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How does working capital management affect the profitability of Indian companies?

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Abstract

Purpose – The purpose of this paper is to examine the relationship between working capital management (WCM) and firm profitability for a sample of 437 non-financial Indian companies.
Design/methodology/approach – The study is based on secondary financial data obtained from Capitaline database, pertaining to a period of ten years. This study employs two-step generalized method of moments (GMM) techniques to arrive at results.
Findings – The results of the study confirm the inverted U-shape relationship between WCM and firm profitability. In addition, the authors also found that the firms should complete its CCC on an average by 63 days.
Originality/value – Unlike prior studies that found a linear relationship between WCM and firm profitability. This study provides newer evidence for an inverted U-shaped relation between investment in working capital and firm profitability in India. In addition, this study uses GMM to control the potential problems of endogeneity.

Keywords India, Firm profitability, Working capital management, Panel data

Paper type Research paper

1. Introduction

Early in 1980, Smith suggested that working capital management (WCM) is essential because it affects firm profitability and risk, and consequently its value. It is argued that working capital is regarded as a life, philanthropic figure for any economic activity that plays a pivotal role in corporate management (Tahir and Anuar, 2016). In addition, the investments in current assets and current liabilities represent an important share of items on a firm's balance sheet. The data from our sample reveals that the median value of current assets (current liabilities) to total assets is about 50 percent (30 percent) for Indian companies. Given the pivotal role of WCM, a firm may adopt either an aggressive or conservative working capital policy. An aggressive working capital policy is a high-risk, high-return approach and is associated with low investment in working capital. On the other hand, a conservative working capital policy is a low-risk, low-return approach and is associated with high investments in working capital.

Studies on working capital management and firm profitability (see recent studies e.g. Singhania and Mehta, 2017; Bhatia and Srivastava, 2016; Tahir and Anuar, 2016; Baños-Caballero *et al.*, 2012; Nazir and Afza, 2009; Juan García-Teruel and Martinez-Solano, 2007; Deloof, 2003; among others) argue that by the adoption of aggressive WCM policy a firm may reduce the investments in working capital and this reduction will result in minimum investments in inventories as well as accounts receivable. Minimizing the investment in

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inventories may reduce the storage and insurance cost and thus increase profitability. In a similar vein, maintaining lower investments in accounts receivable may also increase the firm profitability because these funds can be invested elsewhere. Other set of arguments revolve around a conservative WCM policy. It is argued that a conservative working capital strategy is aimed at increasing sales through increased investments in inventories and receivables (Tauringana and Adjapong Afrifa, 2013). An increased investment in inventories enhances firm profitability because it prevents production disruptions (Juan García-Teruel and Martinez-Solano, 2007), reduces the risk of stock-out (Deloof, 2003) and also reduces the supply costs and price fluctuations (Blinder and Maccini, 1991). With regard to the increased investments in accounts receivable, it is argued that an increase in accounts receivable increases the sales of the firm because it gives customers time to pay (Deloof and Jegers, 1996), can be inexpensive source of credit for customers and also reduce the level of information asymmetry between the buyer and the seller (Deloof, 2003).

However, the aggressive working capital investment strategists have ignored the risk of loss of sales and also the interruptions in production process that may happen due to the low investments in working capital (Baños-Caballero *et al.*, 2012). Therefore, reduction of investments in working capital may also have the negative effect on firm profitability. Similarly, conservative working capital investment strategists have ignored the risk of bankruptcy that may arise on account of the increase in financing expenses due to increase in the investment in working capital. Accordingly, an additional increased investment in working capital may also have a negative impact on firm profitability.

These arguments give us a priori reason to believe that since the investments in working capital have both costs and benefits attached to it, a firm may, therefore, have an optimal working capital that balances the costs and benefits. Consequently, the relationship between working capital and a firm profitability may be concave rather than linear and might be better captured by a quadratic specification. However, the prior literature has ignored these costs and benefits of investment in working capital, and accordingly the studies on WCM and firm profitability have analyzed only a linear relationship between a firm investment in working capital and its profitability (see recent studies e.g. Bhatia and Srivastava, 2016; Tahir and Anuar, 2016; Nazir and Afza, 2009; Juan García-Teruel and Martinez-Solano, 2007; Deloof, 2003; among others); a search of literature identified only two studies (Singhania and Mehta, 2017; Baños-Caballero *et al.*, 2012) that have analyzed a non-linear relationship between a firm's investment in working capital and its profitability and found an inverted U-shape relationship between WCM and firm profitability.

Unlike previous studies, this paper contributes to the WCM literature by following ways. First, we offer new evidence on the relationship between WCM and firm profitability in Indian context, by taking into account the possible non-linearity of this relation and accordingly testing the risk and return trade-off. Second, we also verify the robustness of our results by following Tong (2008) in verifying the possible quadratic relationship between WCM and firm profitability. Lastly, by following (Singhania and Mehta, 2017; Baños-Caballero *et al.*, 2012), we have also used the generalized method of moments (GMM) to deal with the possible endogeneity problems.

Our results confirm that there is an inverted U-shaped relationship between working capital and firm profitability, implying that working capital and firm profitability relate positively at lower levels and negatively at higher levels. This confirms the proposition that a firm must have an optimum working capital level that balances the costs and benefits.

The reminder of the paper is divided into six sections. Section 2 contains a brief literature review of theory and empirics. Section 3 is an operative part of the paper that outlines the methodology employed to arrive at the results. Section 4 reports the empirical results. Section 5 reports the results of robustness checks and Section 6 concludes the overall paper.

2. Literature review

Every business organization irrespective of size and nature ought to have a WCM for the smooth running of a business. The essential part of WCM is to maintain the liquidity so that the business is able to meet its day to day obligations (Eljelly, 2004). Maintaining the desired level of working capital turnover is not an easy task because components of working capital keep on circulating very fast. If the firm is not able to maintain the desired level of working capital then it will have an impact on firm's profitability and risk, and consequently its value (Smith, 1980).

2.1 Cash conversion cycle (CCC) and firm profitability

Most of the empirical studies have adopted CCC to measure the efficiency of WCM of a firm (see e.g. Singhania and Mehta, 2017; Altaf, 2016; Bhatia and Srivastava, 2016; Tahir and Anuar, 2016; Pais and Gama, 2015; Singhania *et al.*, 2014; Chaklader and Shrivastava, 2013; Baños-Caballero *et al.*, 2012; Sharma and Kumar, 2011; among others). CCC measures the time lag between the expenditure for the purchase of raw materials and the collection of sales from finished goods. Prior literature has asserted that CCC is related to firm profitability either positively or negatively. Accordingly, it is argued that the longer CCC might increase profitability because longer CCC might be able to stimulate sales (Deloof, 2003), give customers more time to differentiate between products (Deloof and Jegers, 1996), reduce the information asymmetry between the buyer and seller (Smith, 1987), prevent production interruptions (Ng *et al.*, 1999), and strengthens long-term supplier/customer relationships (Wilner, 2000). Supporting the above literature, positive impact of CCC on firm profitability has been supported by a number of empirical studies (see recent studies e.g. Bhunia and Das, 2015; Chaklader and Shrivastava, 2013; Martínez-Sola *et al.*, 2013; Sharma and Kumar, 2011; Gill *et al.*, 2010; Raheman *et al.*, 2010; Padachi, 2006; Lyroudi and Lazaridis, 2000).

Contrary to the above view "longer CCC has a positive impact on firm profitability" there are numerous reasons as to why shorter CCC increases firm profitability. Firms with shorter CCC can increase profitability because they are able to generate internal funds which reduce the dependence on external funds that are often expensive (Baños-Caballero *et al.*, 2013). In a similar vein, Autukaite and Molay (2011) suggested that by reducing CCC, firms lower down financial cost and thus enjoy financial flexibility. In addition, shorter CCC also indicates the efficacy of the firm in utilizing its working capital (Nobanee, 2009). Further, suggesting a negative relationship between CCC and firm profitability, Deloof (2003) argued that more profitable companies pay their bills faster. In support of the literature above, negative impact of CCC on firm profitability has been found by numerous studies (see recent studies e.g. Bhatia and Srivastava, 2016; Lyngstadaas and Berg, 2016; Enqvist *et al.*, 2014; Linderhof, 2014; Singhania *et al.*, 2014; Ukaegbu, 2014; Baños-Caballero *et al.*, 2013; Ramachandran and Janakiraman, 2009; Juan García-Teruel and Martinez-Solano, 2007; Raheman and Nasr, 2007; Lazaridis and Tryfonidis, 2006; Deloof, 2003).

The empirical shreds of evidence presented above suggest either a positive linear or negative linear relationship between working capital turnover and firm profitability. These studies have not taken into consideration the trade-off between profitability and risk. However, the positive and negative effects of working capital provide a priori indication to believe that working capital decisions involve a trade-off and accordingly, we expect that corporate profitability may rise until a point firm reaches its optimal CCC or working capital level, beyond which the relation between CCC and firm profitability will become negative.

2.2 Accounts receivable/accounts collection and firm profitability

This time lag between the sale and actual realization of cash tends to create receivables that are to be collected by a firm over a period of time (Fabozzi and Peterson, 2003).

Accounts receivable or account collection can thus be seen as short-term loans to customers given by the supplying firm that is to be returned within the specified period of time (Martínez-Sola *et al.*, 2013; Danielson and Scott, 2004). The time period required to convert the receivables back into cash or to collect cash from customers is actually known as accounts receivable period (ARP) or accounts collection period (Mathuva, 2010). The literature on WCM suggest that ARP has a significant impact on firm profitability (see e.g. Bhatia and Srivastava, 2016; Ukaegbu, 2014; Singhania *et al.*, 2014; Baños-Caballero *et al.*, 2013; among others).

However, the nature of a relationship between ARP and firm profitability depends on the type of accounts receivable strategy adopted by a firm. (Baños-Caballero *et al.*, 2016; Tauringana and Adjapong Afrifa, 2013; Juan García-Teruel and Martinez-Solano, 2007). Further, prior literature asserts that firms can pursue a conservative or aggressive receivables policy (Nazir and Afza, 2009; Juan García-Teruel and Martinez-Solano, 2007).

Adopting aggressive receivables policy will result in the reduction of a receivable period that will increase the availability of cash to the company. This cash acts as a buffer when a company is running short of cash to pay off its obligations thus potentially reducing financial distress which ultimately increases profitability. Further availability of cash reduces the chances of bankruptcy because a company is in the position to pay off its obligation in time. The negative relation between accounts receivable and firm profitability has been explained by (Fabozzi and Peterson, 2003) who argue that an increase in an amount of account receivable has opportunity costs and bad debt while increasing sales for a company. Therefore, whenever collection periods increases bad debt increase and hence profitability will fall down and vice versa. Further, increase in profitability due to a reduction of receivables period is supported by transactional cost theory on trade credit. This theory holds that when transactions between sellers and buyers are frequent, both parties may reduce transaction costs by agreeing to a periodical payment schedule (Ferris, 1981). Thus, firms are able to enhance operational efficiency through a reduction in transactional cost by reducing their ARP. Supporting the literature mentioned above a number of studies have found a negative impact of ARP and firm profitability (see recent studies e.g. Bhatia and Srivastava, 2016; Singhania *et al.*, 2014; Sharma and Kumar, 2011; Mathuva, 2010; Juan García-Teruel and Martinez-Solano, 2007; Lazaridis and Tryfonidis, 2006; Deloof, 2003).

Contrary to above, adoption of conservative receivables policy by firms will result in the increase of receivable period that will increase the investment in working capital. Extending the receivable period will give customers enough time to verify the quality of a product before paying. This reduces the level of information asymmetry between the buyer and the seller (Smith, 1987). It is only the product quality guarantee that fosters the reduction of information asymmetries between buyer and seller. Further reduction of information asymmetries between buyer and seller eliminates future contentions relating to a product because customers are given ample time to investigate the quality of a product before any payments are made. This fosters future sales of the product and profitability for the firm (Bastos and Pindado, 2007). Thus the rationale for extending receivables period is driven by the need for firms to achieve higher profitability through enhanced operational flexibility.

This evidence is consistent with the product differentiation theory of trade credit. According to the product differentiation theory of trade credit, firms use accounts receivables like any other sales-promotion tool to increase sales and profitability (Altaf and Shah, 2016; Blazenko and Vandezande, 2003). Accounts receivables, according to the theory are used as a sales tool to differentiate the company's product from its competitors so that consumers prefer to buy that firm's products rather than a competitor's. Various studies (e.g. Blazenko and Vandezande, 2003; Deloof and Jegers, 1996; among others) have suggested that through extended accounts receivables policy, most companies are able to convince their customers that their products are worth the value of their money.

This perspective has received considerable support from certain empirical studies (see recent studies e.g. Bhunia and Das, 2015; Chaklader and Shrivastava, 2013; Abuzayed, 2012; Sharma and Kumar, 2011; Raheman and Nasr, 2007).

From the literature mentioned above, it may be asserted that investment in accounts receivables or the length of ARP adopted by a firm determines the profitability of the firm. Thus, a firm would look for an optimal level of ARP that balances the risks and rewards. Accordingly, we expect that the relationship between ARP and firm profitability will be non-linear.

2.3 Inventory conversion period (ICP) and firm profitability

Inventories represent the stock that is procured with the purpose of resale for some profits. In the case of manufacturing enterprises, inventories consist of about 20-30 percent of the total investment and represents the largest cost for a manufacturing enterprise (Kung'u, 2015; Juan García-Teruel and Martinez-Solano, 2007). Prior literature asserts that under perfect market conditions, firms tend to have exact information about the demand conditions, thus firms tend to maintain lower investment in inventories. However, under imperfect market conditions, firms are forced to maintain huge investments in inventories in order to safeguard against eventualities like non-availability of raw materials, demand rise, etc. (Mathuva, 2013; Koumanakos, 2008). The amount of inventories held by an organization has a significant impact on its sales and ultimately profitability (Ching *et al.*, 2011; Eroglu and Hofer, 2011; Gill *et al.*, 2010; Koumanakos, 2008). Moreover, the amount of inventories held by a firm depends on the type of inventory management strategy adopted by a firm. A firm can adopt an aggressive or conservative inventory management strategy. (Nazir and Afza, 2009; Juan García-Teruel and Martinez-Solano, 2007) depending upon the amount of financial resources in hand, technology, expertise (Tingbani, 2015).

Under aggressive inventory approach, firms maintain a lower investment in inventory, thus avoiding the cost of holding inventory, obsolescence, insurance, etc. However, this approach may result in the loss of sales if inventories are held below the attainable level. Conversely, a firm can adopt a conservative inventory approach with huge investments in inventories. This approach will help a firm to meet all the demand in the market but maintaining higher investments exposes a firm to a number of costs like obsolescence, storage costs, and physical deterioration etc. In addition, excessive investment in inventories keeps the funds tied up that could have been otherwise used elsewhere. (Nazir and Afza, 2009; Juan García-Teruel and Martinez-Solano, 2007).

A firm must ensure that the type of inventory management strategy it adopts must be the most efficient and effective, i.e. it must bring trade-off between costs and benefits. One of the most essential and widely used tools for evaluating the management of inventories is inventory turnover ratio (Lyngstadaas and Berg, 2016; Singhania *et al.*, 2014; Raheman and Nasr, 2007; Lazaridis and Tryfonidis, 2006; Deloof, 2003). This ratio measures the average number of times business sells and replaces its entire batch of inventories or in other words the average rate at which inventories move in and out of a company. Generally, a higher inventory turnover ratio represents efficiency in management of inventories but sometimes higher inventory turnover ratio can be an indication of hand-to-mouth existence[1]. On the other hand, a low inventory turnover ratio is often a sign of excessive, slow-moving, or obsolete items in inventory and thus inefficiency in management of inventories.

Earlier works by Weinraub and Visscher (1998) and Nazir and Afza (2009) asserted that reduction in inventory or adoption of aggressive inventory strategy may increase the profitability of a firm. This increase in profitability was attributed to the reduction in various costs associated with the holding inventory. Theoretically, this argument is justified by just-in-time (JIT) theory of inventory management that asserts holding of inventory is just a waste as it does not add value to the product (Bhattacharya, 2008). Further, the theory suggests that firms should hold zero inventory levels[2] and order for materials only when they are necessarily needed. This will avoid the cost of holding inventories and may also bring holding cost down to zero, thus allowing firms to enjoy higher profitability. Recent works (e.g. Filippini and Forza, 2016; Younies *et al.*, 2007) have empirically validated the successful implementation of JIT and have demonstrated how some companies reduced costs and increased profitability after implementation of JIT inventory system. Moreover, Younies *et al.* (2007) asserted that JIT system can be successfully implemented by developing a strong buyer-supplier relationship. Thus, the literature mentioned above suggests that adopting an aggressive inventory management strategy can improve the profitability of a concern. Researchers have documented evidence in support of this phenomenon (see recent studies e.g. Filippini and Forza, 2016; Kaur and Skilky, 2013 Abuzayed, 2012; Mathuva, 2010).

Contrary to the reduction in inventory, a firm can pursue the conservative inventory management policy by making additional investments in inventories in order to stimulate profitability by increased sales (Deloof, 2003). The theoretical justification of this phenomenon is embedded in the precautionary motive theory, speculative motive theory, and transaction motive theory of holding inventories.

First, the precautionary motive theory asserts that firms must hold inventories as a precaution against stock-outs (Wen, 2003). Further, this theory predicts that because of uncertainty in the lead time of delivery firms can enhance profitability by increasing investment in inventories (Modigliani, 1957). This notion was further strengthened by empirical studies (see e.g. Gill *et al.*, 2010; Bhattacharya, 2008; Wen, 2003) who exemplify that by holding an additional investment in inventories, firms can enhance their profitability. Drawings inferences from a sample of American firms, Gill *et al.* (2010) suggested that high level of inventories reduce production and trading interruptions that further contribute to the profit maximization of a firm. In a similar vein, Bhattacharya (2008) suggested that stock-outs not only deteriorate the name of the company but also drives the customers to other competitors.

Second, the speculative motive theory suggests that firms maintain additional investment in inventories with the expectations of taking advantage of price rise in the future and thus to gain future abnormal profits (Christiano and Fitzgerald, 1989). Further, it is argued that certain companies hoard their inventories in anticipation of the rise in price in future and thus tend to make abnormal profits. In addition, the cost of hoarding inventories is often compensated by the rise in price (Tingbani, 2015). This phenomenon is supported by a number of empirical studies (see e.g. Tingbani, 2015; Blazenko and Vandezande, 2003; Hill and Sartoris, 1992; among others). It is suggested by Hill and Sartoris (1992) that inflationary conditions make hoarding inventories most effective. Further, Blazenko and Vandezande (2003) also found that firms are more inclined toward hoarding inventories in anticipation of abnormal profits.

Third, the transactional cost motive of holding inventory asserts that firms maintain higher inventories because of benefits arising out of bulk purchases. Bulk purchases reduce the cost of procurement like the fixed cost of ordering and processing orders (Modigliani, 1957). Further, bulk purchases also reduce the transportation costs and allow a company to take advantage of quantity discounts. Alternatively, Bhattacharya (2008) suggests that companies stock inventories for the purpose of demonstration and display, as customers prefer to examine the product before actually buying. Prior studies (like Padachi, 2006; Nobanee, 2009; Bhattacharya, 2008) lend an empirical support to the said argument. Thus, according to this part of the literature a conservative inventory management policy has a negative influence on profitability. Numerous studies lend support to this argument (see recent studies e.g. Bhatia and Srivastava, 2016; Lyngstadaas and Berg, 2016; Tauringana and Adjapong Afrifa, 2013; Sharma and Kumar, 2011; Juan García-Teruel and Martinez-Solano, 2007; Raheman and Nasr, 2007; Lazaridis and Tryfonidis, 2006; Deloof, 2003).

The literature mentioned above exemplifies that ICP has either a negative or a positive impact on firm profitability. However, in practice and inventory management strategy must bring trade-off between costs and benefits. Thus, the balancing of costs and benefits by a firm provides enough priory that the relationship between ICP and firm profitability will be non-linear.

2.4 Accounts payable and firm profitability

Under credit transactions, the amount of money that a recipient of goods promises to pay to a supplier is referred to as accounts payable (Kinunda-Rutashobya, 2008). Accounts payable amounts to one of the major sources of unsecured short-term external finance for a firm (Wilner, 2000). Efficient management of accounts payable is imperative in order to ensure cordial relations with suppliers. Such relationships will help in building trust and ensure a constant supply of inventories. Further, it is argued that the existence of market imperfections force a firm to have an optimal accounts payable policy in place (Martínez-Sola *et al.*, 2013). Moreover, firm's accounts payable policy has cost and benefits attached to it (Baños-Caballero *et al.*, 2013; Deloof, 2003). Thus, an efficient accounts payable policy is needed to strike the balance between costs and benefits. The most comprehensive measure for measuring the efficiency of accounts payable in a firm is a number of days of account payable. This ratio measures the time lag between the supply of goods and the payments made for it or in other words, it measures the number of days a company takes to pay back to its suppliers.

Prior literature has found either a positive or a negative relationship of accounts payable period (APP) with firm profitability. One set of studies contended that longer APP helps to improve firm profitability because delaying payment to suppliers reduces that transactional costs and exchange costs (Mathuva, 2010; Bhattacharya, 2008; Banerjee *et al.*, 2007), helps to control and manage the quality of items purchased (Raheman *et al.*, 2010) that further reduces the information asymmetry between buyer and seller[3] (Pike *et al.*, 2005; Smith, 1987), signals product quality (Bastos and Pindado, 2007), avoids time and efforts to be spend on cash refunds, helps to accumulate funds at regular intervals that reduces financial constraints (Pike and Cheng, 2001) and also frees cash for investment in accounts receivable and inventories (Mathuva, 2010), helps to overcome financial distress by passing liquidity shortages or shocks to suppliers (Boissay and Gropp, 2007; Wilner, 2000), sometimes acts as a financing of last resort for constrained firm (Petersen and Rajan, 1997), acts as a substitute for intuitional loans under economic downturns (Nilsen, 2002), works as an alternative means to finance additional production when there are no bank loans (Ferrando and Mulier, 2013; Bougheas *et al.*, 2009), serves as third-party security or guarantees to secure loans from financial institutions (Miwa and Ramseyer, 2005). Documenting support to the above mentioned literature a number of studies found a positive relationship between APP and firm profitability (see recent studies e.g. Bhatia and Srivastava, 2016; Bhunia and Das, 2015; Singhania *et al.*, 2014; Chaklader and Shrivastava, 2013; Abuzayed, 2012; Raheman and Nasr, 2007).

On the contrary, other set of studies contended that longer APP reduces firm profitability because increase in accounts payable results in costly credit management activities (Mian and Smith, 1992) that increases the credit management cost of the buyer in the shape of additional administrative costs (Bougheas *et al.*, 2009; Cheng and Pike, 2003), late payments may result in credit risk, debt defaults because of negative effects on liquidity (Cheng and Pike, 2003), forgo trade and cash discounts high opportunity costs (Ng *et al.*, 1999). In support of the literature mentioned above, a number of studies have found a negative relationship between APP and firm profitability (see recent studies e.g. Pais and Gama, 2015; Tauringana and Adjapong Afrifa, 2013; Sharma and Kumar, 2011; Juan García-Teruel and Martinez-Solano, 2007; Lazaridis and Tryfonidis, 2006; Deloof, 2003).

The positive and negative impact of APP on firm profitability explicitly suggests that it is imperative for a firm to have an optimal account payable policy that balances the costs and benefits. Accordingly, one would expect that the relationship between APP and firm profitability is non-linear.

3. Data and method

3.1 Data and data sources

To analyze the impact of CCC and its components on firm profitability, we use an electronic database, the Capitaline, to extract the firm-level information of all the variables used in the study. Further, the data for macroeconomic variables have been taken from the database of the Indian economy, Reserve Bank of India. We employ a panel data set of 437 Indian companies from 11 industries namely Chemical and Chemical products, Consumer Goods, Construction and real estate, Communication services, Food and Dairy products, Information technology, Machinery, Metal and Metal products, Transport equipment, Textile and Wholesale and retail trading. In addition, the financial information of these firms has been collected for a period of ten years (2007-2016), making the total number of observations equal to 4,370 (i.e. 437 companies over a period of ten years). It must be noted that this time period has been chosen in order to make the results of the study more current and also ensure reliability and reduced measurement error. Chadha and Sharma suggest taking data for a longer period ensures reliability and reduces measurement error.

Further, the companies forming the part of the sample are index contributors of the BSE ALLCAP Index – a broad-based benchmark of the Indian capital market. The BSE ALLCAP Index includes a total of 916 firms across different industries. It must be noted that BSE ALLCAP Index is the broad-based index of Indian economy representing full market capitalization on BSE and thus giving due representation to all the industries and sectors of Indian economy.

We have followed a systematic deletion method of sampling to arrive at the final sample. The final sample of the study has been chosen by dropping all financial firms including banks and financial services. In addition, companies with the different financial year and missing data were also deleted. More specifically, we first dropped 197 financial companies due to their different nature and leaving us with 719 firms. Second, in order to serve the purpose of comparability, we further winsorized the sample by dropping 146 firms because their financial year did not end in March every year. This winsorization left us with 573 firms. Lastly, among the left 573 firms, we further deleted 136 firms that had not reported the full information in all the years of the study period and for all the key variables used in the study. This deletion left us with the final sample of 437 firms.

3.2 Variables

We have used CCC and its components to measure WCM of Indian firms. In addition, to measure profitability, we used two famous measures of profitability, return on assets and gross operating profit. Furthermore, in an attempt to reduce the potential bias that may arise on account of omitted variables, we control for other general firm characteristics by incorporating firm size, growth, asset tangibility, firm age, leverage, current ratio and macroeconomic condition as control variables. In addition, the choice of variables is guided by the prior literature on WCM. The acronym and definition of measurement for all the variables is given in Table I.

3.3 Baseline specifications and estimation approach

3.3.1 Baseline specification. Based on the literature mentioned in Section 2, there are priori reasons to believe that the relationship between WCM and firm profitability may be

Variable	Acronym	Definition
Dependent variables		
Return on assets	ROA	Net profit/total assets
Gross operating profit	GOP	Gross profit/net sales
Independent variables		
Cash conversion cycle	CCC	ARP + ICP APP
Accounts receivable period	ARP	Average receivables × 365/sales
Inventory conversion period	ICP	Average inventories × 365/cost of goods sold
Accounts payable period	APP	Average payables × 365/cost of goods sold
Control variables		
Firm size	Size	Natural logarithm of total assets
Growth	Growth	(Current year sales/ previous year sales) − 1
Asset Tangibility	AT	Fixed financial assets/total assets
Firm age	Age	The number of years from the time the company was incorporated
Leverage	Lev	The ratio of total debt to total assets.
Current ratio	CR	Total current assets/total current liabilities
Economic growth	GDPGR	(Current year GDP/previous year GDP) − 1

Table I.
Variables definition

non-monotonic. Thus, in order to test the positive and negative effects of CCC and its components on firm profitability, we regress firm profitability variables against CCC and its components and their square. In addition, in an attempt to reduce the potential bias that may arise on account of omitted variables, we control for other general firm characteristics by incorporating firm size, growth, asset tangibility, firm age, leverage and current ratio and economic growth as control variables. Therefore, we estimate the following models:

$$\begin{aligned}\mathrm{ROA}_{i,t} = {} & \beta_0 + \beta_1\mathrm{CCC}_{i,t} + \beta_2\mathrm{CCC}^2_{i,t} + \beta_3\mathrm{Size}_{i,t} + \beta_4\mathrm{Growth}_{i,t} + \beta_5\mathrm{AT}_{i,t} \\ & + \beta_6\mathrm{Age}_{i,t} + \beta_7\mathrm{Lev}_{i,t} + \beta_8\mathrm{CR}_{i,t} + \beta_9\mathrm{GDPGR}_t + \gamma_t + \delta_i + \epsilon_{i,t} \end{aligned} \quad (1)$$

$$\begin{aligned}\mathrm{GOP}_{i,t} = {} & \beta_0 + \beta_1\mathrm{CCC}_{i,t} + \beta_2\mathrm{CCC}^2_{i,t} + \beta_3\mathrm{Size}_{i,t} + \beta_4\mathrm{Growth}_{i,t} + \beta_5\mathrm{AT}_{i,t} \\ & + \beta_6\mathrm{Age}_{i,t} + \beta_7\mathrm{Lev}_{i,t} + \beta_8\mathrm{CR}_{i,t} + \beta_9\mathrm{GDPGR}_t + \gamma_t + \delta_i + \epsilon_{i,t} \end{aligned} \quad (2)$$

$$\begin{aligned}\mathrm{ROA}_{i,t} = {} & \beta_0 + \beta_1\mathrm{ARP}_{i,t} + \beta_2\mathrm{ARP}^2_{i,t} + \beta_3\mathrm{Size}_{i,t} + \beta_4\mathrm{Growth}_{i,t} + \beta_5\mathrm{AT}_{i,t} \\ & + \beta_6\mathrm{Age}_{i,t} + \beta_7\mathrm{Lev}_{i,t} + \beta_8\mathrm{CR}_{i,t} + \beta_9\mathrm{GDPGR}_t + \gamma_t + \delta_i + \epsilon_{i,t} \end{aligned} \quad (3)$$

$$\begin{aligned}\mathrm{GOP}_{i,t} = {} & \beta_0 + \beta_1\mathrm{ARP}_{i,t} + \beta_2\mathrm{ARP}^2_{i,t} + \beta_3\mathrm{Size}_{i,t} + \beta_4\mathrm{Growth}_{i,t} + \beta_5\mathrm{AT}_{i,t} \\ & + \beta_6\mathrm{Age}_{i,t} + \beta_7\mathrm{Lev}_{i,t} + \beta_8\mathrm{CR}_{i,t} + \beta_9\mathrm{GDPGR}_t + \gamma_t + \delta_i + \epsilon_{i,t} \end{aligned} \quad (4)$$

$$\begin{aligned}\mathrm{ROA}_{i,t} = {} & \beta_0 + \beta_1\mathrm{ICP}_{i,t} + \beta_2\mathrm{ICP}^2_{i,t} + \beta_3\mathrm{Size}_{i,t} + \beta_4\mathrm{Growth}_{i,t} + \beta_5\mathrm{AT}_{i,t} \\ & + \beta_6\mathrm{Age}_{i,t} + \beta_7\mathrm{Lev}_{i,t} + \beta_8\mathrm{CR}_{i,t} + \beta_9\mathrm{GDPGR}_t + \gamma_t + \delta_i + \epsilon_{i,t} \end{aligned} \quad (5)$$

$$\begin{aligned}\mathrm{GOP}_{i,t} = {} & \beta_0 + \beta_1\mathrm{ICP}_{i,t} + \beta_2\mathrm{ICP}^2_{i,t} + \beta_3\mathrm{Size}_{i,t} + \beta_4\mathrm{Growth}_{i,t} + \beta_5\mathrm{AT}_{i,t} \\ & + \beta_6\mathrm{Age}_{i,t} + \beta_7\mathrm{Lev}_{i,t} + \beta_8\mathrm{CR}_{i,t} + \beta_9\mathrm{GDPGR}_t + \gamma_t + \delta_i + \epsilon_{i,t} \end{aligned} \quad (6)$$

$$\mathrm{ROA}_{i,t} = \beta_0 + \beta_1\mathrm{APP}_{i,t} + \beta_2\mathrm{APP}^2_{i,t} + \beta_3\mathrm{Size}_{i,t} + \beta_4\mathrm{Growth}_{i,t} + \beta_5\mathrm{AT}_{i,t} + \beta_6\mathrm{Age}_{i,t} + \beta_7\mathrm{Lev}_{i,t} + \beta_8\mathrm{CR}_{i,t} + \beta_9\mathrm{GDPGR}_t + \gamma_t + \delta_i + \epsilon_{i,t} \quad (7)$$

$$\mathrm{GOP}_{i,t} = \beta_0 + \beta_1\mathrm{APP}_{i,t} + \beta_2\mathrm{APP}^2_{i,t} + \beta_3\mathrm{Size}_{i,t} + \beta_4\mathrm{Growth}_{i,t} + \beta_5\mathrm{AT}_{i,t} + \beta_6\mathrm{Age}_{i,t} + \beta_7\mathrm{Lev}_{i,t} + \beta_8\mathrm{CR}_{i,t} + \beta_9\mathrm{GDPGR}_t + \gamma_t + \delta_i + \epsilon_{i,t} \quad (8)$$

All the variables in above mentioned equations are same as in Table I. In addition, the variable γ_t is a time dummy variable, δ_i is the firm's unobservable individual effects, and $\epsilon_{i,\,t}$ is the random disturbance.

Further, the inflection point or breakeven point beyond which the CCC and its components have a negative impact on firm profitability is derived by differentiating the firm profitability variable with respect to the CCC and its components variable and making this derivative equal to 0. On solving, we obtain the breakeven point by following expression: $-\beta_1/2\beta_2$ in all the models.

3.3.2 Estimation approach. All the models have been estimated using panel data methodology. Panel data methodology was used because of the advantages it provides. It helps to control for unobservable heterogeneity (Hsiao, 2003; Klevmarken, 1989; Moulton, 1986, 1987), gives more information, produces more variability, more efficiency and less collinearity among variables Hsiao (2003), helps to model technical efficiency in a better way by allowing to construct complicated models (Koop and Steel, 2001).

Panel data methodology offers various methods, like ordinary least squares (OLS), fixed-effects models (FE), random-effect models (RE) and GMM for examining relationships among dependent and independent variable. However, OLS method yields inconstant estimates because ignores time-invariant individual effect (μ_i) and FE and RE approach does not deal with the endogeneity of dependent variable. In order to deal with this inconsistency, GMM has been suggested by the econometric literature. In addition, the tunneling literature on corporate finance suggests that the most important problems in financial literature relate to the acceptability and quality of inferences drawn about the financial relationships. Therefore, a regression of firm profitability on CCC and its components must be examined by a dynamic approach. Accordingly, we use the instrumental variable estimation method to avoid the problem of endogeneity. More specifically we use the two-step GMM estimator proposed by Arellano and Bond (1991) to avoid the problem of endogeneity. In addition, the analysis has been carried out in a STATA 13.

4. Empirical results

Table II summarizes the descriptive statistics of all the variables used in the study. The mean value of ROA is 0.161 and the mean value of GOP is 0.242. These values are approximately similar to the values reported by a study in Indian context by Singhania *et al.* (2014). We find that the mean value of CCC variable is 81.30, implying that an average Indian firm takes 81 days to complete one cycle of working capital. With regard to the components of working capital efficiency, ARP on an average takes 53.44 days, implying that firms collect their receivable within a period of two months while as they pay back to their supplier within the period of 1.5 months since the average value of APP is 47.86. In addition, it takes approximately 76 days for Indian firms to convert back inventories into cash. Further, the average size of the firm is 3.83 and the average tangibility of assets is around 0.797. Furthermore, the average period of time since the company was incorporated across the aggregate sample (firm age) is 36.91 years and the average leverage

	Mean	SD	Max.	Min.
ROA	0.161	0.439	2.69	−1.93
GOP	0.242	0.659	4.04	−2.90
CCC	81.30	66.67	420.74	−139
ARP	53.44	39.07	199	0
ICP	75.72	53.57	381.73	0
APP	47.86	32.81	199	0
Size	3.83	0.694	6.25	0.301
Growth	0.303	0.883	16.10	−2.41
AT	0.797	0.694	2.98	0
Age	36.91	21.65	154	2
Lev	0.422	0.221	1.71	0
CR	2.56	1.65	9.96	0.010
GDPGR	13.42	17.42	6.38	3.89

Note: This table reports descriptive statistics of the variables as defined in Table I

Table II.
Descriptive statistics

ratio is around 0.422. Moreover, the average liquidity ratio is around 2.56. These values are consistent with the previous studies done in Indian context (see e.g. Bhatia and Srivastava, 2016; Singhania *et al.*, 2014). Another important thing to note is that on an average Indian economy grows at a very steady rate of 13.42 percent.

Initially, to test the problems of multicollinearity, Pearson correlations and variance inflation factor (VIFs) for all the independent variables were calculated. Table III reports the Pearson correlation coefficients for all the independent variables. We find that the correlation coefficients of all the independent variables are less than the threshold value of 0.80. As suggested by Damodar (2004), unless the correlation coefficients among independent variables exceed the threshold value of 0.80, multicollinearity is unlikely a problem. Following Chatterjee and Hadi, we used a formal test to ensure that the multicollinearity problem is not present in our analyses by calculating VIFs for all the independent variable included in our models. It must be noted that the largest VIF value turned out to be 1.52 that is far below than threshold value of 10, suggesting multicollinearity is unlikely a problem[4].

4.1 Multiple regression analysis

4.1.1 The impact of WCM on firm profitability. In order to test the relationship between working capital efficiency and firm profitability, we estimate all our models using the

	CCC	ICP	RCP	PDP	AT	Age	Lev	Size	CR	GDPGR
CCC	1.00									
ICP	0.844*	1.00								
RCP	0.417*	0.104*	1.00							
PDP	−0.157*	0.042*	0.513*	1.00						
AT	0.093*	0.071*	0.006	−0.06*	1.00					
Age	−0.0001	0.069*	−0.06*	0.03*	−0.05*	1.00				
Lev	−0.194*	−0.150*	−0.33*	−0.24*	0.21*	−0.04*	1.00			
Size	−0.02***	−0.007	−0.02**	0.004	−0.05*	0.04*	−0.02**	1.00		
CR	0.369*	0.223*	0.13*	−0.22*	0.12*	−0.10*	−0.10*	−0.03**	1.00	
GDPGR	0.007	0.006	0.0005	−0.003	−0.01	0.003	−0.007	−0.002	−0.003	1.00

Notes: This table presents pair-wise correlation coefficients. The variables are as defined in Table I. *,**,***Significant at 1, 5, 10 percent levels, respectively

Table III.
Pair-wise correlation coefficients of all the independent variables

two-step GMM estimator proposed by Arellano and Bond. The results obtained from such estimation are reported in Tables IV and V. In addition, the results presented in Table IV are obtained after taking ROA as the dependent variable. The *p*-values for the m_2 statistics as presented in columns (2)-(5) is a test for the absence of AR(2) process serial correlation in the first difference residuals. These *p*-values of m_2 statistics are non-significant, implying that there is no second-order serial correlation. In addition, the results of the Sargan test are also presented in columns (2)-(5). The Sargan test is the test for correlation between instruments and error term. Since the *p*-values of Sargan test are non-significant, it implies the absence of correlation between instruments and error term.

It is evident from column 2 of Table IV that the estimated coefficient on CCC is positive and the estimated coefficients on CCC^2 are negative. These coefficients are statistically significant at 1 percent level of significance, implying that profitability increases with the investment in working capital at low levels, and decreases at high levels. We found that the coefficient on ARP is significant and positive while as the coefficient on ARP^2 is negative and significant. These results are presented in column 3 of Table IV. In addition, we find similar coefficients on ICP, its square, i.e. a significant positive coefficient on ICP and a significant negative coefficient on ICP^2. These results are presented in column 4 of Table IV. With regard to payment efficiency, the results remain same, a significant positive coefficient on APP and a significant negative coefficient on APP^2. The inverted U-shape relationship between CCC and its components with ROA indicates, unlike previous studies, that the relationship between working capital efficiency and firm profitability is guided by trade-off. Thus, a firm must have an efficient working capital policy in place that balances the cost and benefits.

Dependent variable: ROA (1)	$b/(z)$ (2)	$b/(z)$ (3)	$b/(z)$ (4)	$b/(z)$ (5)
$ROA_{i,\ t-1}$	0.032* (3.82)	0.042* (2.95)	0.043* (3.03)	0.036* (3.62)
CCC	0.077* (2.89)			
CCC^2	−0.061** (−2.09)			
ARP		0.035* (2.66)		
ARP^2		−0.024* (−2.48)		
ICP			0.154* (2.36)	
ICP^2			−0.199** (−1.98)	
APP				0.172* (3.66)
APP^2				−0.189* (−3.32)
AT	0.0051*** (1.78)	0.0048*** (1.63)	0.0049*** (1.77)	0.0047*** (1.72)
Age	0.0076* (18.07)	0.0060* (12.60)	0.0075* (18.31)	0.0064* (21.71)
Lev	−0.0086 (−0.48)	−0.0095 (−0.52)	−0.0091 (−0.51)	−0.0127 (−0.70)
Size	−0.0010 (−1.15)	−0.0009 (−1.06)	−0.0010 (−1.12)	−0.0008 (−0.93)
CR	0.0017*** (1.86)	0.0018*** (1.81)	0.0017** (1.96)	0.0027* (2.86)
GDPGR	0.00007* (2.48)	0.00007* (2.88)	0.00007* (2.50)	0.00007* (2.71)
m_2	0.123	0.125	0.115	0.135
Sargan	0.314	0.321	0.322	0.398

Notes: This table reports empirical results after estimating Equations (1), (3), (5) and (7). Specifically, the results presented in this table are obtained from two-step GMM approach. The variables are same as defined in Table I. *z*-Statistics of two-step GMM model are reported in parentheses and based on robust standard errors. m_2 refers to *p*-values of serial correlation test of second-order using residuals of first differences, asymptotically distributed as $N(0, 1)$ under null hypothesis of no serial correlation. Sargan refers to *p*-values for over-identifying restrictions distributed asymptotically under the null hypothesis of validity of instruments. Industry dummies are included, but not unreported. *,**,***Significant at 1, 5, 10 percent levels, respectively

Table IV.
The relationship between working capital management and firm profitability taking ROA as dependent variable

Table V. The relationship between working capital management and firm profitability taking GOP as dependent variable

Dependent variable: GOP (1)	$b/(z)$ (2)	$b/(z)$ (3)	$b/(z)$ (4)	$b/(z)$ (5)
$GOP_{i,\ t\text{-}1}$	0.044* (3.88)	0.031* (3.27)	0.034* (3.52)	0.038* (3.15)
CCC	0.067* (3.13)			
CCC^2	−0.051* (−2.42)			
ARP		0.045* (2.60)		
ARP^2		−0.034* (−2.44)		
ICP			0.174** (2.10)	
ICP^2			−0.201*** (−1.81)	
APP				0.182* (2.74)
APP2				−0.199** (−2.15)
AT	0.0063*** (1.80)	0.0058*** (1.61)	0.0060*** (1.79)	0.0059*** (1.73)
Age	0.0092* (17.16)	0.0074* (12.47)	0.0091* (17.27)	0.0080* (17.47)
Lev	−0.0092 (−0.42)	−0.010 (−0.47)	−0.0098 (−0.46)	−0.013 (−0.62)
Size	−0.0014 (−1.18)	−0.0013 (−1.11)	−0.0014 (−1.16)	−0.0011 (−1.01)
CR	0.0009*** (1.73)	0.0010*** (1.77)	0.0009*** (1.78)	0.0020** (1.95)
GDPGR	0.00002*** (1.94)	0.00002*** (1.75)	0.00002*** (1.74)	0.00002** (1.95)
m_2	0.148	0.172	0.105	0.158
Sargan	0.217	0.229	0.198	0.210

Notes: This table reports empirical results after estimating Equations (2), (4), (6) and (8). Specifically, the results presented in this table are obtained from two-step GMM approach. The variables are same as defined in Table I. z-Statistics of two-step GMM model are reported in parentheses and based on robust standard errors. m_2 refer to p-values of serial correlation test of second-order using residuals of first differences, asymptotically distributed as $N(0, 1)$ under null hypothesis of no serial correlation. Sargan refers to p-values for over-identifying restrictions distributed asymptotically under the null hypothesis of validity of instruments. Industry dummies are included, but not unreported. *,**,***Significant at 1, 5, 10 percent levels, respectively

As mentioned in Section 3.3.1 that the inflection point or breakeven point beyond which the CCC and its components have a negative impact on firm profitability is given by $(-\beta_1/2\beta_2)$. Thus an optimal number of days within which a firm should complete its CCC are 63 days $(-0.077/2\times-0.061)$. In addition, the optimal number of days for a firm to collect its receivables is calculated as 72 days $(-0.035/2\times-0.024)$, the optimal number of days within which the firm should transform its inventories back into cash is equal to 38 days $(-0.154/-2\times-0.199)$. With regard to the number of days within which the firm should pay back to its suppliers is equal to 45 days $(-0.172/2\times-0.189)$.

The results presented in Table V are obtained after taking GOP as dependent variable. The p-values for the m_2 statistics as presented in all the columns are non-significant, implying that there is no second-order serial correlation. In addition, the p-values of Sargan test are also non-significant, implying the absence of correlation between instruments and error term. It is evident from the results reported in in columns (2)-(5) of Table V that the estimated coefficient on CCC, ARP, ICP APP and their squares do not change, i.e. the significant positive coefficients on CCC, ARP, ICP APP and significant negative coefficients on their squares. These results further confirm our proposition that profitability increases with the investment in working capital at low levels, and decreases at high levels. Thus, our results remain robust across all the specifications. In addition, the inflection point or breakeven point also remains approximately same as found by taking ROA as dependent variable. We found that the inflection point for CCC is 63 days $(-0.067/2\times-0.051)$, for ARP 66 days $(-0.045/2\times-0.034)$, for ICP 43 days $(-0.174/2\times-0.201)$, for APP 45 days $(-0.182/2\times-0.199)$. Overall, we conclude that the breakeven points remain approximately same even after changing the profitability measure.

5. Robustness check

The results presented in the previous section confirm that an inverted U-shape relationship exists between working capital efficiency and firm profitability. These results confirm the proposition that firms have an optimal working capital level that maximizes their profitability and, deviation, either above or below should decrease their profitability. Thus, to give robustness to our results we develop a model for studying the relation between deviations on both sides of optimal CCC and firm profitability. Following Tong (2008), we use a two-stage methodology to test the existence of concave relationship between CCC and firm profitability. In stage1, the deviations from optimal CCC are obtained and then in stage 2, these deviations are regressed against profitability. We expect deviations to negatively affect profitability.

Stage1: we use the following regression for the determinants of CCC length:

$$CCC^{*}_{i,t} = \beta_0 + \beta_1 \mathrm{CF}_{i,t} + \beta_2 \mathrm{Size}_{i,t} + \beta_3 \mathrm{Growth}_{i,t} + \beta_4 \mathrm{AT}_{i,t} + \beta_5 \mathrm{Age}_{i,t} + \beta_6 \mathrm{Lev}_{i,t} + \beta_7 \mathrm{ROA}_{i,t} + \beta_8 \mathrm{GDPGR}_t + \varepsilon_{i,t} \tag{9}$$

where $\mathrm{CCC}^{*}_{i,t}$ represents the optimal CCC of firm i at time t; $\mathrm{CF}_{i,t}$ represents cash flow measured as ratio of net profit plus depreciation to total assets. All other variables are same as in Table I.

As suggested by Tong (2008) that firms current CCC is not equal to desired CCC or optimum CCC. Thus, following Tong (2008), we obtain residuals from regression (9) and we use them as a proxy for the deviations from optimal CCC.

Stage 2: as suggested by Tong (2008), we obtain residuals from Equation (9), these residuals are either positive or negative. These residuals measure the deviations from optimal CCC. More specifically, we define variable $\mathrm{Deviation}_{i,t}$ as absolute value of the residuals from Equation (9). In addition, we define a dummy variable $\mathrm{DUM}_{i,t,}$ which takes the value of 1 for positive residuals and 0 otherwise. We then allow this dummy to interact with the deviation variable. Thus, we test the effect of deviations from the optimum CCC by using following specifications:

$$\mathrm{ROA}_{i,t} = \beta_0 + \beta_1 \mathrm{ROA}_{i,t-1} + \beta_2 \mathrm{Deviation}_{i,t} + \beta_3 \mathrm{Size}_{i,t} + \beta_4 \mathrm{Growth}_{i,t} + \beta_5 \mathrm{AT}_{i,t} + \beta_6 \mathrm{Age}_{i,t} + \beta_7 \mathrm{Lev}_{i,t} + \beta_8 \mathrm{CR}_{i,t} + \beta_9 \mathrm{GDPGR}_t + \gamma_t + \delta_i + \epsilon_{i,t} \tag{10}$$

$$\mathrm{ROA}_{i,t} = \delta_0 + \delta_1 \mathrm{ROA}_{i,t-1} + \delta_2 \mathrm{Deviation}_{i,t} + \delta_3 (\mathrm{Deviation} \times \mathrm{DUM})_{i,t} + \delta_4 \mathrm{Size}_{i,t} + \delta_5 \mathrm{Growth}_{i,t} + \delta_6 \mathrm{AT}_{i,t} + \delta_7 \mathrm{Age}_{i,t} + \delta_8 \mathrm{Lev}_{i,t} + \delta_9 \mathrm{CR}_{i,t} + \delta_{10} \mathrm{GDPGR}_t + \gamma_t + \delta_i + \in_{i,t} \tag{11}$$

$$\mathrm{GOP}_{i,t} = \beta_0 + \beta_1 \mathrm{GOP}_{i,t-1} + \beta_2 \mathrm{Deviation}_{i,t} + \beta_3 \mathrm{Size}_{i,t} + \beta_4 \mathrm{Growth}_{i,t} + \beta_5 \mathrm{AT}_{i,t} + \beta_6 \mathrm{Age}_{i,t} + \beta_7 \mathrm{Lev}_{i,t} + \beta_8 \mathrm{CR}_{i,t} + \beta_9 \mathrm{GDPGR}_t + \gamma_t + \delta_i + \epsilon_{i,t} \tag{12}$$

$$\mathrm{GOP}_{i,t} = \delta_0 + \delta_1 \mathrm{GOP}_{i,t-1} + \delta_2 \mathrm{Deviation}_{i,t} + \delta_3 (Deviation \times DUM)_{i,t} + \delta_4 \mathrm{Size}_{i,t} + \delta_5 \mathrm{Growth}_{i,t} + \delta_6 \mathrm{AT}_{i,t} + \delta_7 \mathrm{Age}_{i,t} + \delta_8 \mathrm{Lev}_{i,t} + \delta_9 \mathrm{CR}_{i,t} + \delta_{10} \mathrm{GDPGR}_t + \gamma_t + \delta_i + \epsilon_{i,t} \tag{13}$$

The sign on β_2 in Equations (10) and (12) will indicate the effect of the deviations from optimum CCC on firm profitability, so we expect the coefficient on $\beta_2 < 0$ or negative. This would indicate that the firm's profitability decreases when a firm moves away from its optimal CCC. In addition, in Equations (11) and (13), δ_2 and $(\delta_2 + \delta_3)$ represent the influence of below-optimal deviations (i.e. when $\mathrm{DUM}_{i,t}$ takes the value 0) and above-optimal deviations (i.e. when $\mathrm{DUM}_{i,t}$ takes the value 1), respectively, on the firm's profitability. Thus, we expect both δ_2 as well as $(\delta_2 + \delta_3) < 0$ or negative. This will indicate that as firms profitability is reduced in both cases when a firm moves below optimal and above optimal. Hence, the profitability of firm will increase until a certain CCC level is reached, after which the profitability will start to decrease. Thus, a firm should aim at maintaining optimal CCC and avoid deviation, either positive or negative.

The results presented in Table VI reveal that firm profitability decreases when it moves away from its optimal CCC, since the coefficient on β_2 or deviation variable is negative in both Equations (10) and (12). In addition, we obtain δ_2 as well as $(\delta_2 + \delta_3)$ negative for both Equations (11) and (13), implying that firm profitability decreases as firm moves below-optimal and above-optimal CCC, respectively. Therefore, to maintain profitability finance managers should be close to optimal CCC and try to avoid both positive and negative deviation.

6. Conclusions and implications

6.1 Concluding observations

This study attempted to investigate the impact of working capital efficiency on firm profitability in 437 Indian manufacturing firms. Given the robustness of our empirical evidence to alternative estimation approaches, we conclude that the relationship between working capital efficiency and firm profitability is guided by the quadratic specification. We also find an inverted U-shape relationship between components of CCC and firm profitability. We found that at lower levels of CCC, firm profitability increases and at higher levels, firm profitability reduces. Further, the optimal breakeven point, as found above, beyond which CCC has a negative effect, turns out to be around 63 days. In addition, robustness check exemplifies that as firms' deviate from the optimal CCC, firm profitability will decrease. Thus, the results of robustness check also exemplify that an inverted U-shape relationship exists between working capital efficiency and firm profitability.

(1)	*b*/(*z*) (2)	*b*/(*z*) (3)	*b*/(*z*) (4)	*b*/(*z*) (5)
$ROA_{i,\ t-1}$	0.40* (3.12)	0.47* (3.78)		
$GOP_{i,\ t-1}$			0.037* (3.62)	0.044* (3.88)
Deviation	−0.00005*** (−1.66)	−0.00007*** (−1.83)	−0.00009*** (−1.90)	−0.00015** (−1.96)
(Deviation × DUM)		−0.0319** (−2.02)		−0.0426** (−1.95)
AT	0.0043*** (1.68)	0.0052*** (1.73)	0.0048*** (1.65)	0.0060*** (1.62)
Age	0.0054* (10.26)	0.0075* (19.36)	0.0070* (15.27)	0.0091* (17.89)
Lev	−0.0066 (−0.25)	−0.0086 (−0.45)	−0.0077 (−0.23)	−0.0084 (−0.36)
Size	−0.0005 (−0.78)	−0.0007 (−0.88)	−0.0009 (−0.85)	−0.0010 (−0.95)
CR	0.0014** (2.01)	0.0022** (2.31)	0.0011** (1.96)	0.0014** (1.90)
GDPGR	0.00007* (2.35)	0.00007* (2.40)	0.00001*** (1.67)	0.00001*** (1.73)
m_2	0.137	0.124	0.189	0.176
Sargan	0.114	0.129	0.163	0.186

Notes: This table reports empirical results after estimating Equations (10), (11), (12) and (13). Columns (2) and (3) report the results from Equations (10) and (12) by taking ROA as dependent variable and columns (4) and (5) report the results from Equation (11) and (13) by taking GOP as dependent variable Specifically, the results presented in this table are obtained from two-step GMM approach. The variables are same as defined in Table I. Deviation denotes the deviations from optimal CCC; (Deviation × DUM) the interaction term. *z*-Statistics of two-step GMM model are reported in parentheses and based on robust standard errors. m_2 refer to *p*-values of serial correlation test of second-order using residuals of first differences, asymptotically distributed as *N*(0,1) under null hypothesis of no serial correlation. Sargan refers to *p*-values for over-identifying restrictions distributed asymptotically under the null hypothesis of validity of instruments. Industry dummies are included, but not unreported. *,**,***Significant at 1, 5, 10 percent levels, respectively

Table VI. Results of robustness check

6.2 Implications

Overall, this paper highlights the importance of good WCM for firms in bringing trade-off between the cost and benefits of investment in working capital. Our findings offer some implications for managers. First, given the inverted U-shape relationship between working capital and firm profitability, a firm should always aim at being close to the optimal CCC and avoid the possible deviations on both sides, in order to increase profitability. Second, this study suggests that for a firm to make highest profits, it should complete its CCC on an average by 63 days. Another important implication for academicians and researchers is that, given the competing hypotheses of effect of WCM on firm profitability, one must test the quadratic specification in subsequent studies.

Notes

1. Hand-to-mouth inventory sometimes indicate that a company is maintaining a very low level of inventory and might be incurring frequent stock-outs (Van Horne and Wachowicz, 2008).
2. Zero inventory levels mean that company only orders for materials needed for manufacturing a specific product at a particular time. This process allows a company to reduce an extra cost of holding inventories (Hsieh and Kleiner, 1992).
3. This is especially true for products that take longer time to verify (Smith, 1987).
4. These results are not reported here but are available upon authors request.

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