

Tiwari, Satish Chandra; Sayyad, Munawar; Azam, Md Sikandar; Sudesh, NS

Article

Determinants of WCM of Indian listed firms: A GMM regression approach

Cogent Economics & Finance

Provided in Cooperation with:

Taylor & Francis Group

Suggested Citation: Tiwari, Satish Chandra; Sayyad, Munawar; Azam, Md Sikandar; Sudesh, NS (2023) : Determinants of WCM of Indian listed firms: A GMM regression approach, Cogent Economics & Finance, ISSN 2332-2039, Taylor & Francis, Abingdon, Vol. 11, Iss. 1, pp. 1-20, <https://doi.org/10.1080/23322039.2023.2199550>

This Version is available at:

<https://hdl.handle.net/10419/304047>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



<https://creativecommons.org/licenses/by/4.0/>

Determinants of WCM of Indian listed firms: A GMM regression approach

Satish Chandra Tiwari, Munawar Sayyad, Md Sikandar Azam & N S Sudesh

To cite this article: Satish Chandra Tiwari, Munawar Sayyad, Md Sikandar Azam & N S Sudesh (2023) Determinants of WCM of Indian listed firms: A GMM regression approach, Cogent Economics & Finance, 11:1, 2199550, DOI: [10.1080/23322039.2023.2199550](https://doi.org/10.1080/23322039.2023.2199550)

To link to this article: <https://doi.org/10.1080/23322039.2023.2199550>



© 2023 The Author(s). This open access article is distributed under a Creative Commons Attribution (CC-BY) 4.0 license.



Published online: 12 Apr 2023.



Submit your article to this journal [↗](#)



Article views: 1565



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 4 View citing articles [↗](#)



Received: 19 January 2023
Accepted: 01 April 2023

*Corresponding author: Satish Chandra Tiwari, ICFAI Business School, IFHE (Deemed to be University), Room No.110, Mokila, Hyderabad, India, 501203
E-mail: satishtiwari@ibsindia.org

Reviewing editor:
David McMillan, University of Stirling,
UK

Additional information is available at
the end of the article

FINANCIAL ECONOMICS | RESEARCH ARTICLE

Determinants of WCM of Indian listed firms: A GMM regression approach

Satish Chandra Tiwari^{1*}, Munawar Sayyad¹, Md Sikandar Azam¹ and N S Sudesh¹

Abstract: This research paper purposes to discover the reasons that impact the working capital management (WCM) of Indian-listed manufacturing firms. The study uses a panel data set of 291 firms covering years from 2011 to 2020. The authors use working capital requirement (WCR) and cash conversion cycle (CCC) as proxies for working capital management and assess the effect of operating cash flow (OCF), performance as return on assets (ROA), valuation as Tobin's Q (TQs), size, age, growth opportunities, leverage, and economic condition as the gross domestic product (GDP) over them. We use OLS and GMM estimators for the analysis of the study. Indian listed manufacturing firms' cash conversion cycle (CCC) has been found to be positively correlated to their firm value, performance, and leverage. At the macro level, CCC is positively correlated to GDP. Further, CCC has been found to be negatively correlated with growth opportunities, operating cash flow, firm size, and age. The working capital requirement (WCR) of the firms, on the other hand, is positively associated with performance, firm age, and value, while it is negatively related to OCF, growth opportunities, leverage, size, and GDP. Our study adds uniqueness to the existing works on working capital in many ways. First, to our knowledge, very few studies exist to measure working capital management in the Indian context using two proxies WCR and CCC of working capital as dependent variables. Second, we used both OLS and GMM estimators to measure the explanatory variable's effect over WCR and CCC which provided a more valid result. Third, we used eight factors as explanatory variables that provide a wider scope to explain the working capital management of Indian listed firms.

Subjects: Economics; Finance; Business, Management and Accounting

Keywords: WCR; CCC; Indian firms; GMM

1. Introduction

Corporate finance decisions are either long-term or short-term decisions (Baker et al., 2017). Long-term financial decisions primarily deal with such topics as capital budgeting and capital structure. In contrast, short-term decisions relate to liquidity, especially working capital management (WCM), which focuses on the composition of a firm's current assets and current liabilities (Jamalinesari & Soheili, 2015). Sagner (2014), opined that a company's financial position is characterized by the optimal utilization of its working capital. And that the working capital influences profitability and liquidity. In the same way, the company's performance defines its profitability (Deloof, 2003; Hassan & Shrivastava, 2019; Shin & Soenen, 1998). Working capital management decisions

influence companies' performance and influence companies' valuation.; So, working capital management has become central to a firm's short-term and long-term financial management (Enqvist et al., 2014; Talonpoika et al., 2016). Efficient WCM helps a firm to maintain its solvency, and avoid situations of financial distress, and is critical for a firm's long-term survival (Padachi & Howorth, 2014).

Most literature on corporate finance has been concentrated largely on long-term financial management and strategies but little attention was given to the important short-term financing decisions (de Almeida & Eid, 2014). Working capital is important in managing cash and accounts receivables (Yazdanfar & Peter, 2014) along with liabilities and liquid assets. It has been found that large businesses face liquidity challenges, particularly since the 2008 worldwide financial crisis. Despite the availability of several sources for raising funds, working capital has been a vital and active source of operations for manufacturing firms and has the potential to eliminate barriers in supply chain financing (Alora & Barua, 2019; Ghosh et al., 2021; Shenoit et al., 2018). The global financial crisis of 2008 has increased companies' alertness to unknot the valuable cash locked in the working capital cycle. A company's many loan contracts enable the company to maintain a necessary networking capital, influencing its capacity for debt financing. From 2010 onwards, most firms registered an increase in their management of working capital funds, although there was an enhancement in payables in comparison to receivables and inventories (Ernst and Young, 2011). However, the businesses also had billions in working capital tied up, showing a significant amount of their working capital range. For instance, as per REL/CFO Asia Magazine's report, \$535 billion was blocked in working capital. Companies have billions tied up in working capital because the growing economies usually have troubles with the competent deployment of resources (Vijayakumar & Venkatachalam, 1996). The net rise in working capital is one factor influencing the shortfall in the fund balance, which influences the amount of debt issued (Shyam-Sunder & Myers, 1999). Besides, many studies have concluded that leverage has a strong influence on the working capital outlays of a company (Chiou et al., 2006; Kargar & Blumenthal, 1994). Other researchers identified certain company-specific factors such as growth trajectory, profitability, size, age, operating cash flow, and valuation to impact working capital management.

Generally, corporate finance is based on three main areas: capital structure, capital budgeting, and working capital malmanagement. Capital structure and capital budgeting were found a substantial portion of the research studies, whereas working capital management has been comparatively less attractive for researchers exploring research (Chiou et al., 2006). Furthermore, the WCM literature has conventionally intensive to know the relationship between a firm's working capital and its performance and less importance placed on the set of factors that outline firms' behavior (Nazir & Afza, 2009; Palombini & Nakamura, 2012). Subsequently, it has become clear that the financial manager role goes beyond simply finding the ideal levels of working capital and its components. Now finance managers have to figure out how various internal and external factors affect WCM. Our paper is a contribution to WCM literature which enables finance managers to know the determinants that influence WCM.

The purpose of our study was to find out the domineering source that affects the working capital management of Indian manufacturing companies. Our study makes several contributions to the literature on WCM. First, although India is considered to be one of the largest economies in the world, no published research has been found by authors purely based on the determinants of WCM for Indian firms. This omission clarifies why this research is contemptuously significant and inimitable. Our research determines working capital management through two proxies to working capital—working capital requirement (WCR) and cash conversion cycle (CCC) – while most studies used these dependent variables disjointedly. Third, to know the factors that influence the working capital of the firms, we used eight independent variables viz; operating cash flow (OCF), performance as return on assets (ROA), valuation as Tobin's Q (TQs), firm size, firm age, growth opportunities, leverage, and economic condition as the gross domestic product (GDP) that provide a wider scope to our study. Our study is anticipated to add new insights to the WCM area because

the consequences are expected to give a better understanding of the influence of different internal and macroeconomic factors on WCM behavior. Also, finance managers can use the finding of different research to identify the relevant consequences of poor WCM (Prasad et al., 2019). So, we recommend essential actions for financial managers and senior management in Indian listed firms.

To achieve the purpose of our study, henceforth the structure of the paper is arranged in the following sequences. Section 2 investigates the preceding literature on WCM and its determinants. Section 3 portrays the research methodology and the analysis of data. Section 5 addresses the key findings of the research. And finally, section 6 discusses the conclusion and recommendation of the study.

2. Literature review

Singh and Kumar (2014) revealed in their study that the key issues with past WCM literature were a lack of systematic theory development study, which would open all new areas for future research. So, our study divides the literature review into two sections. The first section discusses the representative of WCM in form of its proxies and the other section reviews literature related to the factors impacting WCM.

The literature on working capital can be determined by considering CCC and WCR (Akinlo, 2012).

Many researchers used WCR as a proxy of working capital to understand what factors influence WCM (Al-Talab et al., 2010; Cuong & Nhung, 2017; Gill, 2011; Nazir & Afza, 2009; Salawu & Alao, 2014; Wasiuzzaman & Arumugam, 2013; Çetenak et al., 2017). Hill et al. (2010) observed the effect of different firm-specific factors on working capital by taking a sample of 3,343 manufacturing firms from the US. The research concluded that while WCR has a positive relationship with firm size and OCF, it has a negative relationship with market-to-book ratio and financial crunch. In Canada, Gill (2011) examined the same with a sample of 166 Canadian firms and concluded that WCR is positively associated with business operating cycle and return on assets (ROA), and is negatively associated with growth opportunities and firm size. The working capital requirement is the net working capital (NWC) divided by the company's current assets. Where NWC is the difference between the current assets and current liabilities of the firm. Working capital indicates a company's liquid assets compared to its current liabilities and thus providing an insight into the short-term financial health of the firm. In this way, WC also indicates the operational efficiency of the firm. Goes without saying, if a company's working capital is good, it will grow, and on the contrary, if a company's working capital situation is not good, it may face financial troubles.

The cash conversion cycle can be used to measure the productivity of working capital management (Deloof, 2003; Manoori & Muhammad, 2012; Palombini & Nakamura, 2012; Rimo & Panbunyuen, 2010; Valipour et al., 2012; Zariyawati et al., 2010, 2016). The cash conversion cycle is the "net inventory period" coupled with the "accounts receivable period" (ARP) and minus "accounts payable period". CCC and working capital management efficiency are inversely related, as low CCC indicates lower capital requirements leading to less opportunity cost, which in turn results in better cash flows that improve the financial health of firms (Banomyong, 2005). On the contrary, a longer cash conversion cycle results in higher opportunity costs and less working capital management efficiency.

When we look at India's manufacturing sector, there have been very few studies conducted, and even fewer in the international sense. 2006) used panel data analysis to examine 58 small manufacturing firms in Mauritius between 1998 and 2003 to conclude high working capital requirements lower profitability. Raheman, A., et.al (2010) studied 204 Pakistani manufacturing firms from 1998 to 2007 and discovered that CCC, Net trade cycle, and inventory turnover have a major impact on the firms' efficiency. Leverage, sales growth, and firm sizes had a positive impact on the company's profitability. 2012) researched Sri Lankan manufacturing firms from 2008

to 2011 and did not notice any meaningful relationship between CCC and performance measures. 2016) studied Indian manufacturing firms and showed that CCC was adversely related to the return on equity (ROE) but positively associated with the net profit ratio (NPR). 2011) shows that Canadian manufacturing firms' leverage and their firm value influence WCR. 2012) studied 75 manufacturing firms for the period from 2002 to 2009, which were listed on the Istanbul stock exchange, and found that shorter CCC and accounts receivable would increase the profitability of firms.

2.1. Operating cash flow

Baños-Caballero et al. (2010) concluded that companies with greater potential to produce cash flows earmark higher working capital as it reduces the cost of short-term funds. This conclusion is in concurrence with Fazzari and Petersen (1993). On the Other hand, Baños-Caballero et al. (2014) suggest that companies with high cash flow tend to offer longer credit periods significantly increasing CCC, which negatively impacts WCM efficiency. Contradicting this, Chiou et al. (2006) find that firms with high cash flow have better working capital efficiency and possess higher net liquidity, which might result in shorter CCC. 2016), found that companies with cash flows less than the median of the sample have lower working capital investments, while companies with cash flows higher than the sample median have higher working capital investments.

The inverse relation between CCC and operating cash flow is concluded by various studies. Also, it is concluded that firms efficiently manage working capital will have longer CCC resulting in less operating cash flow (Manoori & Muhammad, 2012; Palombini & Nakamura, 2012; Rimo & Panbunyuen, 2010; Valipour et al., 2012; Zariyawati et al., 2016).

Hence, based on the above-stated literature, we develop the following hypotheses:

H_{1a}. Operating cash flow is positively related to WCR.

H_{1b}. Operating cash flow is negatively related to CCC.

2.2. Growth

Blazenko and Vandezande (2003), opine that when businesses expect future earnings growth, the existing inventory level also rises proportionately to support higher sales. Cuñat (2007) concludes that when companies experience slower sales growth sources use their trade credit as a source of financing customers. Petersen and Rajan (1997) argue that firms provide more credit to customers in order to grow their sales, particularly during weak demand. Thus, growth potential seems to have a positive association with CCC.

H_{2a}. Firm Growth is negatively related to WCR.

H_{2b}. Firm Growth is negatively related to CCC.

2.3. Return on assets (ROA)

The study after reviewing the existing literature finds that a reduction in the invested amount of WC helps to achieve higher levels of profitability (Kayani et al., 2019). Better management of working capital and its components will improve firm efficiency i.e., low working capital requirements (Narender et al., 2008). Literature observed that WCR is positively related to firm performance (Abbadi & Abbadi, 2013; Al-Talab et al., 2010; Chiou et al., 2006; Cuong & Nhung, 2017; Narender et al., 2008; Nazir & Afza, 2009; Rehman et al., 2017; Saarani & Shahadan, 2012; Wiguna & Wasistha, 2017).

Naser et al. (2013) show that shorter CCC, which can be used as a proxy to WCM efficiency, improves cash flows and thus profitability. This is in agreement with prior research by Uyar (2009),

Haron and Norman (2016), Azami and Tabar (2016), Baos-Caballero et al. (2013), and Valipour et al. (2012). As a result, the third hypotheses and its variants are:

H_{3a}. Performance is positively related to WCR.

H_{3b}. Performance is negatively related to CCC.

2.4. Firm value

Efficient WCM reflects in the stock market performance of firms (Hill et al., 2010). He predicted in his study that the investors offer higher values to the stocks of the companies holding lower working capital ratios. Similarly, other researchers have shown that additional investment in the WCR level would reduce the company's value (Gill, 2011; Kieschnick et al., 2013). This results in a negative relationship between firm value and WCR. Also, shorter CCC indicates better management of working capital resulting in higher firm value.

The ratio of the net market value of the debt and equity in addition to book value divided by the book value of the company's total assets determines the company's value. According to 1996, Tobin's Q is used to measure firm value, since each measure of value in the above equation would have a different impact. Shin and Soenen (1998) concluded that the cash conversion cycle (CCC) calculates liquidity management that forecasts companies' funding needs, mainly in working capital. If CCC is lengthy, the company will have a low level of working capital investment. Thus, the fourth hypothesis and its variants are as follows:

H_{4a}. Firm value is negatively related to WCR.

H_{4b}. Firm value is positively related to CCC.

2.5. Age

The bond between the age of companies and the effectiveness of CCC has been observed by many studies. Mathuva (2013) investigated non-financial listed firms and could not find any significant link between the firm's age and CCC. According to Niskanen and Niskanen (2006), a firm's age determines the business's capacity to receive external financing and consequently influences working capital.

Since young companies have better growth prospects with less capital reserved, their age is expected to affect business liquidity positively. On the other hand, older companies acquire stability and hold more resources but few growth options, resulting in higher liquidity investment (Chiou et al., 2006). It has been found that older company develops a good relationship with their clients and suppliers, hence better controlling their inventory, reducing the need for working capital (Wasiuzzaman & Arumugam, 2013). So, the fifth hypotheses and its variants based on the literature, are as follows:

H_{5a}. Firm age is positively related to WCR.

H_{5b}. Firm age is positively related to CCC.

2.6. Size

Firms that are large in size have easy access to different sources of capital financing that reduces business failure probability (Wasiuzzaman & Arumugam, 2013). As a result, these firms need not hold excess current assets due to the quick approach of borrowing with reasonable cost (Berger et al., 2001; Moss & Stine, 1993; Niskanen & Niskanen, 2006; Petersen & Rajan, 1997). So, larger firms need less WCR (Abbadi & Abbadi, 2013; Cuong & Nhung, 2017; Gill, 2011; Rehman et al., 2017; Wasiuzzaman & Arumugam, 2013).

Works of literature showing a positive association between a firm's size and CCC is very few. Some of the studies predict large firms to be diverse with a better ability to raise capital and take advantage of trade opportunities with more trade credit periods (Niskanen & Niskanen, 2006). Contrary, small firms have more financial limits, and consequently, they attempt to reduce inventory levels in order to reduce CCC (Fazzari & Petersen, 1993; Petersen & Rajan, 1997). So, the size and CCC are positively associated with each other. But on the contrary, Baños-Caballero et al. (2010) observed negotiating power of firms to be directly proportional to their size, and hence, the CCC of large firms is shorter compared to small firms. Moreover, many empirical studies predicted the size of a firm has a detrimental impact on CCC (Mongrut et al., 2014; Rimo & Panbunyuen, 2010; Iftikhar, 2013; Zariyawati et al., 2010; Manoori & Muhammad, 2012; Haron and Norman, 2016; Valipour et al., 2012; Uyar, 2009).

Thus, the sixth hypothesis and its variants are as follows:

H_{6a}. Firm size is negatively related to WCR.

H_{6b}. Firm size is negatively related to CCC.

2.7. Leverage

A highly levered firm might face a credit crunch for daily business expenses. However, that can be averted through effective working capital management by limiting capital borrowing from external sources (Chiou et al., 2006). Leverage, however, is inversely related to working capital requirements. (Akinlo, 2012; Tjandra et al., 2022). Many researchers have reported an adverse association between leverage and working capital requirement (e.g., Abbadi & Abbadi, 2013; Al-Talab et al., 2010; Chiou et al., 2006; Nazir & Afza, 2009; Rehman et al., 2017; Wiguna & Wasistha, 2017). Hence, we also assume an adverse link between leverage and WCR. Likewise, firms paying more interest against their external borrowing tend to hold shorter CCC (Baños-Caballero et al., 2013). Also, research has concluded that leverage and length of CCC are inversely related (Akinlo, 2012; Azami & Tabar, 2016; Chauhan & Banerjee, 2018; Iftikhar, 2013; Palombini & Nakamura, 2012; Zariyawati et al., 2016). Subsequently, we assume a harmful link between leverage and CCC. So, the following is how seventh hypothesis:

H_{7a}. Firm Leverage is negatively related to WCR.

H_{7b}. Firm Leverage is negatively related to CCC.

2.8. Gdp

The level of working capital requirement and economic conditions have been found correlated. Al Taleb et al., (2010), pointed out that the changes in the interest rates, which are a product of gross domestic product (GDP), impact working capital. Qurashi and Zahoor (2017) found a positive association between GDP and WCR. The findings suggested that general demand in a country will impact working capital requirements, in the other words GDP growth has a significant and positive influence on working capital. Goel and Sharma (2015) found an insignificant relationship between GDP with CCC. Based on the above arguments, the eighth hypotheses and its variants are as follows:

H_{8a}. GDP is positively related to WCR.

H_{8b}. GDP is negatively related to CCC

3. Research methodology

3.1. Data and sample

For this study, balanced panel data of 291 Indian manufacturing firms, from the BSE 500 Index, has been gathered. Services oriented such as banks, and financial institutions are not included in

the study as their working capital requirements are unique. Research data were collected from the Prowess Database for the period 2010–2020. The Prowess is one of the most reliable sources of data for Indian firms. Additionally, GDP-related data was obtained from the various bulletins released by the Reserve Bank of India. Variable descriptions are given in Table 1 and 2.

4. Methodology

Working Capital cannot be measured directly, so we used WCR and CCC as proxies. We used the following two equations (empirical models) to estimate dependent variables:

$$WCR_{i,t} = \alpha + \beta_1 CCC_{i,t-1} + \beta_2 OCF_{it} + \beta_3 GROWTH_{it} + \beta_4 ROA_{it} + \beta_5 TQ + \beta_6 AGE + \beta_7 SIZE + \beta_8 LEV + \beta_9 GDP + \varepsilon_{it}$$

$$CCC_{i,t} = \alpha + \beta_1 WCR_{i,t-1} + \beta_2 OCF_{it} + \beta_3 GROWTH_{it} + \beta_4 ROA_{it} + \beta_5 TQ + \beta_6 AGE + \beta_7 SIZE + \beta_8 LEV + \beta_9 GDP + \varepsilon_{it}$$

Both these models were tested using panel data as Baltagi (2005) and Hsiao (2003) explain panel data offers more degrees of freedom, lower collinearity among variables, and offers better control for heterogeneity for individual variables. Thus, panel data is superior to other methodologies.

Balanced panel data of 291 companies in the manufacturing sector for 2010–2020 was used for this study. Further, the above empirical models were tested to check the endogeneity, multicollinearity, heteroskedasticity, and serial correlation.

The variance inflation factor (VIF) and tolerance values are calculated under collinearity statistics to check the multicollinearity. Variable coefficient does not face multicollinearity if VIF is less than two for all the variables (Field, 2005; Hair et al., 2006). The result of VIF is found less than 5 among the variables. According to Durbin's value, the Watson test for both models is 1.859 (WCR) and 1.898 (CCC). This indicates that there is no serial correlation exists. So, there is no need to consider lagged values for dependent variables. While testing the heteroskedasticity in data, White's test was used to reject the null hypothesis of homoscedasticity. This result proved that the data has heteroskedasticity. Regarding the endogeneity problem, Baños-Caballero et al. (2010) argued that working capital management could significantly impact measures of a firm's performance and sales. The null hypothesis of the Durbin–Wu–Hausman test was accepted at the 1 percent level of significance; hence, the two OLS models face an endogeneity problem.

5. Results and discussion

5.1. Descriptive and correlation statistics

Table 3 provides descriptive statistics of all the variables. The WCR average is 14.30 percent, indicating that the sample's companies have diverted 14% of all investments toward the WCM policy. Likewise, these firms take an average of 39 days to complete their CCC. We can also see a huge range in the CCC values, with the minimum being –684.0 and the maximum being 657.57 days. The difference can be explained through the CCC length in these sectors.

Also, we can see a high standard deviation of 65.03 days. The average operating cash flow is 0.086, meaning as a proportion of total assets operating cash flow is less than 10 percent on average. ROA has an average of about 10 percent and a standard deviation of 0.4379, indicating moderate performance in the sample companies during the period. Tobin's Q ratio has an average of 259.49 percent, saying that the firm value is greater than the total assets of the sample firms. Firm age had an average value of 40.24 years, showing that companies in the sample were founded over an extended period. Firm size varies widely among companies across the study sample, with a mean Firm Size of INR 149,715 and a standard deviation of INR 446,092. In line with firm size, the growth to ranges widely with an average growth rate is 6.7 percent and

Table 1. Review of literature

Study	Sample firms	Country	Methodology	Variables	WCM Proxies	Determinants of WCM
Al-Talab et al. (2010)	82 listed firms	Jordan	Panel OLS	GDP and WCR	WCR	Operating cash flow, sales growth, firm performance and value
Abbadi and Abbadi (2013)	11 listed firms	Palestine	Panel OLS	Firm characteristics, interest rate and GDP	WCR	CCC, return on assets and operating cash flow
Ali and Khan (2011)	28 listed firms	Pakistan	OLS	Firm characteristics and business cycle	WCR, NLB	Factors are varying across sectors
Akinlo (2012)	66 listed firms	Nigeria	Panel OLS and fixed effects	Firm characteristics and GDP	WCR, CCC	Operating cycle, size and sales growth, Leverage and GDP
Baños-Caballero et al. (2010)	4,076 SMEs	Spain	Panel OLS and GMM	Firm characteristics, interest rate and GDP	CCC	Debts, growth opportunities, size, fixed assets and performance and age
2006)	19,180 listed firm	Taiwan	Panel OLS	Firm characteristics, business cycle and recession	WCR and NLB	Growth opportunities, firm age, size and performance
2017)	1,253 firms	14 emerging countries	Panel OLS with fixed effects	Firm characteristics, industry country-level factors	WCR	Tobin Q, Altman Z-score, exchange rate and rule of law
2018)	17,161 unlisted firms	India	Panel OLS and GMM	Firm characteristics	CCC	Cash flow, growth opportunities and leverage
2017)	314 listed firms	Vietnam	Panel GMM	Firm characteristics	WCR	Firm size and investment in fixed assets
2015)	1,200 listed firms	India	Panel GLS with fixed effect	Firm characteristics	CCC	Firm age, fixed assets, profitability and sales growth
2011)	166 listed firms	Canada	Panel OLS	Firm characteristics	WCR	Growth opportunities and firm size.

(Continued)

Table 1. (Continued)

Study	Sample firms	Country	Methodology	Variables	WCM Proxies	Determinants of WCM
Hill et al. (2010)	3,343 firms	USA	Panel OLS with fixed effects	Firm characteristics and industry practices	WCR	Operating cash flow and size Sales variance, market-to-book ratio
2015)	57 listed firms	Malaysia	Panel OLS with random effects	Firm characteristics	CCC	Profitability, size and sales growth
2013)	9 listed firms	Pakistan	Panel OLS with fixed effect	Firm characteristics	CCC	Debts, fixed assets, sales growth and firm size
2014)	9,254 firms	Brazil, Argentina, Chile and Mexico	Panel OLS with fixed effects and quantile regression	Firm characteristics, industry concentration, and country risk	CCC	Firm size and country risk
2012)	94 listed firms	Singapore	Panel OLS with fixed and random effects	Firm characteristics and GDP	CCC	Firm size, operating cash flow, capital expenditure and GDP
2012)	96 listed firms	Brazil	Panel GLS with fixed effects	Firm characteristics and governance mechanisms	WCR and CCC	Debt, free cash flow and sales growth
2017)	760 firms listed firm	China	Panel GMM	Firm characteristics, governance mechanisms and GDP	WCR	Firm size, asset tangibility, operating cash flow, GDP, debt, board size and board independence
Wiguna and Wasistha (2017)	85 listed firm	Indonesia	Panel GLS	Firm characteristics and economic conditions	WCR	Leverage
2016)	30 listed firms	Malaysia	Panel OLS with fixed and random effects,	Firm characteristics, executive compensation	CCC	Leverage, operating cash flow, performance, executive compensation, and inflation rate

Table 2. Variable description

Variable	Description
Dependent variable	
Working Capital Requirement (WCR)	Networking capital/total assets. Where net working capital is the difference between current assets and current liabilities of the firm.
Cash Conversion Cycle (CCC)	Inventory period + accounts receivables period – accounts payable period
Independent Variable	
Operating cash flows (OCF)	Operating cash flows/total assets,
Return on Assets (ROA)	Net profit after taxes/total assets
Growth Opportunities (GROWTH)	Percentage change in sales over the previous year
Firm value (TQ)	(Market value of equity + book value of total debts)/total assets
Firm Size (Size)	Natural logarithm of total assets
Firm Age (Age)	Natural logarithm of the firm's age since the date of its incorporation i.e listing date on stock exchange.
Leverage (LEV)	Total debts/total assets
Economic conditions (GDP)	Annual change in the real gross domestic product
Authors Own Calculation	

Table 3. Descriptive statistics

Variables	Mean	Median	Std. Deviation	Minimum	Maximum
WCR	.1430	.1300	.19711	–1.24	1.00
CCC	38.8988	30.1700	65.03286	–684.11	657.57
OCF	.0859	.0800	.09268	–.99	.72
ROA	.1006	.0700	.43796	–2.49	15.59
TQ	2.5949	1.7500	2.98393	–1.35	70.00
AGE	40.2423	34.0000	22.86436	–3.00	140.00
SIZE	149715.8784	34901.9500	446092.05106	0.00	7766990.00
SizeL	4.5905	4.5434	.68322	–1.00	6.89
LEV	.7114	.4800	12.53527	0.00	676.60
GROWTH	.0676	.1000	.62269	–27.20	1.00
GDP	7.0260	6.8900	1.20833	4.90	8.89

a minimum of –27.20 percent while the maximum is 1 percent. The ratio is around 0.71, meaning that debt is around 71 percent of total assets, revealing that the firms in the sample are considerably leveraged. Lastly, average GDP growth is about 7 percent, meaning comparatively Indian economy was growing at a brisk pace during the analysis period.

Table 4 shows correlations among variables. As evident from the table, independent variables are significantly correlated with at least one of the two proxies. Therefore, both independent variables hold good in the considered model.

Further, Pearson's correlation matrix shows WCR is positively correlated with operating cash flow, cash conversion cycle, Tobin Q, growth, and GDP while negatively correlated with age,

Table 4. Correlation										
Correlations										
	WCR	CCC	OCF	ROA	TQ	AGE	LEV	GROWTH	GDP	Size (log)
WCR	1									
CCC	.264**	1								
OCF	.019	-.128**	1							
ROA	0.212	-.078	.066**	1						
TQ	.097	-.068	-.024	-.028	1					
AGE	-.067	-.042	.018	.006	-.006	1				
LEV	-.0397	-.011	-.019	-.006	-.011	-.030	1			
GROWTH	.025	.068**	.066**	-.020	-.042*	-.029	-.001	1		
GDP	0.073	-.010	.006	.066**	-.027	-.069**	-.005	.029	1	
Size(log)	-.269**	-.091**	-.068**	.032	-.114**	.234**	-.132**	-.026	-.107**	1

** Correlation is significant at the 0.01 level (2-tailed).

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

Source: Author's Calculations.

leverage, and size. Whereas CCC is positively correlated with growth, it is negatively correlated with operating cash flow, ROA, Tobin Q, age, leverage, GDP, and size.

The OLS model is applied to variables as per Tables 5-6. We analyzed OLS regression to check the robustness of our model. The regression analysis lays out the predictors OCF (p-value of 0.211 with a t-value of -1.252), ROA (p-value of 0.00 with a t-value of 7.274), TQ (p-value of 0.042 with t-value of -2.037), Age (p-value of 0.00 with t-value of -3.789), size log (p-value of 0.042 with t-value of 2.030), leverage (p-value of 0.167 with t-value of 1.381), growth (p-value of 0.00 with t-value of -4.475), GDP (p-value of 0.00 with t-value of -16.031).

The values mean that apart from OCF and LEV, all the other variables are significant in the model, as the p-value and t-values are in insignificant ranges to determine the profitability (financial performance) of India's manufacturing firms.

Table 4 A (ANOVA) shows a linear regression relationship between the dependent (represented by WCR) and independent variables, from the F statistics of 40.869 (highly significant at 0.000) and with a p-value of less than 0.05.

Table 5. Working capital requirement OLS regression

WCR

	Coefficients (t-values)	Sig (.05%)	Tolerance	VIF
(Constant)	17.767	.000		
OCF	-1.252	.211	.983	1.017
ROA	7.274	.000	.989	1.012
TQ	-2.037	.042	.981	1.019
AGE	3.789	.000	.941	1.062
SIZE(Log)	2.030	.042	.981	1.020
LEV	1.381	.167	.991	1.009
GROWTH	-4.475	.000	.980	1.021
GDP	-16.031	.000	.900	1.112
No. of observations	2894			
Adjusted R2	0.099			
F-statistic	40.869			
Durbin-Watson statistic	1.859			
Significant at .01				

Source: Authors Calculation The table shows the regression values for the WCR model

Table 6. Wcr – ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	11.470	8	1.434	40.869	.000 ^b
	Residual	101.246	2886	.035		
	Total	112.716	2894			

a. Dependent Variable: WCR

b. Predictors: (Constant), SizeL, GROWTH, ROA, OCF, TQ, GDP, LEV, AGE

The Durbin Watson (DW) statistic, an autocorrelation residual from regression analysis, is 1.859 – which is between 0 and 2 – meaning data shows slight positive autocorrelation. A value of 2.0 indicates no autocorrelation and any value from 0 to 2 indicates positive autocorrelation. VIF is computed for each predictor, and it is observed that there is no correlation between the variables.

The OLS model is applied to variables as per Tables 7-8. Regression analysis shows that the predictors OCF (p-value of 0.00 and the corresponding t-value of –8.16), ROA (p-value – 0.363 and t-value – .909), TQ (p-value – 0.00 and t-value – –8.87), Age (p-value – .6450 and t-value – .461), size log (p-value – .075 and t-value – –1.782), leverage (p-value – 0.00 and t-value – 3.796), growth (p-value – 0.078 and t-value – –1.765), GDP (p-value – 0.00 and t-value – –6.677). Except for ROA, age, Size (log), and growth, all the other variables are significant for the model, as the p-value and t-values are within the range to determine the profitability (financial performance) of the manufacturing companies in India.

When we analyze Table 8 (ANOVA), we see that the F-value of 23.139 is highly significant at 0.000. Thus, we can safely conclude that there is a linear regression relationship between the dependent (represented by WCR) and independent variables as the p-value is less than 0.05. The Durbin-Watson statistic value is 1.898 – which is between 0 and 2 – indicating that there is positive autocorrelation. VIF is computed for each predictor, and it is observed that there is no correlation between the variables.

Table 7. Cash conversion cycle OLS regression

	Coefficients (t-values)	Sig (.05%)	Tolerance	VIF
(Constant)	10.686	.000		
OCF	–8.160	.000	.983	1.017
ROA	–.909	.363	.989	1.012
TQ	–8.872	.000	.981	1.019
AGE	.461	.645	.941	1.062
SIZE(Log)	–1.782	.075	.981	1.020
LEV	3.796	.000	.991	1.009
GROWTH	–1.765	.078	.980	1.021
GDP	–6.677	.000	.900	1.112
No. of observations	2910			
Adjusted R2	0.058			
F-statistic	23.139			
Durbin–Watson statistic	1.898			
Significant at .01				

Source: Authors Calculation. The table shows the regression values for the CCC model

Table 8. Ccc—anova

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	740196.927	8	92524.616	23.139	.000 ^b
	Residual	11539943.293	2886	3998.594		
	Total	12280140.220	2894			

a. Dependent Variable: CCC

b. Predictors: (Constant), SizeL, GROWTH, ROA, OCF, TQ, GDP, LEV, AGE

Table 9 illustrates the empirical model results, in which WCR is used as a proxy variable to analyze working capital management. As already discussed that the OLS model does not address the endogeneity problem; therefore, to overcome that, Blundell and Bond (1998) suggested 2 steps, and a dynamic GMM estimator was tested. The adjusted R² means that about 85.7% of explanatory variables can be explained through the cross-sectional variation in WCR of the two-step GMM model(column1).

The Durbin—Watson test result is 1.812, which is within the range and indicates an auto-correlation between the dependent and independent variables. By Sargan's statistics, we can say that two-step GMM and dynamic GMM are valid. The Arellano—Bond test was conducted to test whether the model has second-order autocorrelation and the results do not indicate any second-order autocorrelation problem. Therefore, the conditions for the GMM estimator were satisfied. Table VII does not show any significant positive relation between WCR and OCF with both dynamic and two-step GMM for all models' significance levels; hence, H₁ is partially established.

This negative correlation contrasts the findings of Hill et al. (2010), Abbadi and Abbadi (2013), Al-Talab et al. (2010), and Wasiuzzaman and Arumugam (2013) and postulate that efficient WCM leads to high levels of operating cash flow. Efficient WCM accelerates receivables collection and lengthened liabilities maturities increasing cash flows and lowering WCR.

The two-step and dynamic GMM results indicate a negative relationship between growth opportunities and WCR proving H_{2a}. These findings follow the conclusions of previous studies by Narender et al. (2008), Hill et al. (2010), and Gill (2011). This is also in consonance with the practices of companies with higher growth opportunities that try to reduce total working capital levels by lowering net operating working capital and liabilities (Chiou et al., 2006). Another important measure of a firm's financial performance is the return on total assets, which at the 1% level of significance in all models proves a significant positive association with WCR. Therefore, H₃ is partially accepted. Previous empirical studies have also shown a firm's performance has a positive impact on WCR levels (Abbadi & Abbadi, 2013; Al-Talab et al., 2010; Chiou et al., 2006; Cuong & Nhung, 2017; Narender et al., 2008; Nazir & Afza, 2009; Rehman et al., 2017; Saarani & Shahadan, 2012; Wiguna & Wasistha, 2017). This result shows that firms with higher profitability would have enough cash available for their investments; hence, their working capital requirements are met with internal finances leading to less attention to WCM.

Tobin's Q, which measures a firm's value, shows a strong positive relationship with WCR, therefore, we reject H_{4a}. Nazir and Afza (2009) and (2017) also show positive relationship between Tobin's Q and WCR. Contrary to the studies of Kieschnick et al. (2013), Hill et al. (2010), Gill (2011), and Wasiuzzaman and Arumugam (2013), this study shows that companies with high WCR ensure sufficient liquid cash for operations lowering its liabilities and thus galvanizing investors' optimism.

We can conclude that firm age has a very positive relationship with WCR at the 1% significance from both, the two-step GMM and the dynamic GMM; hence, H_{5a} is accepted. On similar lines, Chiou et al. (2006) and Saarani and Shahadan (2012) conclude that older companies have higher WCR. Young firms have lower working capital due to their higher growth. Growth rates saturate over time increasing working capital requirements (Chiou et al., 2006). From Table 9, we can see that the mean firm age is about 40.24 years, supporting the findings that firm age has a very positive relationship with WCR.

Firm size and WCR, as shown in the dynamic GMM models' coefficients, have a highly significant negative relationship. Earlier studies by Gill (2011), Wasiuzzaman and Arumugam (2013), Abbadi and Abbadi (2013), Cuong and Nhung (2017), and Rehman et al. (2017) all supported these findings. Large companies have better access to capital with high bargaining power compared to smaller firms. This provides an opportunity for large firms to better manage their working capital. Nevertheless, dynamic GMM results are contrary to this. As per Table X10 firm size is positively

Table 9. GMM estimate for WCR

Two-Step GMM Estimate			Dynamic GMM estimate					
Model	1		2		3			
	Coefficients	t-values	Coefficients	t-values	Coefficients	t-values		
WCR _{t-1}	0.635	12.854***	0.458	36.524***	0.41	16.854***		
OCF	-0.1425	-3.236***	-0.096	-5.124**	-0.079	-3.265**		
ROA	.2920	3.954***	0.411	9.957***	0.411	10.025***		
TQ	.020	2.295***	0.024	4.154**	0.031	6.112**		
AGE	0.004	1.745*	0.11	3.958**	0.049	0.436**		
Size _{it}	-0.0690	-3.658**	0.049	6.154**	0.061	5.965***		
LEV	-0.073	-3.124*	-0.685	-1.991**	-0.088	-1.296**		
GROWTH	-0.029	-1.652*	-0.029	2.541**	-0.43	-3.121***		
GDP	-0.0039	1.695**	-0.005	-5.952***	-0.017	-5.549***		
Industry Dummy	Used		Not-Used		Not-Used			
Control for firm effect	No		Yes		Yes			
Control for Year effect	No		No		Yes			
No. of observation	2910		2910		2910			
Adjusted R ²	0.857		-		-			
Durbin-Watson statistic	1.812		-		-			
Sargan statistic (p-value)	7.256	a	50.168	0.192	41.622	0.221		
Arellano-Bond test (p-value)	-		-1.002	0.301	-0.826	0.352		

Notes: ***, **, * Significant at .1005, 0.01 levels

Table 10. GMM estimates for CCC

Two-Step GMM Estimate			Dynamic GMM estimate					
1			2			3		
Model	Coefficients	t-values	Coefficients	t-values	Coefficients	t-values	Coefficients	t-values
CCC _{t-1}	0.875	31.254***	-0.011	-1.758*	-0.42	-4.186***		
OCF	-1.754	-4.121**	-0.956	-61.584***	-0.985	-18.988***		
ROA	2.152	3.954***	1.765	20.325**	1.278	13.948***		
TQ	.0156	3.125**	0.081	5.024***	0.059	2.201**		
AGE	.006	.195	-1.141	-10.256	0.215	.812		
SizeL	-0.410	-1.021	-0.108	-71.85***	-0.093	4.965**		
LEV	.315	2.014**	0.215	4.965***	0.342	2.187***		
GROWTH	-0.121	-0.396	-0.312	-18.542**	-0.491	-11.958**		
GDP	.065	2.158**	0.003	1.521	0.002	0.129		
Industry Dummy	Used		Not-Used		Not-Used			
Control for firm effect	No		Yes		Yes			
Control for Year effect	No		No		Yes			
No. of observation	2910		2910		2910			
Adjusted R ²	0.832		-		-			
Durbin-Watson statistic	2.354		-		-			
Sargan statistic (p-value)	10.887	0.298	41.897	0.345	30.548	0.701		
Arellano-Bond test (p-value)	-		-1.211	0.205	-1.021	0.212		

Notes: ***, **, * Significant at .1005, 0.01 levels

correlated with WCR at a 1 percent significance level indicating that smaller firms better manage working capital due to their limited financing avenues to meet their WCR (Hill et al., 2010). These results are in line with the prior literature (Akinlo, 2012; Hill et al., 2010; Salawu & Alao, 2014).

Both the GMM models reveal a significant negative relationship between financial leverage and WCR, thus, H_7a is accepted. These findings are consistent with many previous studies such as Chiou et al. (2006); Nazir and Afza (2009); Al-Talab et al. (2010); Abbadi and Abbadi (2013); Rehman et al. (2017); among many other studies. This research signaled that due to heavy debt, firms will have a higher interest burden, therefore, be left with limited resources for day-to-day operations and future investments.

GDP and the level of WCR have a significant negative relationship; therefore, H_8 is partially accepted. During the recession, firms have high inventory levels and longer accounts receivable cycles leading to higher WCR contrary to this during boom periods firms have lower WCR. These findings backed up previous research by Chiou et al. (2006), Narender et al. (2008), and Rehman et al. (2009), Ali and Khan (2011).

Table 9 reveals all of the explanatory factors that have impacted WCR and thus WCR can be predicted using these variables. Eight sub-hypotheses have been accepted and thus we can conclude that WCR is positively related to firm age, firm performance, firm size, and firm value, whereas WCR, is negatively related to operating cash flow, growth opportunities, leverage, and economic conditions.

Table 10 illustrates the empirical model results, in which CCC is used as a proxy variable to analyze working capital management. As already discussed, the OLS model does not address the endogeneity problem; therefore, to overcome that, Blundell and Bond (1998) have suggested a 2 step and dynamic GMM estimator, which was tested. The adjusted R^2 demonstrated that the explanatory variables explained 83.2% of the cross-sectional variation in CCC of the two-step GMM model(column1).

The Durbin—Watson test result is 2.354, which is within the range, proving that the data is stationary data and not time series data, therefore, no auto-correlation between the dependent and independent variables. The Sargan statistics result showed that two-step GMM and dynamic GMM are valid. The Arellano—Bond test was conducted to test whether the model has second-order autocorrelation. The results also indicated no second-order autocorrelation problem with the data, satisfying the conditions of the GMM estimator. Table 10 indicates that the WCR of any year is positively associated with the CCC of the past year; hence it can be interpreted for the sample firms of CCC were already decided.

6. Conclusion and recommendation

In line with prior literature on the determinants of WCM, this study shows that working capital behavior in Egyptian corporations is affected by factors related to firm characteristics, economic conditions, and industry type. Hence, financial managers have to take the impact of these factors into account when determining investment and financing strategies to guarantee the achievement of efficient WCM. As per the analysis of our empirical results, we can propose the following recommendations for financial managers of listed manufacturing firms on the BSE 500.

- Finance manager should not only focus on the requirement of working capital but also attempt to manage the credit collection period efficiently to maintain a net liquid balance for smooth and efficient business operation.
- Cash conversion cycle becomes more significant in case of depressed GDP, so finance managers must think about alternative sources of financing in case the credit period gets lengthy.

- Our study suggests finance manager to overview the financing pattern as the size of the firm and the age of the firm increases, its financing pattern also changes.

The joint usage of WCR and CCC measurements when exploring the determinants of working capital behavior will help in providing a more comprehensive view, rather than using one of them as a single proxy.

Financial managers should pay more attention to the effective management of both WCR and CCC because this will help them in increasing the levels of current operating cash flows.

In times of economic slack, shrinking CCC length will help firms by providing more liquidity and cash flows necessary to meet their operational needs.

Firms have to take into account the impact of the variations in industry practices when determining the optimal WCR and CCC lengths.

Author details

Satish Chandra Tiwari¹

E-mail: satishitiwari@ibsindia.org

ORCID ID: <http://orcid.org/0000-0003-2029-829X>

Munawar Sayyad¹

Md Sikandar Azam¹

N S Sudesh¹

¹ ICFAI Business School, IFHE (Deemed to be University), Hyderabad, India.

Disclosure statement

No potential conflict of interest was reported by the authors.

Citation information

Cite this article as: Determinants of WCM of Indian listed firms: A GMM regression approach, Satish Chandra Tiwari, Munawar Sayyad, Md Sikandar Azam & N S Sudesh, *Cogent Economics & Finance* (2023), 11: 2199550.

References

- Abbadi, S. M., & Abbadi, R. T. (2013). The determinants of working capital requirements in Palestinian industrial corporations. *International Journal of Economics and Finance*, 5(1), 65–75. <https://doi.org/10.5539/ijef.v5n1p65>
- Afrifa, G. A., & Padachi, K. (2016). Working capital level influence on SME profitability. *Journal of Small Business and Enterprise Development*, 23(1), 44–63. <https://doi.org/10.1108/JSBED-01-2014-0014>
- Agrawal, A., & Knoeber, C. R. (1996). Firm performance and mechanisms to control agency problems between managers and shareholders. *The Journal of Financial and Quantitative Analysis*, 31(3), 377–397. <https://doi.org/10.2307/2331397>
- Akinlo, O. O. (2012). Determinants of working capital requirements in selected quoted companies in Nigeria. *Journal of African Business*, 13(1), 40–50. <https://doi.org/10.1080/15228916.2012.657951>
- Ali, S., & Khan, M. R. A. (2011). Searching for internal and external factors that determine working capital management for manufacturing firms in Pakistan. *African Journal of Business Management*, 5(7), 2942–2949.
- Alora, A., & Barua, M. K. (2019). Barrier analysis of supply chain finance adoption in manufacturing companies. *Benchmarking: An International Journal*, 26(7), 2122–2145. <https://doi.org/10.1108/BIJ-08-2018-0232>
- Al-Talab, G., Al-Zoued, A. A., & Al-Shubiri, N. F. (2010). The determinants of effective working capital management policy: A case study on Jordan. *Interdisciplinary Journal of Contemporary Research in Business*, 2(4), 248–264.
- Aravind, M. (2016). Influence of working capital metrics on profitability: A critical examination of the Indian manufacturing sector. *Kelaniya Journal of Management*, 5(1), 58. <https://doi.org/10.4038/kjm.v5i1.7506>
- Azami, Z., & Tabar, F. J. (2016). Investigating the factors affecting working capital of companies using the generalized method of moments. *Bulletin de la Société Royale des Sciences de Liège*, 85(1), 1402–1415. <https://doi.org/10.25518/0037-9565.6143>
- Baker, H. K., Kumar, S., Colombage, S., & Singh, H. P. (2017). Working capital management practices in India: Survey evidence. *Managerial Finance*, 43(3), 331–353. <https://doi.org/10.1108/MF-07-2016-0186>
- Baltagi, B. H. (2005). *Econometric analysis of panel data*. John Wiley & Sons.
- Banomyong, R. (2005). Measuring the cash conversion cycle in an international supply chain, *Annual Logistics Research Network (LRN) Conference Proceedings*. Plymouth, UK.
- Banos-Caballero, S., García-Teruel, P. J., & Martínez Solano, P. (2014). Working capital management, corporate performance, and Financial constraints. *Journal of Business Research*, 67(3), 332–338.
- Baños-Caballero, S., García-Teruel, P. J., & Martínez-Solano, P. (2010). Working capital management in SMEs. *Accounting & Finance*, 50(3), 511–527. <https://doi.org/10.1111/j.1467-629X.2009.00331.x>
- Baños-Caballero, S., García-Teruel, P. J., & Martínez-Solano, P. (2013). The speed of adjustment in working capital requirement. *European Journal of Finance*, 19(10), 978–992. <https://doi.org/10.1080/1351847X.2012.691889>
- Berger, A. N., Klapper, L. F., & Udell, G. F. (2001). The ability of banks to lend to informationally opaque small businesses. *Journal of Banking & Finance*, 25(12), 2127–2167. [https://doi.org/10.1016/S0378-4266\(01\)00189-3](https://doi.org/10.1016/S0378-4266(01)00189-3)
- Blazenko, G. W., & Vandezande, K. (2003). Corporate holding of finished goods inventories. *Journal of Economics and Business*, 55(3), 255–266. [https://doi.org/10.1016/S0148-6195\(03\)00023-7](https://doi.org/10.1016/S0148-6195(03)00023-7)
- Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115–143. [https://doi.org/10.1016/S0304-4076\(98\)00009-8](https://doi.org/10.1016/S0304-4076(98)00009-8)

- Çetenak, E. H., Vural, G., & Sökmen, A. G. (2017). Determinants of working capital in emerging markets: Do economic developments matter? In Ü. Hacıoğlu, H. Dinçer, & N. Alayoğlu (Eds.), *Global business strategies in crisis: strategic thinking and development* (pp. 385–397). Springer International Publishing.
- Chauhan, G. S., & Banerjee, P. (2018). Financial constraints and optimal working capital – evidence from an emerging market. *International Journal of Managerial Finance*, 14(1), 37–53. <https://doi.org/10.1108/IJMF-07-2016-0131>
- Chiou, J. R., Cheng, L., & Wu, H. W. (2006). The determinants of working capital management. *Journal of American Academy of Business*, 10(1), 149–155.
- Cuñat, V. (2007). Trade credit: Suppliers as debt collectors and insurance providers. *The Review of Financial Studies*, 20(2), 491–527. <https://doi.org/10.1093/rfs/hhl015>
- Cuong, N. T., & Nhung, N. T. H. (2017). Determinants of working capital requirement: Evidence from non-financial firms listed on the Vietnam exchange. *Journal of Insurance and Financial Management*, 3(1), 19–29.
- de Almeida, J. R., & Eid, W., Jr. (2014). Access to finance, working capital management and company value: Evidences from Brazilian companies listed on BM&Fbovespa. *Journal of Business Research*, 67(5), 924–934. <https://doi.org/10.1016/j.jbusres.2013.07.012>
- Deloof, M. (2003). Does working capital management affect profitability of Belgian firms? *Journal of Business Finance and Accounting*, 30(3–4), 573–587. <https://doi.org/10.1111/1468-5957.00008>
- Enqvist, J., Graham, M., & Nikkinen, J. (2014). The impact of working capital management on firm profitability in different business cycles: Evidence from Finland. *Research in International Business and Finance*, 32, 36–49. <https://doi.org/10.1016/j.ribaf.2014.03.005>
- Ernst and Young. (2011). Size Matter in Working Capital. Capital Agenda Insights. [[Google Scholar]]. [www.ey.com/Publication/vwLUAssets/Capital_Agenda_Insights_Issue_9/\\$FILE/Capital_Agenda_Insights_Size_matters_in_working_capital.pdf](http://www.ey.com/Publication/vwLUAssets/Capital_Agenda_Insights_Issue_9/$FILE/Capital_Agenda_Insights_Size_matters_in_working_capital.pdf)
- Fazzari, S. M., & Petersen, B. (1993). Working capital and fixed investment: New evidence on financing constraints. *The Rand Journal of Economics*, 24(3), 328–342. <https://doi.org/10.2307/2555961>
- Field, A. (2005). *Discovering statistics using SPSS*. SAGE Publications.
- Ghosh, D., Mehta, P., & Avittathur, B. (2021). Supply chain capabilities and competitiveness of high-tech manufacturing start-ups in India. *Benchmarking: An International Journal*, 28(5), 1783–1808. <https://doi.org/10.1108/BIJ-12-2018-0437>
- Gill, A. (2011). Factors that influence working capital requirements in Canada. *Economics and Finance Review*, 1(3), 30–40.
- Goel, U., & Sharma, A. (2015). Working capital management efficiency in Indian manufacturing sector: Trends and determinants. *International Journal of Economics and Business Research*, 10(1), 30–45. <https://doi.org/10.1504/IJEBR.2015.070273>
- Hair, J. F., Black, W. C., Babin, B. J., Anderson, R. E., & Tatham, R. L. (2006). *Multivariate data analysis*. Pearson Prentice Hall.
- Haron, R., & Amli Norman, N. M. (2015). Determinants of working capital management before, during, and after the global financial crisis of 2008: Evidence from Malaysia. *Asia Pacific Conference on Business and Social Sciences 2015, Kuala Lumpur*. 331–340.
- Hassan, M., & Shrivastava, S. K. (2019). Working capital management and its impact on the profitability of tata motors. In *Proceedings of 10th International Conference on Digital Strategies for Organizational Success*, Gwalior, India.
- Hill, M. D., Kelly, G. W., & Highfield, M. J. (2010). Net operating working capital behavior: A first look. *Financial Management*, 39(2), 783–805. <https://doi.org/10.1111/j.1755-053X.2010.01092.x>
- Hsiao, C. (2003). *Analysis of Panel Data*. Cambridge University Press.
- Iftikhar, M. F. (2013). Determinants of working capital management efficiency: Case study of Pakistani automotive and engineering firms listed in Karachi stock exchange. *Research Journal of Finance and Accounting*, 4(7), 216–236.
- Jamalinesari, S., & Soheili, H. (2015, October). The relationship between the efficiency of working capital management companies and corporate rule in Tehran Stock Exchange. *Procedia – Social and Behavioral Sciences*, 205, 499–504. <https://doi.org/10.1016/j.sbspro.2015.09.052>
- Kargar, J., & Blumenthal, R. (1994). Successful implementation of strategic decisions in small community banks. *Journal of Small Business Management*, 32(2), 10–22.
- Kieschnick, R., Laplante, M., & Moussawi, R. (2013). Working capital management and shareholders' wealth. *Review of Finance*, 17(5), 1827–1852. <https://doi.org/10.1093/rof/rfs043>
- Manoori, E., & Muhammad, J. (2012). Determinants of working capital management: Case of Singapore firms. *Research Journal of Finance and Accounting*, 3(11), 15–23.
- Mongrut, S., O'shee, D. F., Zavaleta, C. C., & Zavaleta, J. C. (2014). Determinants of working capital management in Latin American companies. *Innovar*, 24(51), 5–18. <https://doi.org/10.15446/innovar.v24n51.41235>
- Moss, J. F., & Stine, B. (1993). Cash conversion cycle and firm size: A study of retail firms. *Managerial Finance*, 19(8), 25–34. <https://doi.org/10.1108/eb013739>
- Narender, V., Menon, S., & Shwetha, V. (2008). Factors determining working capital management in cement industry. *South Asian Journal of Management*, 15(4), 64–78.
- Naser, K., Nuseibeh, R., & Al-Hadeya, A. (2013). Factors influencing corporate working capital management: Evidence from an emerging economy. *Journal of Contemporary Issues in Business Research*, 2(1), 11–30.
- Nazir, M. S., & Afza, T. (2009). Working capital requirements and the determining factors in Pakistan. *The IUP Journal of Applied Finance*, 15(4), 28–38.
- Niresh, J. A. (2012). Working capital management & financial performance of manufacturing sector in Sri Lanka. *European Journal of Business and Management*, 4(15), 23–30.
- Niskanen, J., & Niskanen, M. (2006). The determinants of corporate trade credit policies in a bank-dominated financial environment: The case of Finnish small firms. *European Financial Management*, 12(1), 81–102. <https://doi.org/10.1111/j.1354-7798.2006.00311.x>
- Padachi, K. (2006). Trends in working capital management and its impact on firms' performance: An analysis of Mauritian small manufacturing firms. *International Review of Business Research Papers*, 2(2), 45–58.
- Padachi, K., & Howorth, C. (2014). Focus on working capital management practices among Mauritian SMEs: Survey evidence and empirical analysis. E3

- Journal of Business Management and Economics*, 5 (4), 97–108.
- Palombini, N. V. N., & Nakamura, W. T. (2012). Key factors in working capital management in the Brazilian market. *Revista de Administração de Empresas*, 52(1), 055–069. <https://doi.org/10.1590/S0034-75902012000100005>
- Petersen, M. A., & Rajan, R. G. (1997). Trade credit: Theories and evidence. *Review of Financial Studies*, 10(3), 661–691. <https://doi.org/10.1093/rfs/10.3.661>
- Prasad, P., Narayanasamy, S., Paul, S., Chattopadhyay, S., & Saravanan, P. (2019). Review of literature on working capital management and future research agenda. *Journal of Economic Surveys*, 33(3), 827–861. <https://doi.org/10.1111/joes.12299>
- Qurashi, M., & Zahoor, M. (2017). Working capital determinants for the UK pharmaceutical companies listed in FTSE 350 index. *International journal of academic research in Accounting, Finance and Management Sciences*, 7(1), 11–17.
- Raheman, A., Afza, T., Qayyum, A., & Bodla, M. A. (2010). Working capital management and corporate performance of manufacturing sector in Pakistan. *International Research Journal of Finance and Economics*, 47(1), 156–169.
- Rehman, A. U., Wang, M., & Kabiraj, S. (2017). Working capital management in Chinese firms: An empirical investigation of determinants and adjustment towards a target level using dynamic panel data model. *Afro-Asian Journal of Finance and Accounting*, 7(1), 84–105. <https://doi.org/10.1504/AJFA.2017.082930>
- Rimo, A., & Panbunyuen, P. (2010). “The effect of company characteristics on working capital management: a quantitative study of Swedish listed companies”, master’s thesis, Umeå University.
- Saarani, A., & Shahadan, F. (2012). The determinant factors of working capital requirements for Enterprise 50 (E50) firms in Malaysia: Analysis using structural equation modeling. *Scottish Journal of Arts, Social Sciences and Scientific Studies*, 5(2), 52–66.
- Sagner, J. (2014). *Working capital management: Applications and case studies*. John Wiley & Sons.
- Salawu, R. O., & Alao, J. A. (2014). Determinants of working capital management: Case of Nigerian manufacturing firms. *Journal of Economics and Sustainable Development*, 4(14), 49–56.
- Seth, H., Chadha, S., & Sharma, S. (2021). Benchmarking the efficiency model for working capital management: Data envelopment analysis approach. *International Journal of Productivity and Performance Management*, 70(7), 1528–1560. <https://doi.org/10.1108/IJPPM-10-2019-0484>
- Shenoi, V. V., Dath, T. S., Rajendran, C., & Shahabudeen, P. (2018). Strategic action grids: A study on supply chain risk management in manufacturing industries in India. *Benchmarking: An International Journal*, 25(8), 3045–3061. <https://doi.org/10.1108/BIJ-11-2017-0321>
- Shin, H. H., & Soenen, L. (1998). Efficiency of working capital management and corporate profitability. *Financial Practice and Education*, 8(2), 39–45.
- Shyam-Sunder, L., & Myers, C. S. (1999). Testing static tradeoff against pecking order models of capital structure. *Journal of Financial Economics*, 51(2), 219–244. [https://doi.org/10.1016/S0304-405X\(98\)00051-8](https://doi.org/10.1016/S0304-405X(98)00051-8)
- Singh, H. P., & Kumar, S. (2014). Working capital management: A literature review and research agenda. *Qualitative Research in Financial Markets*, 6(2), 173–197. <https://doi.org/10.1108/QRFM-04-2013-0010>
- Talonpoika, A. M., Kärri, T., Pirttilä, M., & Monto, S. (2016). Defined strategies for financial working capital management. *International Journal of Managerial Finance*, 12(3), 277–294. <https://doi.org/10.1108/IJMF-11-2014-0178>
- Tjandra, C. K., Murhadi, W. R., & Herlambang, A. (2022). The determinants of working capital management in Indonesia and the Philippines. *Jurnal Siasat Bisnis*, 26 (1), 110–120. <https://doi.org/10.20885/jsb.vol26.iss1.art8>
- Uyar, A. (2009). The relationship of cash conversion cycle with firm size and profitability: An empirical investigation in Turkey. *International Research Journal of Finance and Economics*, 24(2), 186–193.
- Valipour, H., Moradi, J., & Karimi, K. (2012). The impact of company characteristics on working capital management. *Journal of Applied Finance and Banking*, 2(1), 105–125.
- Vijayakumar, A., & Venkatachalam, A. (1996). Responsiveness of working capital management. – a case study of Tamil Nadu Sugar Corporation. *Finance India*, 10(3), 647–655.
- Vural, G., Sökmen, A. G., & Çetenak, E. H. (2012). Effects of working capital management on firm’s performance: Evidence from Turkey. *International Journal of Economics and Financial Issues*, 2(4), 488–495.
- Wasiuzzaman, S., & Arumugam, V. C. (2013). Determinants of working capital investment: A study of Malaysian public listed firms. *Australasian Accounting Business & Finance Journal*, 7(2), 49–70. <https://doi.org/10.14453/aabfj.v7i2.5>
- Wiguna, S., & Wasistha, G. H. (2017). “The determinants of working capital requirements of manufacturing firms in Indonesia, Competition and Cooperation in Economics and Business. Routledge.
- Yazdanfar, D., & Peter, Ö. (2014). The impact of cash conversion cycle on firm profitability: An empirical study based on swedish data. *International Journal of Managerial Finance*, 10(4), 442–452. <https://doi.org/10.1108/IJMF-12-2013-0137>
- Zariyawati, M. A., Annuar, M. N., & Pui-San, N. (2016). Working capital management determinants of small and large firms in Malaysia. *International Journal of Economics & Management*, 10(2), 365–377.
- Zariyawati, M. A., Taufiq, H., Annuar, M. N., & Szali, A. (2010, June). Determinants of working capital management: Evidence from Malaysia. In 2010 *International conference on financial theory and engineering*, United States (pp. 190–194). IEEE.