

The Determinants of The Cash Conversion Cycle Of Public Firms In Pakistan

Mohsin Mustafa (Corresponding Author)

Newhuawdu Business School, University: Minjiang University

Email: mmmwarraich@gmail.com

Zunara Farid

Management Sciences, University PMAS Arid Agriculture University Barani
Institute Burewala

Email: zunaira.farid@baraniinstitute.edu.pk

Naveed Khan

Ph.D. Scholar, Department: Hailey College of Banking & Finance, University:
University of the Punjab

Email: naveedsaldera@gmail.com

Abstract

This study investigates the determinants of the cash conversion cycle (CCC) among public firms listed on the Pakistan Stock Exchange (PSX). Using panel data from 466 firms across ten industrial sectors, the research examines how total sales, return on equity (ROE), leverage, market-to-book ratio, and asset change influence CCC. Panel regression and dynamic system GMM estimations reveal that sales and market-to-book ratio significantly reduce CCC, implying that efficient sales management and stronger market valuation improve working capital efficiency. Conversely, asset change positively and significantly increases CCC, suggesting that rapid asset expansion may prolong cash flow recovery. ROE and leverage are found largely insignificant in explaining CCC variations across sectors. Among industries, the healthcare sector records the highest CCC, while the retail sector shows the lowest, indicating superior liquidity management in retail. These findings provide actionable insights for policymakers and managers to optimize working capital and for investors seeking efficient sectors for capital allocation. Panel regression and dynamic system GMM estimations with robustness checks validate the results.

Keywords: Cash Conversion Cycle, Sales, Leverage, Market-to-Book Ratio, Asset Change, Pakistan

Background

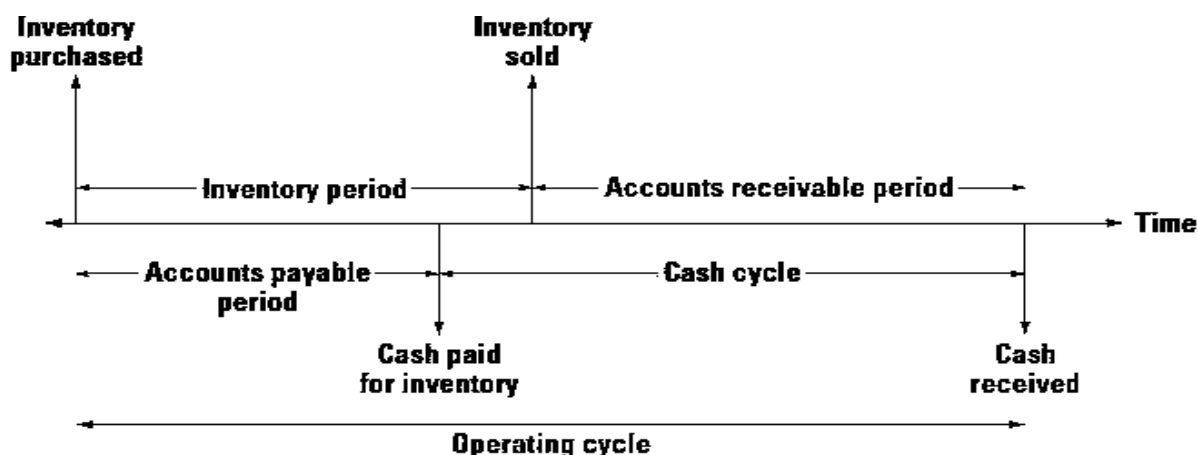
The public firms in Pakistan relate to 10 different sectors, including textile, food, automobile, cement, oil and gas, refineries, transportation, paper, steel, power sector, communication, chemical, etc. All these sectors heavily depend upon the supply of

goods and services to their customers and daily receiving inventory from the supplier. For the efficient functioning of their day-to-day operation, they require cash only if cash is obtained from the customer in a shorter period. Industries fail to service due to inefficiency in working capital management (Kolias et al., 2020; Safia, 2020). Cash is the essential tool used by every human being, organization, and firm for making their day-to-day needs. In the business world, especially in the manufacturing business, cash is required daily for the payment of inventory on day-to-day basis, which is only possible if the timely cash is available after receiving from the customer in time (Jahan, 2020; Joshi, Dave, Dave, & Ramapati, 2020). The high length of the cash conversion cycle is not feasible for today's business concerns as it makes the firms delay their inventory payments to suppliers required in time. The supplier prefers timely payments with the shortest possible time, which enhances his confidence in the company and makes the supplier provide inventory in time and retain the firm for a more extended period (Dibon, 2020; Dogan & Kevser, 2020). The most preferred solution to this situation is the shorter CCC. That means that the time between receiving cash from customers and paying suppliers becomes shorter, enhancing the speedy delivery of inventory to the business. The management of the firms is too concerned about the factors that may significantly shorten the cash conversion cycle to enhance their business operations more efficiently, speedily and effectively (Hassan and Rehman, 2022).

THEORETICAL FOUNDATION OF THE STUDY

Cash Cycle

Wang (2019), the concept of the cash cycle is the time when money spent on acquisitions and



when cash received from selling. It is used as an indicator to assess a company's managerial effectiveness and its inherent requirement for external finance. It is, therefore, an indication of the timeframe in which a firm wants to sell its merchandise, including the recovery of the receivables minus the duration it needs to raise the business's accruals. Furthermore, it shows the number of days a company's cash locked up in its operations. Similarly, Cosemans and Frehen (2021) described that the CCC has four core business activities (buying or manufacturing, selling, collections, and settlement), causing non-instantaneous movements well within cash flow records, which is a crucial characteristic of a company's functioning. The cash cycle is explained below with the help of figure 1 for illustrations established as per the guidelines (Cosemans and Frehen, 2021, Wang, 2019).

Figure 1: Cash Cycle/Operating Cycle

Reasons for Cash Cycle

There are two main reasons to consider a cash cycle with utmost care as per the directions (Wang 2019, Cosemans and Frehen, 2021).

Firstly, the CCC influenced by technological elements, including the time spent in the manufacturing process and the functioning method. As a result, it is critical to grasp how well the CCC related to enterprises' operating costs.

Secondly, companies with a higher CCC level have a greater demand for working capital financing, relying primarily on relatively brief borrowing. They may be more exposed to collective financing risk unless existing funding liquidity deteriorates, finding it challenging for any of them to generate funds or causing them to incur losses when turning through existing due debt.

LITERATURE REVIEW

The cash conversion cycle (CCC) has long been viewed as a primary measure of corporate liquidity and operating efficiency and is the speed at which companies transform investments in inventory and receivables into cash inflows. It has been widely studied in relation to its determinants in a variety of economies, industries and characteristics of firms. This part is a review of the previous studies on the key variables that influence CCC: sales, return on equity (ROE), leverage, market-to-book ratio, and asset change.

Shorter CCCs are usually associated with the increase in sales because of the increased inventory turnover and accelerated receivable collection. Mathuva (2014) discovered that liquidity management is better managed when sales are higher because it enhances the speed at which cash is recovered in Kenyan companies. In the same respect, Chang (2018) and Wang (2019) indicated that there is a relationship between the volume of sales and the cash conversion period; thus, sales efficiency positively correlates with working capital performance. In Pakistan, Ahmad and Sarwar (2016) and Bashir et al. (2018) found that companies that can sell more have shorter CCCs, which is why the size of operations was important. On the other hand, Jahan (2020) observed that excessive sales increase when the cash inflows do not

correspond to the increase in sales can increase CCC in manufacturing companies, and balanced sales expansion in relation to the control of credit is essential.

ROE is a measure of the profitability and management efficiency in a firm but it has ambivalent relations with CCC. Nobanee and Al Hajjar (2014) have discovered that more profitable firms are more likely to decrease their CCC by improving their liquidity management. Deloof and Jegers (2022) also noted that profitability stimulates an increased restraint in receivables and payables. Other works, however, like those of Bhutto et al. (2015) and Safia (2020) have discovered that ROE is statistically inconsequential in the prediction of CCC in Pakistani firms, which can be argued to indicate that profitability does not necessarily correspond to liquidity efficiency in less developed financial markets.

Leverage is a ratio of debt funding and affects CCC in terms of liquidity or credit benefits. Dogan and Kevser (2020) discovered leverage as a negative factor of CCC in that highly indebted firms have tighter cash management demands. Conversely, Kolias et al (2020) observed that leverage can be used to reduce CCC in case the funds borrowed are well used to manage inventory and payables. Pakistani research, such as by Yasir et al. (2014) and Farooq et al. (2016) demonstrates both positive and negative evidence, in that some parts of the economy have been positively impacted by the disciplining effect of leverage, but other industries are subjected to liquidity pressures because of high debt burdens.

The market-to-book (MTB) ratio is a measure of the perception and growth potential by the investor, which has an impact on the working capital decision. Zeidan and Shapir (2017) and Lin and Lin (2021) observed that companies that are highly valued in the market tend to have shorter CCCs because a good reputation has a positive impact on the trust of suppliers and credit conditions. In the new markets, Hassan and Rehman (2022) affirmed the negative relationship between MTB and CCC, which means that companies with good market positions have a liquidity benefit. This trend is supported by empirical evidence in the context of Pakistan (Ali, 2021; Amin and Jabeen, 2023), which implies that companies that feel more confident about the market can make working capital cycles more effective.

There is an increase in total assets which indicates the expansion and behavior of investments in the firm which may have a direct impact on CCC duration. Mathuva (2014) and Nastiti et al. (2019) found that the rapid growth of assets tends to lengthen CCC as companies spend more money on inventory and receivables. Deloof and Jegers (2022) on the other hand discovered that the CCC is minimized by efficient use of the assets in large firms. In Pakistani listed companies, Usama (2017) and Shabbir (2018) found that asset change and CCC had a positive, and the results manifested that expanding companies had higher liquidity requirements owing to capital intensity.

FRAMEWORK

The following is the research framework indicating the impact of total sales, ROE, leverage, market to book ratio, and asset growth rate, CCC for the public companies in Pakistan with combined panel estimates for 2001 to 2019.

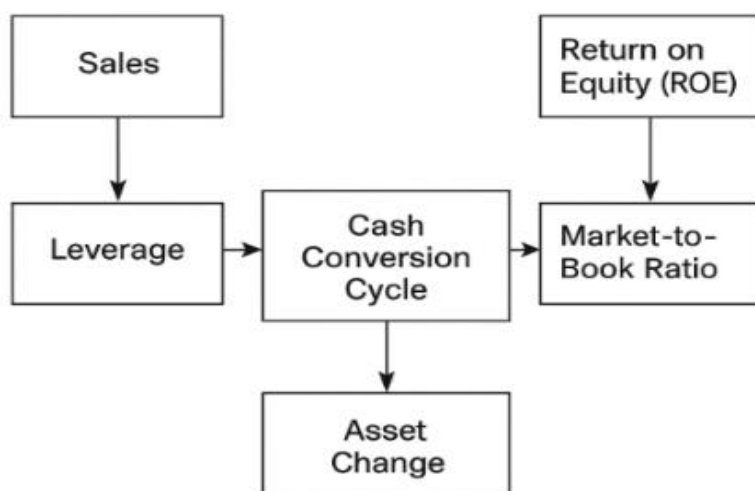


Figure 2: Research Framework

The above figure explains the proposed relationship between CCC for public companies in Pakistan by considering total sales, return on equity, leverage, market to book ratio and asset change. The cash conversion cycle on the right side indicated as the dependent variable. In contrast, the total sales, return on equity, leverage, market to book ratio, and asset's change on the left-hand side indicate the study's independent variables.

6. METHODOLOGY

This present research is required to determine the significant factors that affect the CCC in listed public companies of Pakistan stock exchange for the period covering 2001-2019. The study requires combined as well as cross-industry analysis using secondary data analysis techniques. The population of the study comprised of the listed Pakistani public firms for the year 2001-2019. The listed firms in Pakistan have included around ten industries; durable, non-durable, healthcare, hi-tech, manufacturing, healthcare, retailer, telecom, utilities, others. The study requires drawing a complete set of data based on these ten industries. The data for this purpose was collected through the "Compustat Global" database based on the SIC numbers of industries and checking the year range from 2001 to 2019.

Variables of the study

Dependent variable

The CCC is the dependent variable for this study. The measurement and references given in table 1

Independent variables

The independent variables are sales, leverage, the book to market ratio, ROE, & asset change. The detailed measurements of the variables given in table 1 are as follows.

Table 1: Variable Measurement

Variable Type	Variable Name & Symbol	Measurement
<i>Dependent</i>	<i>Cash Conversion Cycle (CCC)</i>	$CCC = (DIO + DSO) - DPO$ Where DIO = outstanding days of Inventory DSO = outstanding days of Sales DPO = Outstanding days of Payable
<i>Independent</i>	<i>Sales (S)</i>	Sales = Net Credit sales
<i>Independent</i>	<i>Return on Equity (ROE)</i>	ROE = Net profit after tax as a proportion of shareholder's equity
<i>Independent</i>	<i>Market to Book ratio (MB)</i>	MB = Market value as the proportion of book value
<i>Independent</i>	<i>Leverage (LEV)</i>	LEV = Total debt as a proportion of total assets.
<i>Independent</i>	<i>Asset's Change (ASTCH)</i>	$ASTCH = (\text{Asset's value in the current year} - \text{Assets value in the base year}) / \text{Asset's value in the base year}$

Methods of Estimations

For analysis of the study concerning CCC in public companies of Pakistan and their proposed determining factors like total sales, ROE, leverage, and market to book ratio, asset growth rate, the secondary data approach was used. The study's proposed variables obtained from the Compustat database from 2001 to 2019 for 466 Pakistani public firms. The public firms were separated based on the type of industries into five major groups (based on CCC). Two proposed datasets arranged in panel shape as the time dimension and many public firms involved; one panel for all companies and the other panel of companies with industrial characteristics. For the primary estimation purpose of the proposed study, descriptive panel statistics, correlation analysis, and panel unit root testing are required. For regression estimation of the proposed research, panel econometric modelling and estimation techniques are needed as a fixed effect, random effect, pooled OLS with the help of Hausman specification test, and LM test. If the test finalizes the fixed effect model, the researcher will test its basic assumptions. These assumptions are cross-sectional endogeneity, heteroscedasticity, and serial correlation. If these assumptions are significant, the final model will be either fixed effect GLS or panel corrected error model. Besides, suppose the issue of endogeneity found in the proposed explanatory variables of the study. In that case, the proposed research may also move towards dynamic panel data modelling and estimations like 2SLS, 3SLS, difference GMM or system GMM approach. The

dynamic panel data estimation excludes panel unit root testing due to the inclusion of the dependent variable as the first lagged independent variable. The estimation also includes the combined panel estimation, which consists of the regression estimations for all public companies of Pakistan. The other analyses include the regression estimations based on industrial characteristics by considering the industrial dummy of five major industries for the companies included in the study.

Econometric Modeling

The present research analyses based on panel data modelling techniques. The primary panel data model given below:

$$(CCC)_{it} = \alpha_0 + \alpha_1 (Sales)_{it} + \alpha_2 (LEV)_{it} + \alpha_3 (MB)_{it} + \alpha_4 (ROE)_{it} + \alpha_5 (ASTCH)_{it} + U_{it} \quad (1)$$

The above model used for **pooled ordinary least square** estimations. The panel data modelling requires an estimate based on fixed effect and random effect modelling techniques.

The **fixed effect modelling** for the above basic model followed:

$$(CCC)_{it} = (\alpha_0 + \mu_i) + \alpha_1 (Sales)_{it} + \alpha_2 (LEV)_{it} + \alpha_3 (MB)_{it} + \alpha_4 (ROE)_{it} + \alpha_5 (ASTCH)_{it} + v_{it} \quad (2)$$

Here μ_i refers to the fixed parameter in the basic model, and v_{it} refers to the error term. Here the term $\alpha_0 + \mu_i$ refers to the fixed effect in the panel data modelling.

The **random effect modeling** for the study given below:

$$(CCC)_{it} = \alpha_0 + \alpha_1 (Sales)_{it} + \alpha_2 (LEV)_{it} + \alpha_3 (MB)_{it} + \alpha_4 (ROE)_{it} + \alpha_5 (ASTCH)_{it} + (\mu_i + v_{it}) \quad (3)$$

Here the term $\mu_i + v_{it}$ refers to the random effect in the panel regression modelling.

It is assumed that the dependent variable RE_{it} is also dependent upon its past values, which make

model I the **dynamic panel data model**, which converted the first model into 1.4 below:

$$(CCC)_{it} = \alpha_1 (CCC)_{it-1} + \alpha_2 (Sales)_{it} + \alpha_3 (LEV)_{it} + \alpha_4 (MB)_{it} + \alpha_5 (ROE)_{it} + \alpha_6 (ASTCH)_{it} + U_{it} \quad (4)$$

Research Hypotheses

This study aims to explore the determinants of the cash conversion cycle. The study requires the following proposed hypothesis to be tested:

It is concluded with the critical analysis of past literature studies and evidence that there should be a negative and statistically strong relationship between total sales and the cash conversion cycle (Mathuva, 2014, Bhutto et al., 2015, Zeidan and Shapir, 2017, Chang, 2018, Jahan, 2020, Ali, 2021). Therefore, the present research expected to establish a negative relationship between total sales & CCC of public companies in Pakistan.

H1: There should be a negative and significant relationship between total sales & CCC in public firms of Pakistan for the year of the study 2001-2019.

It was concluded from the critical analysis of the past literature evidence that the majority of the study proved a strong relationship between ROA and CCC with significant and negative impact (Mathuva, 2014, Bhutto et al., 2015, Chang, 2018, Kalantonis et al., 2019, Doğan and Kevser, 2020). Therefore, the present study expects a similar relationship based on the majority of literature evidence.

H2: Return of equity of public firms in Pakistan should have a significant and adverse determination of CCC during years of the study 2001-2019.

It is concluded from the discussion in past literature that the majority of the studies provide support for a negative yet significant relationship between the value of leverage & CCC for different industries, sectors, firms, etc., around the globe (Nobanee and Al Hajjar, 2014, Das, 2015, Chang, 2018, Doğan and Kevser, 2020, Yubi et al., 2021). Therefore, the present research studies expect a similar negative yet enormously significant link between both the variables of the study

H3: The cash conversion cycle of public firms in Pakistan should be significantly determined by the firm's leverage with negative impact during the 2001-2019 periods. The critical review of past literature studies indicated a negative trend of the book to the market ratio for determining the cash conversion cycle around the globe for different industrial sectors (Tsagem et al., 2015, Nijam, 2016, Chamaazi, 2017, Yilmaz and Acar, 2019, Campomanes, 2020). Therefore, the present research expected to negatively affect the book-to-the-market ratio for determining CCC in the publicly listed companies of Pakistan.

H4: Market to book ratio should have a negative and significant influence on CCC during the 2001-2019 period for the public firms of Pakistan.

The previous research studies indicated that most evidence supported a negative yet statistically significant impact of asset change in determining the cash conversion cycle for different firms, industries, sectors around the globe (Mathuva, 2014, Yasir et al., 2014, Nwude et al., 2018). Therefore, this research intends to explore the impact of asset change for determining the cash conversion cycle by considering its negative impact on the non-financial public companies of Pakistan.

H5: There should be a negative and significant relationship between an asset's growth rate & CCC for the public companies in Pakistan during the 2001-2019 period.

Expected Outcomes

The outcome of the research expected to indicate the following:

Identification of the most significant determinant of cash conversion cycle in public firms of Pakistan for the period of study using industrial and time dummy in comparative and combined mode.

It will infer the factors that strongly reduce the cash conversion cycle in public firms of Pakistan.

Determination of practical/managerial and policy implications for the public firms in Pakistan for managing the cash conversion cycle based on significant proposed

determinants for the period of study.

Table 2: Output Expectations

CCC	Variables Reference	Significance	Impact on
•			
•			
•	Total Sale	Sig	Negative (Mathuva, 2014, Bhutto et al., 2015, Zeidan and Shapir, 2017, Chang, 2018, Jahan, 2020, Ali, 2021).
•			
•	Return on Equity	Sig	Negative (Mathuva, 2014, Bhutto et al., 2015, Chang, 2018, Kalantonis et al., 2019, Doğan and Kevser, 2020).
•			
•	Leverage	Sig	Negative (Nobanee and Al Hajjar, 2014, Das, 2015, Chang, 2018, Doğan and Kevser, 2020, Yubi et al., 2021).
•			
•	Market to Book value	Sig	Negative (Tsagem et al., 2015, Nijam, 2016, Chamaazi, 2017, Yilmaz and Acar, 2019, Campomanes, 2020).
•			
•	Asset's Change	Sig	Negative (Mathuva, 2014, Yasir et al., 2014, Nwude et al., 2018).
•			

Determinants of CCC in Pakistan

This research explores the impact of total sales, ROE, leverage, market to book ratio, and asset's change on the CCC for publicly listed companies in Pakistan during 2001-2019. These determinants were found concerning Pakistani companies in the studies of; total sales (Yasir et al., 2014), return on equity (Bhutto et al., 2015), leverage (Ahmad and Sarwar, 2016), market to book ratio (Usama, 2017), and asset's change (Shabbir, 2018), as the determinants of cash conversion cycle in different sectors of Pakistan.

DATA ANALYSIS

The present study meant to examine the pre-defined determinants CCC for the listed public companies of Pakistan by considering the annual frequency of data from the

year 2001-2019 in a comparative and combined panel. The pre-defined determinants of the cash conversion cycle are total sales, return on equity, leverage, market to book ratio, and assets' growth rate. The data analysis includes a summary in terms of frequency for industries of public firms in Pakistan, descriptive statistics, correlation analysis, average firm's characteristics (individual industries and all industrial sectors), and regression results. The detailed analysis and their interpretation elaborated under separate tables.

Summary of Industrial distribution of Public Firms in Pakistan

Table 3 indicates the number of observations for data achieved from each industrial sector for Pakistan's public firms from 2002-19. It noted that the non-durable industry is the largest sector of Pakistan while the retail sector is a minor sector.

Table 3: Cross-Industry Frequency of Pakistani Public Firms

Sr#	Industries	Freq.	Percent
1	Durable	233	3.29
2	Energy	173	2.44
3	Healthcare	182	2.57
4	Hi-tech	106	1.50
5	Manufacturing	1,651	23.33
6	Non-Durables	2,348	33.18
7	Others	1,933	27.32
8	Retailer (shops)	80	1.13
9	Telecom	91	1.29
10	Utilities	279	3.94
	Total	7,076	100.00

Descriptive Statistics of the Study

The research is conducted to achieve the primary objective for determining the cash conversion cycle based on determinants like total sales, return on equity, leverage, market to book ratio, asset growth rate, and industrial dummy and time dummy for the public firms in Pakistan for the year 2002 to 2019 in comparative as well as combined panel mode. However, the following Table 4 indicates that the Healthcare sector indicates a higher cash conversion cycle based on the cash conversion cycle. In contrast, the retailer sector shows the lowest value for the same.

Table 4: Summary Statistics (Based on CCC)

Mean	S.D	Kurtosis	Skewness	Range	Min	Max	Count
------	-----	----------	----------	-------	-----	-----	-------

Non-Durable	4.60	0.74	5.35	-0.42	10.16	0.75	10.91	2348
Durable	4.08	1.09	5.38	-2.03	7.61	-1.88	5.73	233
Manufacturing	4.55	0.82	5.92	-1.86	7.81	-1.24	6.57	1651
Energy	3.71	1.20	1.19	-0.99	6.56	-0.75	5.81	173
Hi-Tech	3.97	1.12	0.28	-0.81	5.40	0.91	6.30	106
Telecom	3.86	1.13	3.68	-1.50	7.02	-1.22	5.81	91
Shops	3.13	1.14	-0.46	-0.48	5.17	0.10	5.28	80
Healthcare	4.80	0.58	10.03	-2.85	5.86	-0.21	5.64	182
Utilities	3.80	1.11	2.87	-1.36	6.85	-0.93	5.92	279
Other	4.31	0.97	6.09	-1.90	8.90	-2.65	6.25	1933

Descriptive Statistics

Table 5 indicates the mean, standard deviation, minimum and maximum values for the variables. It shows that the average value for CCC is 4.41, the sale is 8.19, ROE is 0.09, leverage is 0.43, market to book value is 11.31, and assets' change is 0.11.

Table 5: Combined Descriptive Statistics (Based on Determining Factors)

Variable	Obs	Mean	Std. Dev.	Min	Max
Ln(CCC)	7075.00	4.41	0.93	-2.65	10.91
Ln(Sale)	7076.00	8.19	1.82	-1.91	13.99
Return on equity	7076.00	0.09	0.40	-5.94	4.98
Leverage	7076.00	0.43	0.50	-8.09	8.12
Market to Book value	7076.00	11.31	21.04	0.03	339.99
Asset's Change	7076.00	0.11	0.45	-1.00	8.61
Industries					
Durable	7076.00	0.03	0.18	0.00	1.00
Energy	7076.00	0.02	0.15	0.00	1.00
Healthcare	7076.00	0.03	0.16	0.00	1.00
Hi-tech	7076.00	0.01	0.12	0.00	1.00
Manufacturing	7076.00	0.23	0.42	0.00	1.00
Non-Durables	7076.00	0.33	0.47	0.00	1.00
Others	7076.00	0.27	0.45	0.00	1.00
Shops, etc.	7076.00	0.01	0.11	0.00	1.00
Telecom	7076.00	0.01	0.11	0.00	1.00
Utilities	7076.00	0.04	0.19	0.00	1.00

Correlation Analysis

Table 6 indicates a correlation matrix for the variables of the study. It suggests that there is a negative as well as a non-significant association between sales and cash conversion cycle for the public firms in Pakistan. Similarly, there is a moderate positive and highly significant relationship between sales and its log value. However, ROE indicates a negative association with CCC, while a positive association of the same was found with a log of sales, with sales having an insignificant link for both. Leverage has a zero correlation with cash conversion cycle, sales log, sales, and returns on equity with a negligible link.

Similarly, the market to book ratio has a significant positive association with the log of sales and sales while the negative association with CCC and leverage insignificantly. Finally, the asset's change has a negative and insignificant association with CCC, a sales log, sales, and market to book value. In contrast, the same is a positive and negligible association with roe and leverage.

Table 6: Correlation Analysis (Combined sectors)

	Ln(CCC)	Ln(Sales)	sales	ROE	Leverage	MB	Asset Change
Ln(CCC)	1						
Ln(Sales)	-0.0025 (0.8337)	1					
Sales	-0.0016 (0.895)	0.4977*** (0.000)	1				
ROE	-0.0016 (0.8947)	0.0049 (0.6838)	0.0022 (0.8543)	1			
Leverage	0 (0.9968)	0.0133 (0.267)	0.0068 (0.5707)	0.0006 (0.9569)	1		
MB	-0.0046 (0.7017)	0.1104*** (0.000)	0.0732*** (0.000)	0.0067 (0.5754)	-0.0011 (0.9249)	1	
Asset Change	-0.0006 (0.9618)	-0.0123 (0.3079)	-0.0033 (0.7833)	0.0029 (0.8075)	0.0009 (0.9405)	-0.0019 (0.8737)	1

Average Firm Characteristics

Table 6.1 below indicates the average firm characteristic in the combined format for all the industrial sectors of public firms in Pakistan. The average firm's features grouped into five categories based on cash conversion cycle rankings. The first group, in this case, indicates a cash conversion cycle with a value of 1.44, sales as 9.28, return on equity as 0.09, leverage as 0.40, and market to book as 13.80 and asset's change as 0.08 with 69 unique firms and 200 observations with an unbalanced year category of

2001-2019. On an average basis, the highest level of cash conversion cycle reported in the fifth rank grouping with a value of 5.60.

Table 6.1: Average Firm Characteristics (Combined Sectors)

CCC rank	1	2	3	4	5	5 – 1
CCC	1.44	3.02	3.96	4.76	5.60	4.16*** (23.05)
Sale	9.28	8.94	8.57	8.03	7.31	-1.97***(- 11.05)
ROE	0.09	0.11	0.11	0.09	0.03	-0.06 (-0.26)
Leverage	0.40	0.43	0.39	0.44	0.48	0.08 (0.20)
Market Book	to13.80	12.78	14.22	10.67	7.50	-6.30*** (-8.00)
Asset's Change	0.08	0.10	0.11	0.11	0.07	-0.01 (-0.05)
Observation	200	721	1261	4210	665	200
Unique Firms	69	156	379	415	176	69
Time period	2002-19	2001-2019	2001-2019	2001-2019	2001-2019	2001-2019
	(unbalanced)	(unbalanced)	(unbalanced)	(unbalanced)	(unbalanced)	(Balanced)

Average firm characteristics (Industry-wise)

Table 6.2 reports the average firm characteristics of all the industrial sectors of public firms in Pakistan. The industry-wise cash conversion cycle for durable, energy, healthcare, high-tech, manufacturing, non-durable, retail, telecom, utilities, and others is 4.08, 3.69, 4.80, 3.95, 4.54, 4.60, 3.12, 3.87, 3.78, and 4.31, respectively. It inferred that the highest average CCC was estimated in Pakistan's healthcare sector, while the lowest was evaluated in the retail sector. The highest cash conversion cycle in the healthcare sector reflects that the average payment period is low while their average receivable period is increased.

Similarly, the retail sector's most downward cash conversion cycle indicates a comparatively high average payment period. In contrast, their average receivable period is relatively low than other industrial sectors of Public firms in Pakistan. The industry-wise sales indicate that the average log sales values in durable, energy, healthcare, high-tech, manufacturing, non-durable, retail, telecom, utilities, and others are 8.59, 10.61, 8.14, 8.01, 7.91, 7.81, 8.98, 8.49, 9.33, and 8.48 respectively. It inferred that the highest average log sale value was estimated in the energy sector. In contrast, the lowest average log sale value was reported in the manufacturing industry during the period 2002-2019. The highest average log sale value in the energy sector reflects the basic need of every individual in Pakistan. Its demand is continuously increasing, which enhances its sales figures. Similarly, the average log sale value in the manufacturing sector is slightly low since the manufacturing industry in Pakistan has low output/sales compared to other sectors.

Similarly, the industry-wise return on equity indicates that the average roe value in the durable, energy, healthcare, high-tech, manufacturing, non-durable, retail, telecom, utilities, and other sectors for the public firms in Pakistan are 0.16, 0.23, 0.14, 0.08, 0.09, 0.08, 0.19, 0.06, 0.13, and

0.06 respectively during 2002-19. The highest roe average value reported in the table is for the energy sector while the lowest is in telecom and another industrial sector in Pakistan. The highest sale value backs the highest value of roe in the energy sector in the same industry. The highest average figure for sale provides the basis of the highest roe in this sector. In contrast, the lowest average roe in the telecom and other sectors is due to the lowest-earning on shareholders.

The leverage indicates the financing of the firm by way of debt in the total assets. The industry-wise estimates suggest that the average value of the leverage in the durable, energy, healthcare, high-tech, manufacturing, non-durable, retail, telecom, utilities, and other sectors for the public firms in Pakistan are 0.33, 0.24, 0.22, 0.29, 0.46, 0.54, 0.26, 0.34, 0.52, and 0.32

respectively. The highest level of the average leverage value was reported in the non-durable sector as 0.54, which infers that this sector heavily relies on debt as the source of their financing requirement. In contrast, the remaining proportion of their financing comes from equity. The lowest level of the average value of leverage was reported by healthcare as 0.22. It infers that the firms in this sector mostly rely on equity financing by 78%. A tiny part of their financing needstocovered by debt as 22%.

The market to book value ratio indicates the proportion of the share's market value as reflected by its book value. The table shows that the average market to book values in the durable, energy, healthcare, high-tech, manufacturing, non-durable, retail, telecom, utilities, and other sectors for the public firms in Pakistan are 13.22, 16.97, 15.12, 13.57, 9.75, 14.89, 36.65, 2.34, 7.40, and 7.47 respectively. The highest market to book ratio reported in the retail sector. It infers that this sector is exceptionally over-valued its stock in the market while the lowest value of the average market to book value was indicated in the telecom sector, which infers the undervaluation of its stock's market price as compared to its book value.

Finally, the assets change the value on an average basis as reported in the table in the

durable, energy, healthcare, high-tech, manufacturing, non-durable, retail, telecom, utilities, and other sectors for the public firms in Pakistan are 0.16, 0.20, 0.15, 0.14, 0.13, 0.09, 0.21, 0.11, 0.07, and 0.13 respectively for the period covering 2002-19. The entire industrial sector for the public firms in Pakistan indicates a positive change in their gross assets on an average basis, which infers that their gross assets are increasing yearly during the study period. The retail sector reported the highest average value of asset change as a 21% increase, while the lowest increase in the average assets written by the utility sector. Figure 3 illustrates that the healthcare sector records the highest average CCC, while the retail sector exhibits the lowest, confirming the tabular results in Table 6.2.

Table 6.2: Average Firm Characteristics for Sample Firms Separated by Industry (2002-19)

Industry	Durable Sector	Energy Sector	Healthcare Sector	High-Tech Sector	Manufacturing Sector	Non-Durable Sector	Retail Sector	Telecom Sector	Utilities Sector	Other Sectors
CCC	4.08	3.69	4.80	3.95	4.54	4.60	3.12	3.87	3.78	4.31
Sale	8.59	10.61	8.14	8.01	7.91	7.81	8.98	8.49	9.33	8.48
ROE	0.16	0.23	0.14	0.08	0.09	0.08	0.19	0.06	0.13	0.06
Leverage	0.33	0.24	0.22	0.29	0.46	0.54	0.26	0.34	0.52	0.32
Market to Book	13.22	16.97	15.12	13.57	9.75	14.89	36.65	2.34	7.40	7.47
Asset's Change	0.16	0.20	0.15	0.14	0.13	0.09	0.21	0.11	0.07	0.13
Firm-year Observations	223	167	176	104	1597	2303	79	89	269	1891
Unique Firms number	14	11	12	8	89	128	6	6	19	106

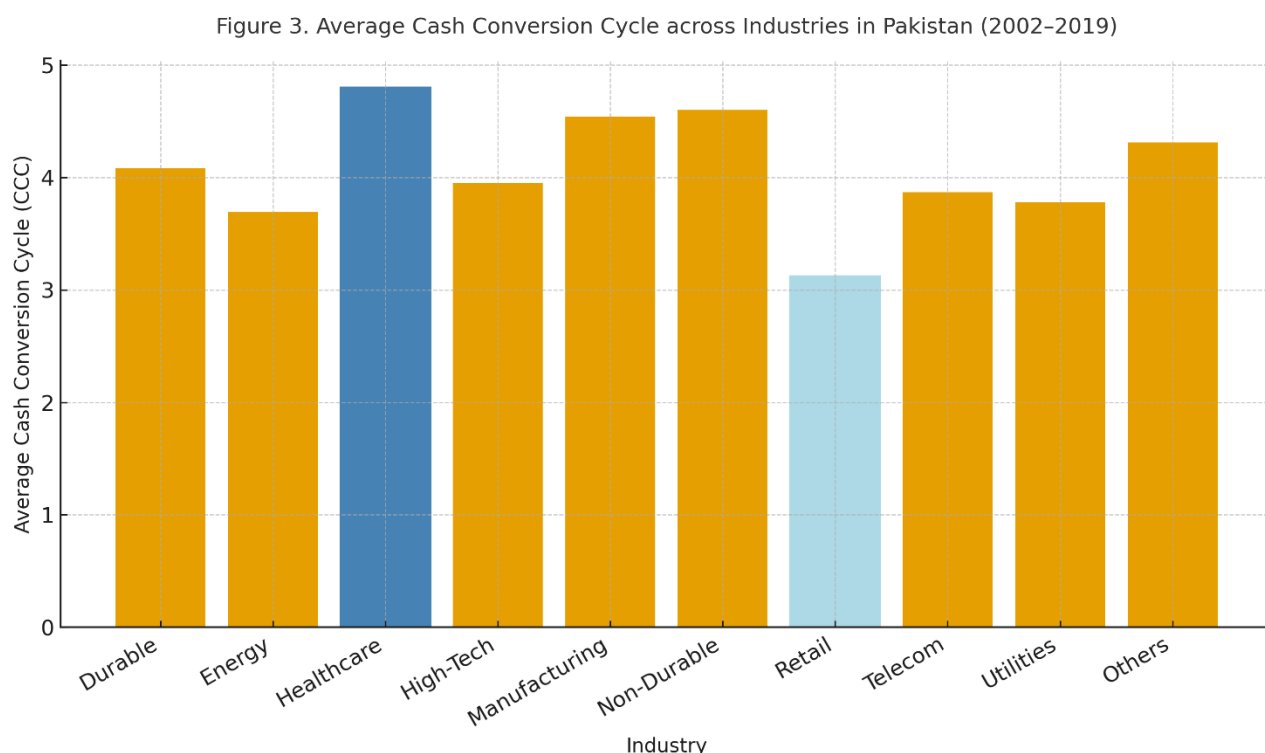


Figure 3. Average Cash Conversion Cycle across Industries in Pakistan (2002–2019)

Regression Analysis

The present study requires examining the role of sales, roe, leverage, market to book ratio, and asset's change in determining CCC for the listed public firms in Pakistan during the period 2001–2019. The analysis requires hypothesis testing based on defined determinants of CCC and the impact of industrial & time dummy on the comparative and combined regression model. The data for this purpose obtained from the Compustat database from 2001 to 2019 for 466 Pakistani public listed firms. The dataset was arranged in panel shape comprising the years and firms, including their industrial sector for analysis. The panel data analysis requires using the fixed effect, random effect, pooled OLS model estimations (Torres-Reyna, 2007). The advanced panel data estimates include dynamic panel estimations utilising the system and the different GMM techniques (Roodman, 2009).

The estimation of panel data using fixed-effect requires that the researcher estimate the reasons for deviation within firms/entities/individual/cross-sections (Torres-Reyna, 2007). The property of fixed estimation requires that an effect of the cross-section is assumed to be present in the estimation model, which is technically verified with the significance of the Hausman (1978) specification test. The Hausman testing value ($p < 0.05$) confirms that a cross-section fixed effect is present in the model, which validates the estimations of the fixed effect panel data model (Das, 2019).

Sometimes, a cross-sectional fixed effect is not confirmed after the insignificance of

the Hausman specification test (1978). In that case, the next choice is between the random effect and pooled OLS model. A Breusch and Pagan (1980) Lagrange multiplier (LM) test is used for this purpose. The LM testing value ($p < 0.05$) confirms that a random cross-section effect is present in the model, which validates the estimations of the random effect panel data model (Mućk, 2013). Otherwise, the pooled OLS is the final choice for the analysis of the static panel data model. Finally, the advanced estimation of panel data requires that sometimes the historical values of the explained variables also affect it, which demands the panel data analysis using dynamic panel estimations techniques like GMM (Baum, 2013). The dynamic panel estimation techniques are necessary when the endogeneity issue prevails in the static panel dataset (Arellano & Bond, 1991; Das, 2019; Hoechle, 2007; Mileva, 2007; Roodman, 2009).

The estimation performed using the STATA 13 software package. Table 5.6 indicates the analysis of the required set of variables of the study using fixed effect, random effect, pooled OLS, and dynamic panel estimation techniques like difference and system GMM. The sale indicated significance and a negative impact using all the methods of estimations, which accepted the first hypothesis of the study stating the sale as the significant determinant of the cash conversion cycle. It infers that sale value plays an essential role in decreasing CCC of all the industrial sectors of public firms in Pakistan for the period of study 2001-2019. The significant and negative impact of sale for determining the cash conversion cycle is consistent with the similar findings of (Aanesland & Nitter, 2019; Abbas et al., 2013; Ahangar, 2020; Araújo & Machado, 2018; Çetenak et al., 2017; Farooq et al., 2016; Mathuva, 2014).

However, the return on equity shows an insignificant and inverse impact as the determinant of CCC for the public listed firms in Pakistan during the period 2001-2019 using fixed effect, random effect, first and 2nd difference GMM, and 1st system GMM except for pooled OLS where it was positive and insignificant. It rejects the second hypothesis using these methods. While the same variable has shown a highly significant impact as the determinant of CCC using the second system of GMM accepting the 2nd hypothesis. It infers that return on equity also plays an essential role in determining CCC in public listed firms of Pakistan. The finding is consistent with similar estimations (Alehegne et al., 2019; Ali, 2020; Bashir et al., 2013; Bashir et al., 2018; Javadi & Nikoumaram, 2017).

Additionally, the leverage has shown a positive and robust link to determine CCC in the public listed companies in Pakistan for the period of study using FE, RE, 1st and 2nd difference GMM, and 1st system GMM. It accepted the third hypothesis of the study. However, the same variable shows a negative and statistically significant link for determining the CCC using the second system GMM. It infers that leverage also plays an essential role in decreasing CCC in public sector firms in Pakistan. The finding is comparable with the similar estimations (Bui, 2020; Dalci & Ozyapici, 2018; Doruk & Ergün, 2019; Kumara, 2017; Tariq et al., 2013).

However, the market to book ratio indicates a negative and robust link in determining the CCC in the public listed firms in Pakistan for the study period using Pooled OLS and second system GMM method for the estimations. It accepted the fourth hypothesis

of the study. It inferred that market to book ratio also plays an essential role in determining and decreasing CCC in the industrial sector of public firms in Pakistan for the period of study 2001-2019. The finding is comparable with the similar conclusive evidence of (Dibon, 2020; Dogan & Kevser, 2020; Kajola et al., 2019; Moussa, 2019; Nyeadi et al., 2018; Wiguna & Wasistha, 2017).

Finally, the asset's change as the determinant of CCC indicated a highly significant and optimistic factor for the public firms in Pakistan using all the methods of estimations. It accepted the fifth hypothesis and inferred that asset change strongly enhances the cash conversion cycle in the industrial sector of Pakistan. The findings are consistent and comparable with similar conclusive evidence of (Dogan & Kevser, 2020; Jahan, 2020; Joshi et al., 2020; Koliass et al., 2020; Nastiti et al., 2019; Nyeadi et al., 2018; Safia, 2020; Shroff, 2019; Tesfay & Batra, 2018; Wang, 2019). The industrial dummy for every sector significantly determined the CCC in Pakistan's public listed firms except the high-tech industry. The industry-wise determining factors for the cash-conversion cycle were indicated in the appendix section at the end of this study.

Table 7: Overall Regression Estimations

VARIABLES	(1) FE	(2) RE	(3) OLS	(4) 1 st GMM	(5) Diff2 nd GMM	(6) Diff1 st GMM	(7) Sys2 GMM	Sys
Ln (sale)	-	-	-0.110***	0.289*** (0.0471)	0.280*** (0.0202)	0.509*** (0.0334)	0.508*** (0.000879)	
	0.170***	0.163***		-	-0.170***	-	-	
				0.195***		0.0832** *	0.0845***	
	(0.0239)	(0.0208)	(0.00730)	(0.0245)	(0.0155)	(0.0186)	(0.000537)	
ROE	-0.00326	-0.00270	0.00797	-0.0179	-0.00525	-0.0298	-	
							0.0298***	
	(0.0263)	(0.0264)	(0.0327)	(0.0254)	(0.0125)	(0.0246)	(0.000419)	
Leverage	0.0416*	0.0421*	0.00658	0.0957** *	0.0915** *	-0.0169	-	
							0.0169***	
	(0.0248)	(0.0249)	(0.0232)	(0.0323)	(0.0184)	(0.0235)	(0.00121)	
Market Book Value	9.60e-06	-	-	0.000795	0.00120*	-0.00131	-	
		0.000799	0.00307** *				0.00130** *	
	(0.00139)	(0.00105)	(0.000468)	(0.00129)	(0.000710)	(0.00117)	(1.86e-05)	
				)				
Asset's Change	0.0611** *	0.0600** *	0.0637***	0.172***	0.0938** *	0.163***	0.162***	
			(0.0229)	(0.0339)	(0.0219)	(0.0324)	(0.00169)	
Energy			-0.146					

Healthcare			(0.110)				
			0.683***				
			(0.0788)				
Hi-tech			-0.167				
			(0.123)				
Manufacturing			0.387***				
Non-Durables			(0.0706)				
			0.445***				
			(0.0694)				
Others			0.210***				
			(0.0713)				
Shops, etc.			-0.842***				
Telecom			(0.131)				
			-0.253*				
			(0.133)				
Utilities	(0.0170)	(0.0170)	-0.217**				
			(0.0957)				
Constant	5.778***	5.712***	5.051***	-	-	2.840***	2.853***
	(0.194)	(0.174)	(0.0899)			(0.244)	(0.00663)
Observations	7,075	7,075	7,075	5,904	5,904	6,466	6,466
Number of firms	476	476	476	476	476	476	476
Number of Instruments	0.049	0.078	0.141	158	158	1111	1111
R-squared				-	-		
Firmid FE	YES	-	-				
AR(1)-P-values				0.000	0.000	0.000	0.000
AR(2)-P-values				0.934	0.918	0.320	0.332
Sargans' Test				0.000	0.000	0.000	0.000
P-values							
Hansens' Test				0.021	0.021	1.000	1.000
P-values							

Discussion of Findings:

This table indicates all these factors, including the sale, roe, leverage, market to book ratio, and asset change, have adverse and enormously significant effects on the cash conversion cycle by applying the 2nd stage system GMM. However, the other methods give mixed results. The reliability of the model is justified with the value of AR(2), 0.332.

Table 5.7: Robust Regression Estimates

VARIABLES	OLS	Robust OLS	OLS	Robust OLS
Ln (sale)	-0.0311** (0.0145)	-0.0311** (0.0132)	-0.0456*** (0.00989)	-0.0456*** (0.00815)
ROE	0.0107 (0.0573)	0.0107 (0.0673)	0.0185 (0.0437)	0.0185 (0.0448)
Leverage	0.00527 (0.0322)	0.00527 (0.0137)	0.0246 (0.0270)	0.0246 (0.0157)
Market to Book Value	-0.00551*** (0.00204)	-0.00551** (0.00223)	0.000498 (0.000847)	0.000498 (0.000938)
Asset's Change	0.105** (0.0430)	0.105*** (0.0368)	-0.0178 (0.0569)	-0.0178 (0.0400)
Constant	3.313*** (0.125)	3.313*** (0.106)	3.414*** (0.0910)	3.414*** (0.0701)
Observations	256	256	465	465
Time Period (Unbalanced)	2001-10	2001-10	2011-19	2011-19
No of Firms	91	91	127	127
R-squared	0.064	0.064	0.097	0.097

CONCLUSION

This study concludes that the cash conversion cycle of Pakistani public firms is primarily determined by sales performance, market valuation, and asset growth dynamics. Firms with higher sales and stronger market-to-book ratios maintain shorter CCCs, reflecting efficient working capital management. Conversely, asset expansion tends to extend CCC duration, emphasizing the need for balanced growth strategies. Managers should focus on boosting sales efficiency, optimizing receivables, and enhancing market valuation through transparent reporting and profitability improvements. Industries with long CCCs, such as healthcare and manufacturing, should prioritize faster inventory turnover and better collection processes. Regulators should encourage disclosure standards and credit market reforms that enable firms to better manage liquidity. Supporting efficient industries like retail can further stimulate investment and employment.

Future studies can integrate macroeconomic factors such as inflation, interest rates, and exchange rate volatility or compare pre- and post-crisis periods to examine how external shocks influence CCC determinants in emerging markets.

REFERENCES

- Abbas, A., Bashir, Z., Manzoor, S., & Akram, M. N. (2013). Determinants of firm's financial performance: An empirical study on the textile sector of Pakistan. *Business and Economic Research*, 3(2), 76–86.
- Ahmad, N., & Sarwar, N. (2016). Cash conversion cycle management in automobile industry: Relationship with firm performance, leverage, liquidity, and capital employed. *Industrial Engineering Letters*, 6(2), 33–39.
- Ali, A. (2021). Firm size and supply chain finance in the Indian pharmaceutical industry: Analysis of size determinants and the cash conversion cycle. *Accounting*, 7(1), 197–206.
- Araújo, R. C. d. C., & Machado, M. A. V. (2018). Book-to-market ratio, return on equity, and Brazilian stock returns. *RAUSP Management Journal*, 53(3), 324–344.
- Amin, S., & Jabeen, R. (2023). Sectoral determinants of cash conversion cycle in Pakistan. *Pakistan Business Review*, 25(2), 45–62.
- Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2), 277–297.
- Bashir, Z., Arshad, M. U., Ghazali, A., Haider, A., & Fazal, S. (2018). Working capital management attributes and firm profitability: Evidence from the textile sector of Pakistan. *Journal of Commerce, Accounting and Finance Management*, 1(2), 1–23.
- Bhutto, N. A., Abbas, G., Rehman, M., & Shah, S. M. M. (2015). Relationship of cash conversion cycle with firm size, working capital approaches, and profitability: A case of Pakistani industries. *Pakistan Journal of Engineering, Technology & Science*, 1(1), 45–64.
- Chang, C.-C. (2018). Cash conversion cycle and corporate performance: Global evidence. *International Review of Economics & Finance*, 56, 568–581.
- Chen, J., & Yang, Z. (2024). Revisiting the cash conversion cycle: A dynamic panel approach across emerging markets. *Finance Research Letters*, 60, 104533.
- Dalci, I., & Ozyapici, H. (2018). Working capital management policy in healthcare: The effect of leverage. *Health Policy*, 122(11), 1266–1272.
- Deloof, M., & Jegers, M. (2022). Working capital management and corporate profitability revisited. *International Review of Financial Analysis*, 82, 102165.
- Dogan, M., & Kevser, M. (2020). Determinants of the cash conversion cycle and firm performance: Evidence from Borsa Istanbul. *Management and Economics Review*, 5(2), 197–206.
- Farooq, U., Maqbool, M. Q., Waris, M., & Mahmood, R. (2016). Liquidity risk, performance, and working capital relationship of cash conversion cycle: Evidence from Pakistan. *International Journal of Information Research and Review*, 3(3), 1946–1950.

- Garanina, T. A., & Belova, O. A. (2015). Liquidity, cash conversion cycle, and financial performance: Evidence from Russian companies. *Investment Management and Financial Innovations*, 12(1), 90–100.
- Hassan, A., & Rehman, M. (2022). Determinants of working capital efficiency in emerging markets: Evidence from South Asia. *Emerging Markets Review*, 52, 100867.
- Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica*, 46(6), 1251–1271.
<https://doi.org/10.2307/1913827>
- Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *The Stata Journal*, 7(3), 281–312.
- Jahan, N. (2020). An empirical investigation of cash conversion cycle of manufacturing firms and its association with firm size and profitability. *Bank Parikrama*, 36(2), 18–32.
- Kajola, S. O., Sanyaolu, W. A., Onifade, H. O., & Adewumi, A. A. (2019). Determinants of working capital management practice in Nigerian firms. *UNILAG Journal of Business*, 5(1), 112–128.
- Kalantonis, P., Goumas, S., & Rodosthenous, M. (2019). Cash conversion cycle and firm performance: Evidence from Greek listed firms. In *Economic and Financial Challenges for Eastern Europe* (pp. 75–92). Springer.
- Kolias, G., Arnis, N., & Karamanis, K. (2020). Simultaneous determination of cash conversion cycle components. *Accounting and Management Information Systems*, 19(2), 311–332.
- Lin, Q., & Lin, X. (2021). Cash conversion cycle and aggregate stock returns. *Journal of Financial Markets*, 52, 100547.
- Mathuva, D. M. (2014). Determinants of the cash conversion cycle in Kenyan listed non-financial firms. *Journal of Accounting in Emerging Economies*, 4(2), 175–198.
- Nastiti, P. K. Y., Atahau, A. D. R., & Supramono, S. (2019). Determinants of working capital management: The contextual role of enterprise size and age. *Business, Management and Education*, 17(2), 94–110.
- Nobanee, H., & Al Hajjar, M. (2014). An optimal cash conversion cycle. *International Research Journal of Finance and Economics*, 120(3), 13–22.
- Nyeadi, J. D., Sare, Y. A., & Aawaar, G. (2018). Determinants of working capital requirement in listed firms: Evidence using a dynamic system GMM. *Cogent Economics & Finance*, 6(1), 1–14.
- Roodman, D. (2009). How to do xtabond2: An introduction to difference and system GMM in Stata. *The Stata Journal*, 9(1), 86–136.
- Safia, F. (2020). Determinants of working capital: Evidence from production and service sectors of Pakistan. *International Journal of Finance and Accounting*, 5(1), 67–78.
- Shabbir, M. K. (2018). Cash conversion cycle and firms' profitability: Evidence from Pakistan's tobacco industry. *International Journal of Research in Social Sciences*, 8(4), 448–462.

- Tariq, W., Ali, I., Usman, H. M., Abbas, J., & Bashir, Z. (2013). Determinants of firm's financial performance: Textile and food sectors of Pakistan. *Business and Economic Research*, 3(1), 487–501.
- Usama, M. (2017). Working capital management and performance: Evidence from Pakistan's sugar sector. *Pakistan Journal of Social Issues*, 8(1), 160–167.
- Wang, B. (2019). The cash conversion cycle spread. *Journal of Financial Economics*, 133(2), 472–497.
- Yasir, M., Majid, A., & Yousaf, Z. (2014). Cash conversion cycle and its impact on firm performance: Evidence from Pakistan's cement industry. *Global Business and Management Research*, 6(2), 139–149.
- Zeidan, R., & Shapir, O. M. (2017). Cash conversion cycle and value-enhancing operations: Theory and evidence. *Journal of Corporate Finance*, 45, 203–219.