Working capital management, firm performance and financial constraints

Empirical evidence from India

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Abstract

Purpose – The purpose of this paper is to examine the relationship between working capital management and firm performance for a sample of 437 non-financial Indian companies. In addition, this paper examines the impact of financial constraints on working capital management-performance relationship.

Design/methodology/approach – This study is based on secondary financial data of 437 non-financial Indian companies obtained from CAPITALINE database, pertaining to a period of ten years. This study employs the two-step generalized method of moments (GMM) technique to arrive at results.

Findings – Results of the study confirm the inverted U-shape relationship between working capital management and firm performance. In addition, the authors also found that the firms that are likely to be more financially constrained have lower optimal working levels.

Originality/value – Unlike prior studies, which found a linear relationship between working capital management and firm performance, this study provides newer evidence for an inverted U-shaped relation between investment in working capital and firm performance in India. In addition, this study also tests the impact of financial constraints on this relationship. In contrast to the prior studies, this study uses GMM to control the potential problems of endogeneity.

Keywords India, Financial constraints, Firm performance, Panel data, Working capital management

Paper type Research paper

1. Introduction

In a pioneering study, Smith (1980) argued that managing working capital is imperative because it has an effect on the profitability and risk of the firm and ultimately the value of a firm. Accordingly, scholars devoted considerable time and effort to explain the relationship between working capital management and firm performance across varying contexts (see recent studies, e.g. Singhania and Mehta, 2017; Bhatia and Srivastava, 2016; Baños-Caballero *et al.*, 2012). However, the results of these studies are divided into two competing camps. One camp belongs to those who argue that a firm must maintain less investment in working capital that results in shorter cash conversion cycle (CCC). Shorter CCC may improve the firm performance because it will result in the reduction in investment in inventories as well as accounts receivable. Such reduction in inventories may reduce the storage and insurance costs. On the other hand, reduction in accounts receivable will release funds that can be invested elsewhere. Another camp belongs to those that argue that investing more in working capital will result in longer CCC. Longer CCC improves firm performance because it will result in the increased investments in inventories and receivables (Tauringana and Adjapong Afrifa, 2013). Such increased investment in inventories reduces the production interruption and loss of demand, and the increased investment in receivables increases sales because customers are given more time to pay.

However, these scholars have ignored the risk of loss of sales and also the interruptions in a 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 performance. Similarly, they have also ignored the risk of bankruptcy that may arise on account of the increase in

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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.

Based on the positive and negative effects of working capital on firm performance there are a priori reason to believe that the relationship between investments in working capital and firm performance may be non-monotonic. Accordingly, we believe that the firm may have an optimal working capital level that balances the cost and benefits. However, the prior studies on working capital have analyzed only a linear relationship between a firm investment in working capital and its performance (see recent studies, e.g. Bhatia and Srivastava, 2016; Tahir and Anuar, 2016, among others). A search of the 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 performance and found an inverted U-shape relationship.

Unlike previous studies, this paper contributes to the working capital management literature in following ways. First, we offer new evidence on the relationship between working capital management and firm performance in an Indian context, by taking into account the possible non-linearity of this relation and accordingly testing the risk and return trade-off. Second, we test the impact of firm's financial constraints on this relationship. Finally, following Singhania and Mehta (2017) and Baños-Caballero *et al.* (2012), we have also used the generalized method of moments (GMM) to control the potential problems of endogeneity.

Our results confirm that there is an inverted U-shaped relationship between CCC and firm performance and the optimal number of days within which a firm should complete its CCC is approximately 65 days. However, after classifying firms into the likelihood of being more or less financially constrained, we found that the break-even point for more financially constrained firms is approximately equal to 20 days.

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 concludes the overall paper.

2. Literature review

The amount of investments in working capital determines the length of a working capital cycle. For example, if a company extends trade credit and hold large inventories, then the amount of cash available to pay bills will be less. Consequently, a company may delay payments to the suppliers. Thus, as working capital will remain blocked in inventories and receivables for more days, greater will be the number of days creditors will have to wait for payments. Accordingly, a firm may have a longer CCC. Prior literature has attributed various plausible reasons as to why the longer CCC might increase firm performance like, longer CCC gives customers more time to differentiate between products (Deloof and Jegers, 1996) that may stimulate sales (Deloof, 2003) and also encourage customer to buy products in times of low demand (Emery, 1987). Further, longer CCC gives customers enough time to verify the quality of the products before making payments (Lee and Stowe, 1993; Smith, 1987) that strengthen the long-term relationships with suppliers and customers (Wilner, 2000), and thus reduces the information asymmetry between buyer and seller (Smith, 1987). Further longer CCC prevents production interruptions (Ng *et al.*, 1999), since holding larger inventories reduces the price fluctuation and thus prevent production interruption and also the loss of demand due to the scarcity of products (Blinder and Maccini, 1991). In addition, stocking more inventories gives customers more choice and variety of products to choose from. Moreover, stocking more inventories means that there will be no unmet demand of the product, this again will improve performance. In a similar vein, a recent work by Martínez-Sola *et al.* (2013) also suggested that by relaxing a credit period, firms can improve their performance because they are able to reduce the accumulation of inventories and thus storage costs.

Furthermore, granting trade credit may also stimulate sales because it serves as an effective price cut mechanism (Petersen and Rajan, 1997). It is argued that customers feel discouraged when a supplier uses aggressive working capital management strategy to patronize its product. This is because extending trade credit reflects the reputation and financial health of the firm (Peel *et al.*, 2000). Thus, extended CCC is a convincing factor that a company's products offer value for money (Blazenko and Vandezande, 2003; Deloof and Jegers, 1996). Prior literature amplifies that in situations when it is hard to differentiate products, the important selection criteria turns out to be trade credit (Deloof and Jegers,1996; Shipley and Davies, 1991). In addition, collecting receivables quickly involves other negative effects like high transaction cost of converting receivables back into cash (Kim and Atkins, 1978), default risk (Shi and Zhang, 2010) and proves determinant in patronizing company's products. With regard to accounts payable, it is argued that firm may obtain important discounts for early payments when it reduces its supplier financing (Ng *et al.*, 1999; Wilner, 2000). Supporting the above literature, positive impact of CCC on firm performance has been supported by a number of empirical studies (see recent studies, e.g. Bhunia and Das, 2015; Martínez-Sola *et al.*, 2013; Sharma and Kumar, 2011; Gill *et al.*, 2010; Raheman *et al.*, 2010).

Contrary to the above view "longer CCC has a positive impact on firm performance" there are numerous reasons as to why shorter CCC increases firm performance. Firms with longer CCC need to stock higher inventories that increase various costs like warehousing rent, insurance and security expenses (Kim and Chung, 1990).Further, greater the working capital needs, more will be financing costs and opportunity costs for business. In addition, companies that hold higher working capital need to pay more interest expenses (Kieschnick *et al.*, 2011) and, therefore face more credit risk. Maintaining higher working capital levels means that a large amount of investment is looked up, that hampers the ability of a firm to take up value enhancing projects (Deloof, 2003). Further, an increase in working capital also increases the financial distress and chances of bankruptcy (Baños-Caballero *et al.*, 2014). In support of the literature above, negative impact of CCC on firm performance has been found by numerous studies (see recent studies e.g. Bhatia and Srivastava, 2016; Lyngstadaas and Berg, 2016; Pais and Gama, 2015; Enqvist *et al.*, 2014; Singhania *et al.*, 2014; Ukaegbu, 2014; Baños-Caballero *et al.*, 2013).

The positive and negative impacts of working capital on firm performance amplify that working capital decisions might involve a trade-off, which balances the costs and benefits. Consequently, we expect that firms may have an optimal CCC that balances costs and benefits, since the positive and negative effect of CCC depends on the length of CCC adopted by a firm. More specifically, we expect that corporate performance may rise until a point firm reaches its optimal CCC, beyond which the relation between CCC and firm performance will become negative.

2.1 Investment in working capital and financial constraints

As noted above that investment in working capital has cost and benefits attached to it. However, the magnitude of such cost and benefits will not be equal across firms. Accordingly, we expect that optimal level of investment in working capital or CCC to differ across firms likely to face more or less financing constraints. Modigliani and Miller (1958) argues that in a frictionless world, firms can obtain external finance without any problems and thus investments of firm do not depend on the availability of internal capital. However, as capital market imperfections emerge, the real investments investment may depend on the financial position of the firm because of the prevailing wedge between the costs of internal and external finance (Sasidharan *et al.*, 2015; Lensink *et al.*, 2001; Fazzari and Petersen, 1993). Accordingly, external finance tends to be more costly than internal funds because of asymmetric information (Myers and Majluf, 1984); agency problems (Jensen and Meckling, 1976); and transaction costs (Gertler, 1988). Consequently, external finance and internal finance tend to become imperfect substitutes. In a similar vein, Fazzari *et al.* (1988) suggested that under imperfect capital markets conditions investments of a firm may depend on financial factors such as the availability of internal finance, access to capital markets or cost of financing. In addition, Fazzari and Petersen (1993) also suggested that investments in working capital are more sensitive to financing constraints compared to fixed capital. Accordingly, we expect that optimal level of working capital to be lower for more financially constrained firms. More specifically, we tend to examine how the optimal level of working capital tend to change by the likelihood of firms being financially constrained or unconstrained.

To test the effect of financial constraints on the optimal level of investment in working capital, we classify firms into various subsamples, classified on the basis of the likelihood of being financially constrained. Prior literature has suggested various measures for classifying firms into the likelihood of being financially constrained. However, it is still a matter of debate as to which measure is best. For the present study, we have classified firms for the likelihood of being financially constrained on the basis of following proxies:

(1) Cash flow: following Moyen (2004), we define the variable cash flow as earnings before interest and tax plus depreciation to total assets. It is argued by Moyen (2004) that, unlike dividends, cash flows allow us to focus on the firm's beginning-of-the-period funds since dividends account for firm's investment and financial decisions during that period. Accordingly, firms with cash flow above (below) the sample median are assumed to be less (more) financially constrained.

(2) Size: firm size has been used as an inverse proxy of financial constraints (see eg. Baños-Caballero *et al.*, 2014; Faulkender and Wang, 2006; Almeida *et al.*, 2004). These studies suggest that smaller firms are more financially constrained because they face higher informational asymmetry and agency costs. Therefore, we classify firms according to their size measured as the natural logarithm of total assets, and we assume firms with size above (below) the sample medians as less (more) financially constrained.

(3) Whited and Wu Index: following Whited and Wu (2006), firms are classified according to their Whited and Wu index score. Whited and Wu (2006) index is measured as a linear combination of six factors: cash flow, a dividend payer dummy, leverage, firm size, industry sales growth and firm sales growth[1]. According to Whited and Wu (2006) firms with Whited and Wu index score below (above) the sample median are considered as less (more) financially constrained.

(4) Interest coverage ratio: this ratio is actually a proxy of the degree of bankruptcy risk and hence financial constraints. Interest coverage ratio is measured as the ratio of earnings before interest and tax to financial expenses, where greater the ratio, fewer would it be difficult for a firm to repay its debt (Baños-Caballero *et al.*, 2014). Accordingly, firms having interest coverage ratio above (below) the sample medians are likely to be less (more) financially constrained.

3. Data and method

3.1 Data and data sources

To analyze the impact of CCC on firm performance and the impact of financial constraints on this relationship, we use an electronic database, the CAPITALINE, to extract the firm-level information of all the variables used in the study. 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). 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 left 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. Finally, 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

In order to carefully estimate the impact of CCC on firm performance and the impact of financial constraints on this relationship, we used two measures of performance, one accounting-based and another market-based measure. Accounting-based performance is measured by return on assets, whereas market-based performance is measured by Tobin's *Q*. In addition, we use CCC as a measure of the level of investment in working capital. It is argued that the shorter CCC, the less will be the amount of investment in working capital and vice versa. In order to examine the non-linear relationship between CCC and firm performance, we incorporate CCC squared as a variable in all the models. 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 and current ratio as control variables. 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. The literature mentioned in Section 2 implies that the relationship between working capital and firm performance may be non-monotonic. In order to test the functional form, we specify the following quadratic models:

$$\mathrm{ROA}_{i,t} = \beta_0 + \beta_1 \mathrm{CCC}_{i,t} + \beta_2 \mathrm{CCC}_{i2,t} + \beta_3 \mathrm{Size}_{i,t} + \beta_4 \mathrm{Growth}_{i,t} + \beta_5 \mathrm{AT}_{i,t} + \beta_6 \mathrm{Age}_{i,t} + \beta_7 \mathrm{Lev}_{i,t} + \beta_8 \mathrm{CR}_{i,t} + \gamma_t + \delta_i + \epsilon_{i,t} \quad (1)$$

$$Q_{i,t} = \beta_0 + \beta_1 \mathrm{CCC}_{i,t} + \beta_2 \mathrm{CCC}_{i2,t} + \beta_3 \mathrm{Size}_{i,t} + \beta_4 \mathrm{Growth}_{i,t} + \beta_5 \mathrm{AT}_{i,t} + \beta_6 \mathrm{Age}_{i,t} + \beta_7 \mathrm{Lev}_{i,t} + \beta_8 \mathrm{CR}_{i,t} + \gamma_t + \delta_i + \epsilon_{i,t} \quad (2)$$

All the variables incorporated in Equations (1) and (2) are same as mentioned in Table I. In addition, the variable γ_t is a time dummy variable, δ_i is the firm's unobservable individual effects, and ϵ_i is the random disturbance. Further, the inflection point or breakeven point

Variables	Acronym	Definition
Dependent variables		
Return on assets	ROA	Net profit/total assets
Tobin's Q	Q	Market value of equity + book value of debt/book value of assets
Independent variables		
Cash conversion cycle	CCC	ARP + ICP-APP
Cash conversion squared	CCC^2	Square of CCC
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
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

Table I. Variables definition

beyond which the CCC has a negative impact on firm performance is derived by differentiating the firm performance variable with respect to the CCC 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. More specifically, we expect CCC and firm performance to relate positively at low levels of working capital and negatively at higher levels. Accordingly, we expect β_1 to be positive and β_2 to be negative.

3.3.2 Estimation approach. The models specified above were tested using panel data methodology because of the advantages panel data methodology offers. First, it helps to control for unobservable heterogeneity (Hsiao, 2003; Klevmarken, 1989; Moulton, 1986, 1987). Second, it gives more information, produces more variability, more efficiency and less collinearity among variables (Hsiao, 2003). Finally, it helps to model technical efficiency in a better way by allowing to construct complicated models (Koop and Steel, 2001). In addition, the 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 performance on CCC 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 Q is 2.242. These values are approximately similar to the values reported by a study in the Indian context by Bhatia and Srivastava (2016). We find that the mean value of CCC variable is 81.30, implying that on an average Indian firms take 81 days to complete one cycle of working capital. 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 ratio is around 0.422. Moreover, the average liquidity ratio is around 2.56. These values are consistent with the previous studies conducted in the Indian context (see e.g. Bhatia and Srivastava, 2016; Singhania *et al.*, 2014).

	Mean	SD	Max.	Min.
ROA	0.161	0.439	2.69	−1.93
Q	2.242	1.659	4.04	0.90
CCC	81.30	66.67	420.74	−139
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

Notes: This table reports descriptive statistics of the variables as defined in Table I. Max., maximum; Min., minimum

Table II.
Descriptive statistics

Table III reports the results of correlation coefficients and variance inflation factors (VIFs) for all the independent variables. As reported in Table III, all the independent variables are statistically significantly correlated with the dependent variables which offer a rough support to the proposition that these independent variables interact with both accounting- and market-based performance measures. This evidence also confirms that it is necessary to include these variables in our empirical models to mitigate potential bias caused by variable omission. In addition, it can be inferred from Table III that none of the correlation coefficients among independent variables are larger than the value of 0.80. Thus, following the suggestions of Damodar (2004) that unless correlation coefficients among independent variables exceed this threshold, multi-collinearity is unlikely a problem. This is further confirmed by the VIFs calculated for all independent variables in our models. As suggested by Chatterjee *et al.* (2012) the VIF larger than 10 is an indication of the presence of multicollinearity problems. The VIFs reported in Table III are all smaller than 2. This again implies that multicollinearity is unlikely a problem in our analysis.

4.1 Multiple regression analysis

4.1.1 The effect of CCC on firm performance. The results obtained after estimating Equations (1) and (2) are presented in Table IV where Column (2) reports the results of Equation (1) and column (3) reports the results of Equation (2). The p values for the m_2 statistics as presented in columns (2) and (3) are a test for the absence of AR (2) process serial correlation in the first difference residuals. These p values of m_2 statistics are

	ROA	*Q*	CCC	AT	Age	Lev	Size	CR	VIFs
ROA	1.00								
Q	0.935*	1.00							
CCC	0.036**	0.023*	1.00						1.20
AT	0.078***	0.084*	0.093*	1.00					1.00
Age	0.262*	0.258**	−0.0001	−0.05*	1.00				1.05
Lev	−0.084**	−0.055*	−0.194*	0.21*	−0.04*	1.00			1.07
Size	0.076*	0.081**	−0.02***	−0.05*	0.04*	−0.02**	1.00		1.00
CR	0.003**	−0.016**	0.369*	0.12*	−0.10*	−0.10*	−0.03**	1.00	1.13

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

Table III.
Pair-wise correlation coefficients and variance inflation factors of all variables

(1)	(2)	(3)
CCC	0.077* (2.89)	0.067* (3.13)
CCC^2	−0.061**(−2.09)	−0.051*(−2.42)
AT	0.0051***(1.78)	0.0063***(1.80)
Age	0.0076*(8.07)	0.0092*(7.16)
Lev	−0.0086 (−0.48)	−0.0092 (−0.42)
Size	−0.0010 (−1.15)	−0.0014 (−1.18)
CR	0.0017*** (1.86)	0.0009***(1.73)
m_2	0.123	0.148
Sargan	0.314	0.217

Notes: This table reports empirical results after estimating Equations (1) and (2). 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* refers to *p*-values of serial correlation test of second-order using residuals of first differences, asymptotically distributed as *N*(0, 1) under 2 the null hypothesis of no serial correlation. Sargan refers to *p*-values for over-identifying restrictions distributed asymptotically under the null hypothesis of the validity of instruments. Industry dummies are included, but not unreported. *,**,***Significant at 1, 5 and 10 percent levels, respectively

Table IV. The relationship between CCC and firm performance

non-significant, implying that there is no second-order serial correlation. In addition, the results of the Sargan test presented in columns (2) and (3) are 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 columns (2) and (3) of Table IV that the estimated coefficient on CCC is positive and the estimated coefficient on CCC^2[2] is negative. These coefficients are statistically significant at 1 percent level of significance, implying that performance increases with the investment in working capital at low levels, and decreases at high levels. This confirms that an inverted U-shape relationship exists between CCC and firm performance. Further, it indicates, unlike previous studies, that the relationship between working capital efficiency and firm performance is guided by a trade-off. Thus, a firm must have an efficient working capital policy in place that balances the cost and benefits. As mentioned in Section 3.3 that the inflection point or breakeven point beyond which the CCC has a negative impact on firm performance is given by $-\beta_1/2\beta_2$. Thus, an optimal number of days within which a firm should complete its CCC is approximately 65 days. In addition, we also find an inverted U-shape relation between the individual components of CCC and firm performance[2]. We found that the break-even point for ARP is approximately 70 days, for ICP is approximately 40 days and finally for APP is approximately 45 days.

4.2 Impact of financial constraints

Having verified the existence of inverted U-shape relationship between CCC and firm performance, we further explore the effect of financial constraints on this relationship. Since higher working capital needs to be financed, we expect that firms likely to be more financially constrained to have a lower optimal level as compared to those that are less likely to face financial constraints. To account for this Equations (1) and (2) are extended by incorporating a dummy variable (DUM) that distinguishes firm according to the likelihood of being financially constrained. We use cash flow, firm size, Whited and Wu Index and interest coverage ratio to classify firms into the likelihood of being financially constrained. More, specifically DUM is a dummy variable that takes a value of 1 for firms more financially constrained, and 0 otherwise. Accordingly, following models are proposed:

$$\begin{aligned}\mathrm{ROA}_{i,t} = {} & \beta_0 + (\beta_1 + \varphi_1 \mathrm{DUM}_{i,t})\mathrm{CCC}_{i,t} + (\beta_2 + \varphi_2 \mathrm{DUM}_{i,t})\mathrm{CCC}_{i2,t} \\ & + \beta_3 \mathrm{Size}_{i,t} + \beta_4 \mathrm{Growth}_{i,t} + \beta_5 \mathrm{AT}_{i,t} + \beta_6 \mathrm{Age}_{i,t} \\ & + \beta_7 \mathrm{Lev}_{i,t} + \beta_8 \mathrm{CR}_{i,t} + \gamma_t + \delta_i + \epsilon_{i,t} \end{aligned} \quad (3)$$

$$\begin{aligned}Q_{i,t} = {} & \beta_0 + (\beta_1 + \varphi_1 \mathrm{DUM}_{i,t})\mathrm{CCC}_{i,t} + (\beta_2 + \varphi_2 \mathrm{DUM}_{i,t})\mathrm{CCC}_{i2,t} \\ & + \beta_3 \mathrm{Size}_{i,t} + \beta_4 \mathrm{Growth}_{i,t} + \beta_5 \mathrm{AT}_{i,t} + \beta_6 \mathrm{Age}_{i,t} \\ & + \beta_7 \mathrm{Lev}_{i,t} + \beta_8 \mathrm{CR}_{i,t} + \gamma_t + \delta_i + \epsilon_{i,t} \end{aligned} \quad (4)$$

All the variables are same as mentioned in Table I. By construction the optimal working capital level of less financially constrained firm is measured by $-\beta_1/2\beta_2$, while as the optimal working capital level of more financially constrained firm is measured by $-(\beta_1+\varphi_1)/2(\beta_2+\varphi_2)$. The estimated results of Equations (3) and (4) are presented in Table V. The results presented in Table V further confirm the proposition that an inverted-U shape relationship exists between working capital and firm performance since the coefficient on CCC variable is positive and significant and the coefficient on CCC^2 variable is negative and significant in all the specifications made.

In addition, we found that the inflection point for firms likely to face more financial constraints is lower, which confirms our proposition that the optimal level of working capital varies across the firms being more or less financially constrained. More specifically, the lower optimal level of working capital for more financially constrained firm may be because these firms facing high financing costs and greater capital rationing. It must be noted that the break-even point for more financially constrained firms is approximately equal to 20 days. It implies that for more financially constrained firm, performance will start decreasing after 20 days. In addition, this break-even point is approximately same across all the specifications, implying the robustness of the results.

5. Conclusion

This paper aimed to examine the relationship between working capital and firm performance. Unlike the previous literature that examined the linear relationship between working capital and firm performance, this study analyzed the functional form of this relationship in the Indian context. Accordingly, the results reveal that there is an inverted U-shape relationship between working capital and firm performance. These results imply that there exists an optimal level of investment in working capital that balances costs and benefits and maximizes a firm's performance. In addition, this study contributes to the literature by analyzing the impact of financial constraints on the said relationship. We found that the optimal number of days within which the firm should complete its CCC is on an average is 70 days. In addition, we also found that the firms that are likely to be more financially constrained have lower optimal working levels and their optimal CCC on an average is 20 days.

These results support the notion that at the lower level of working capital managers would tend to increase the investment in working capital in order to increase the performance of the firm. However, investing in working capital beyond the optimal level will backfire and may increase the chances of the credit risk of firms. Thus, it is advisable for managers to stay close to optimal and try to avoid the deviations, either above or below the optimal. Further, as results reveal the investments in working capital is sensitive to financial constraints and the lower optimal level of working capital for more financially constrained firm justifies the importance of internally generated funds and the access to capital markets in firm's working capital investment decisions.

Table V. Impact of financial constraints on the relationship between CCC and firm performance

	Dependent variable: ROA				Dependent variable: Q			
	CF grouping	Size grouping	WW index grouping	IC grouping	CF grouping	Size grouping	WW index grouping	IC grouping
CCC	0.326** (1.99)	0.1825 ** (2.22)	0.0223** (1.98)	0.0151** (2.01)	0.0341* (2.43)	0.173** (2.31)	0.0382* (2.77)	0.0282** (2.17)
CCC × DUM	−0.320** (−1.98)	−0.1625** (−2.34)	−0.0213** (−2.02)	−.0144** (−2.09)	−0.033** (−2.20)	−0.154** (−2.12)	−0.0368* (−2.52)	−0.017** (−2.21)
CCC^2	−0.053** (−2.09)	−0.053** (−2.03)	−0.0195*** (−1.76)	−0.0152** (−1.99)	−0.0273* (−2.58)	−0.063** (−2.17)	−0.0281* (−2.43)	−0.0153** (−2.09)
CCC^2 × DUM	0.0367*** (1.89)	0.0107 (1.06)	0.0172*** (1.77)	0.0136*** (1.87)	0.0244* (2.72)	0.020** (2.09)	0.0246* (2.51)	−0.0176** (−2.11)
AT	0.0049* (3.38)	0.0046* (3.18)	0.0074* (3.43)	0.0036* (3.23)	0.0048* (3.35)	0.0045* (3.14)	0.0022** (1.95)	0.0052* (2.51)
Age	0.169* (3.82)	0.174* (3.94)	0.170* (3.83)	0.175* (3.94)	0.168* (3.80)	0.173* (3.92)	0.163* (3.63)	0.147* (3.23)
Lev	−0.007 (−0.69)	−0.005 (−0.79)	−0.006 (−0.60)	−0.004 (−0.70)	−0.006 (−0.61)	−0.009 (−0.70)	−0.007 (−0.81)	−0.005 (−0.84)
Size	−0.0008 (−1.32)	−0.0007 (−1.24)	−0.0009 (−1.16)	−0.0003 (−1.15)	−0.0008 (−1.27)	−0.0006 (−1.22)	−0.0007 (−1.13)	−0.0008 (−1.11)
CR	0.0071** (2.15)	0.0073** (2.13)	0.0075*** (1.66)	0.0073*** (1.63)	0.0047 ** (2.72)	0.0046* (2.74)	0.0046** (2.24)	0.0047** (2.26)
m_2	0.099	0.098	0.097	0.099	0.148	0.142	0.143	0.147
Sargan	0.171	0.165	0.167	0.162	0.186	0.181	0.185	0.183

Notes: This table reports empirical results after estimating Equations (3) and (4). Specifically, the results presented in this table are obtained from two-step GMM approach. The variables are same as defined in Table I. Firms have been grouped on the likelihood of being more or less constrained by using proxies mentioned in Section 2.2. *Z*-statistics of two-step GMM model are reported in parentheses and based on robust standard errors. *m* refer to *p* 2 values of serial correlation test of second-order using residuals of first differences, asymptotically distributed as *N*(0, 1) under the null hypothesis of no serial correlation. Sargan refers to *p*-values for over-identifying restrictions distributed asymptotically under the null hypothesis of the validity of instruments. Industry dummies are included, but not unreported. *,**,***Significant at 1, 5 and 10 percent levels, respectively

Notes

1. The Whited and Wu (2006) index is given by:

$$-0.091CF_{i,t}-0.062DIVPOS_{i,t}+0.021TLTD_{i,t}-0.044LNTA_{i,t}+0.102ISG_{i,t}-0.035SG_{i,t}$$

where CF is the ratio of cash flow to total assets; DIVPOS is a dummy variable that takes the value of 1 if the firm pays cash dividends; TLTD is the ratio of the long-term debt to total assets; LNTA is the natural logarithm of total assets; ISG is the firm's industry sales growth; and SG is firm sales growth.

2. These results are reported in Table AI.

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Appendix

	Dependent variable: ROA			Dependent variable: Q		
ARP	0.035* (2.66)			0.045* (2.60)		
ARP^2	−0.024* (−2.48)			−0.034* (−2.44)		
ICP		0.154* (2.36)			0.174** (2.10)	
ICP^2		−.0.199** (−1.98)			−0.201*** (−1.81)	
APP			0.172* (3.66)			0.174* (2.74)
APP^2			−0.189* (−3.32)			−0.199** (−2.15)
AT	0.0048*** (1.63)	0.0049*** (1.77)	0.0047*** (1.72)	0.0058*** (1.61)	0.0060*** (1.79)	0.0059*** (1.73)
Age	0.0060* (12.60)	0.0075* (18.31)	0.0064* (21.71)	0.0074* (12.47)	0.0091* (17.27)	0.0080* (17.47)
Lev	−0.0095 (−0.52)	−0.0091 (−0.51)	−0.0127 (−0.70)	−0.010 (−0.47)	−0.0098 (−0.46)	−0.013 (−0.62)
Size	−0.0009 (−1.06)	−0.0010 (−1.12)	−0.0008 (−0.93)	−0.0013 (−1.11)	−0.0014 (−1.16)	−0.0011 (−1.01)
CR	0.0018*** (1.81)	0.0017** (1.96)	0.0027* (2.86)	0.0010*** (1.77)	0.0009*** (1.78)	0.0020** (1.95)
m_2	0.125	0.115	0.135	0.172	0.105	0.158
Sargan	0.321	0.322	0.398	0.229	0.198	0.210

Notes: This table reports empirical results after taking components of CCC as independent variables. 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 refer to p-values of serial correlation test of second-order using residuals of first differences, asymptotically 2 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 and 10 percent levels, respctively

Table AI. Relationship of components of CCC with firm performance

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