.13	0.8657	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.47256614	-5.33523012	0.00010523				
Qurate Retail, Inc.	Days Sales in Inventory	0.00140402	8.06600332	0.00019439	84.30	0.9656	Null hypothesis is rejected	Null hypothesis is rejected
	Days Payable Outstanding	-0.00126172	-9.1751791	9.4419E-05				

Source: *Author's Computation, Results of the Regression Model.*

V. DISCUSSION

A) Interpretation of SCRs Ratio Results

SCRs ratio results suggest a relationship between supply chain responsiveness and the models results. Correlations of model variables indicate the SCRs ratio may function as an indicator of supply chain responsiveness. Model results suggest SCRs differences based on corporate life span and country of origin. For instance, corporations with a year of inception after 2017 did not have enough data for the regression model to assess the accuracy of the ratio results. In addition, ratio results for those companies outside of the United States and whose main consumers are not U.S.-based diverged from the results of U.S.-based corporations.

These results suggest supply chain responsiveness may be associated with corporate location and market preference. Financial reporting differences among U.S.-based and foreign corporations may also have an impact on ratio results. Model findings are consistent with the literature on supply chain responsiveness and international financial reporting of multinational corporations, which suggest proximity to supply chain components and consumers tend to increase business responsiveness. The divergence of financial reporting standards across countries correlates with difficulties in effective cross-business analysis (Dvořák & Vašek, 2015).

Table 3: ***SCRs Ratios for Internet Retail Companies***

Year	Amazon.com, Inc.	Alibaba Group Holding Limited	JD.com, Inc.	Pinduoduo Inc.	Sea Limited	MercadoLibre, Inc.	Coupang, Inc.	eBay Inc.	Chewy, Inc.	Etsy, Inc.	Vipshop Holdings Limited	Wayfair Inc.	Carvana Co.	Global-e Online Ltd.	Farfetch Limited	Dada Nexus Limited	Revolve Group, Inc.	Poshmark, Inc.	Baozun Inc.	Jumia Technologies AG	Liquidity Services, Inc.	CarParts.com, Inc.	Qurate Retail, Inc.	Industry Ratio
2020	0.9765	3.5839	8.7851	0.1740	0.3488	1.4890	16.2960	2.6484	4.1687	1.0000	9.5979	0.5421	15.1902	6.4126	0.6838	0.0134	21.2899	0.7794	0.4819	0.6046	0.9521	15.7801	0.8849	4.8993
2019	1.0047	4.7274	5.8936	0.2212	0.3506	0.1875	-	1.8980	4.5315	1.0000	1.8666	0.7175	16.0986	-	0.6667	-	20.4676	0.4609	0.4620	0.6444	1.3794	15.9672	0.7826	3.9664
2018	1.1064	11.7969	3.1210	3.2217	0.2974	0.1131	-	1.9076	-	0.7104	1.1835	0.8380	13.5456	-	3.6796	-	19.1531	-	0.3920	0.7236	1.8738	16.7592	0.8102	4.5130
2017	1.2683	15.0602	2.1726	10.8195	0.1417	0.0681	-	1.8019	-	0.5981	1.6590	0.8165	20.8593	-	19.2855	-	-	-	0.4058	-	2.2023	18.3290	0.7841	6.0170
2016	1.4703	8.4658	2.0320	-	0.1125	0.0246	-	1.8893	-	0.7003	3.6314	0.9705	-	-	-	-	-	-	0.6532	-	3.2099	14.0405	0.7154	2.9166
2015	1.5407	3.6649	3.0791	-	-	0.0003	-	1.8064	-	0.7765	16.1938	-	-	-	-	-	-	-	0.9707	-	3.7296	14.1446	0.7660	4.2430
2014	1.5136	2.5686	6.3229	-	-	0.0003	-	1.7467	-	0.6864	30.2449	-	-	-	-	-	-	-	1.0565	-	2.3448	10.6717	0.8778	5.2758
2013	1.5659	-	12.7192	-	-	0.0003	-	-	-	-	41.2194	-	-	-	-	-	-	-	-	-	1.2332	6.3975	0.9121	9.1497
2012	1.5800	-	-	-	-	0.0007	-	-	-	-	19.1816	-	-	-	-	-	-	-	-	-	1.6042	6.1859	0.9209	4.9122
2011	-	-	-	-	-	0.0011	-	-	-	-	16.8027	-	-	-	-	-	-	-	-	-	2.3933	6.2676	-	6.3661
2010	-	-	-	-	-	0.0016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2.7990	6.5197	-	3.1068
2009	-	-	-	-	-	0.0024	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3.3655	7.1946	-	3.5208
2008	-	-	-	-	-	0.0026	-	-	-	-	-	-	-	-	-	-	-	-	-	-		5.1880	-	2.5953
2007	-	-	-	-	-	0.0022	-	-	-	-	-	-	-	-	-	-	-	-	-	-		3.5090	-	1.7556
2006	-	-	-	-	-	0.0012	-	-	-	-	-	-	-	-	-	-	-	-	-	-		3.0190	-	1.5101
2005	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-		1.1603	-	1.1603
2004	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-		1.0229	-	1.0229
2003	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	
2002	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	
2001	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	
2000	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	
Average	1.3363	7.1240	5.5157	3.6091	0.2502	0.1263	16.2960	1.9569	4.3501	0.7817	14.1581	0.7769	16.4234	6.4126	6.0789	0.0134	20.3035	0.6202	0.6317	0.6575	2.2573	8.9504	0.8282	3.9371

Source: *Author's computation, 2023 underlying data from Field Survey*.

Ratio results for each company within the examined period reveal no negative SCRs ratios, which suggest each company has a functional level of supply chain responsiveness. Model figures also imply companies had higher SCRs ratios at the startup and growth phase of operations. However, as years passed their SCRs ratios declined or stabilized, which suggests newer companies have greater operational responsiveness. Mergers and acquisitions (M&A) tended to drastically increase a company's SCRs ratio. The added resources and operational capacity of M&As increased business responsiveness.

In 2020, all companies had significant changes in their SCRs ratios, although no discernable pattern of increase or decrease in the ratio was detected. Amazon had the most stable SCRs ratio of the examined companies. The changes in SCRs ratio scores suggest the COVID-19 epidemic may not have had a significant impact on supply chain responsiveness. Although the degree of impact on the supply chain's responsiveness was likely dependent on the product each company offered and the complexity of moving the product along the supply chain.

As a result of the Internet retail industry being comprised of companies with a wide array of offerings, we posit that the SCRs ratio for this industry is dependent on the company's life cycle, and to a lesser degree product type. For instance, Amazon's offerings (e.g., traditional retail items) differ greatly from Carvana's products (i.e., automobiles), as such the responsiveness of each companies supply chain is expected to vary greatly, even though both companies are part of the same industry and technically direct competitors. These findings indicate that the intricacies of product along with the organization's inventory method and flexibility in providing credit sales are associated with the supply chain's responsiveness.

B) Discussion of SCRs Results in the Internet Retail Industry

All companies had positive SCRs ratios during the assessed years. Ratio results diverged greatly between companies. SCRs ratios for some companies oscillated between 0 and 2, whilst others ranged from 10 to 40. A close examination of each company's results suggests the differing supply chain responsiveness scores are likely related to the companies' stage in their life cycle along with contrasting supply chains.

In addition, those companies that were in an aggressive growth phase and had higher inventory levels along with extended times between payment receivables fell in the higher end of the SCRs scores, whilst those companies that experienced steady figures had more stable SCRs results. All these data points suggest that a company's supply chain responsiveness may be linked to their core business, stage in the life cycle, inventory management practices, and ability to accept purchases with delayed customer payments.

For instance, companies in the apparel business tended to have higher SCRs ratios than those involved in other products. Revolve Group Inc. had over 20% growth year-over-year from 2018 through 2020. The company has an SCRs ratio between 19 and 21. The company is in the growth stage with their IPO being in 2019 (Revolve Group Inc., 2021). Farfetch Limited is another growth company (e.g., 55% sales growth in 2017) whose core business is apparel and had an average SCRs ratio double the industry average (Farfetch Limited, 2021).

Companies involved in automotive retail also tended to have higher SCRs ratio. For example, Car Parts.com, Inc. had average sales growth year-over-year from 2014 to 2019 in excess of 15%. In addition, they purchased AutoMD in 2017, thereby increasing their capacity (Car Parts.com, 2019). Carvana Co. is another example of a growth company in the automotive retail business with consistent double-digit growth (Carvana, 2020). The automotive retail business is known for its unique inventory management and payment practices, which as previously noted have a direct impact on supply chain responsiveness.

High SCRs scores were also seen in companies in the growth phase that employ a direct-to-consumer business model. For instance, Vishop Holdings had an average year-to-year growth rate of 120% from 2013 through 2016 (Vishop Holdings Limited, 2019). Pinduoduo was also a company that experienced triple digit sales growth in 2018 (Pinduoduo Annual Report, 2020). These findings suggest that a company's supply chain responsiveness may be linked to their stage in the life cycle, regardless of the corporate product. An examination of the life cycle model supports the notion that as businesses mature there is a learning curve to ascertaining their optimal inventory method and establishing their industry footprint (i.e., which impacts their ability to generate credit sales) that likely has a direct impact on supply chain responsiveness.

Supply chain responsiveness is a function of an organization's ability to deliver their product to the end user (Sandberg & Jafari, 2018). Responsiveness in the supply chain is likely strengthened by a business ability to manage their inventory and provide credit sales. The COVID-19 pandemic affected business performance across all levels. However, the pandemic may not have had as strong an impact on supply chain responsiveness given the lack of a significant trend in SCRs results for 2020. SCRs results for each company tended to follow the trajectory established in prior years and appeared to be associated to the stage in the life cycle. These findings are consistent with past research on inventory and credit sales management, which attribute success to efficiencies in managerial decision making rather than exogenous variables (Konstantaras et al., 2021; Liu et al., 2018; Lawrence, 2014; Ahmadi Javid & Azad, 2010).

VI. CONCLUSION

In conclusion, associations between SCR ratings and supply chain responsiveness were discovered. The results of this study offer quantitative justification for how supply chain responsiveness or a lack thereof affects the online retail sector. Results from the SCRs ratio specifically shed information on how responsively an organisation is to consumer demands. SCR insufficiency can be linked to both operational news about Internet retailers and released financial reports. Furthermore, the use of the SCR model shows that the supply chain is responsive. Although the companies in this study did well overall, the use of the SCR model can also show that a supply chain is unresponsive. According to the study's findings, Amazon's supply chain responded well to the COVID-19 global pandemic in 2020. Wayfair and Poshmark were two additional well-known online merchants that performed higher in terms of response. Based on their respective SCR model scores for 2020, we have come to this conclusion. Therefore, it can be said that for the period under study, the company's supply chains operated in a responsive manner in the Internet retail sector.

More studies on supply chain responsiveness using the SCRs ratio are needed to validate the model. Investigation results indicate that analysts and academics can use the SCRs ratio as a reliable metric for supply chain responsiveness in other markets and industries. Additional research on supply chain responsiveness and its association to business performance is needed to enrich the literature. This investigation is the first attempt to develop a measurement tool of supply chain responsiveness for any user along with the first study on supply chain responsiveness in the Internet retail industry pre- and post-COVID-19. The study expands the work on supply chain efficiencies pre- and post-COVID-19 begun by Forehand et al. (2021) by tying the SCRs ratio to SCOR metrics. Nonetheless, we recommended additional research on how the COVID-19 pandemic impacted global supply chains to fully gauge its impact on the global economy.

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