Received 3 February 2018
Revised 2 May 2018
10 July 2018
Accepted 16 July 2018

Working capital financing, 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 financing and firm performance for a sample of 437 non-financial Indian companies. In addition, this study examines the impact of financial constraints on working capital financing–performance relationship.
Design/methodology/approach – The study is based on secondary financial data of 437 non-financial Indian companies obtained from Capitaline database, pertaining to a period of 10 years (2007–2016). This study employs two-step generalized method of moments techniques to arrive at results.
Findings – Results of the study confirm the inverted U-shape relationship between working capital financing and firm performance. In addition, the authors also found that the firms that are likely to be less financially constrained can finance greater proportion of working capital using short-term debt.
Originality/value – This study contributes to the scant existing literature by testing the impact of financial constraints on the relationship between working capital financing and firm performance, representing a typical emerging market in India.

Keywords India, Financial constraints, Firm performance, Panel data, Working capital financing
Paper type Research paper

1. Introduction

Working capital is actually a difference between current assets and current liabilities. If the difference is positive or if current assets are more than current liabilities, then there is a need for the firm to finance its positive working capital requirement. However, the way firm finances its working capital has an impact on its performance (Baños-Caballero *et al.*, 2016). Firms may either adopt a conservative working capital management strategy by investing larger amounts in current assets that are financed by utilizing low proportion of short-term sources of funds. This strategy allows a firm to reduce both the refinancing and interest risk at the same time this approach might force a firm to bear the high cost of liquidity. Conversely, a firm may adopt an aggressive working capital management strategy by investing smaller amounts in current assets that are financed by utilizing the high proportion of short-term sources of funds. This strategy might allow a firm to reduce its financing costs and also mitigate agency costs, however, this approach might push the firm to bear the high cost of illiquidity.

Based on these arguments it can be amplified that both conservative and aggressive approach have their cost and benefits attached to it that might affect the performance of the firm. Thus, it might be expected that a firm's need strikes a trade-off between costs and benefits while financing working capital. Accordingly, a non-linear relationship between working capital financing and firm performance might be expected, thereby emphasizing the need to study the functional form possibilities of working capital financing and performance relationship. It is thus, assertive that investment in working capital is not the only factor that affects the performance of firms, financing of working capital might also affect the performance of the firm.

While financing of working capital might be an important determinant of firm performance, the prior literature on working capital management has largely remained

International Journal of Managerial Finance
Vol. 15 No. 4, 2019
pp. 464-477

1743-9132
DOI 10.1108/IJMF-02-2018-0036

focused on asserting the impact of investment in working capital on firm performance (see e.g. Altaf and Shah, 2018a, b; Singhania and Mehta, 2017; Bhatia and Srivastava, 2016; Tahir and Anuar, 2016). However, few studies have tried to examine the impact of working capital management policies on firm performance (see e.g. Nyabuti and Alala, 2014; Nazir and Afza, 2009). Thus, the way this working capital is financed and its effect on firm performance have not been given much attention. A search of the literature identified only one study (Baños-Caballero *et al.*, 2016) that examined the impact of working capital requirement financing on firm performance. As mentioned earlier that relationship between working capital financing and firm performance might be guided by functional form specification. Thus, for the purpose of this study idea of Baños-Caballero *et al.* (2016) has been implemented in the Indian context.

Keeping in view the above-mentioned literature this study attempts to advance the working capital management literature as follows. First, unlike most prior studies that examined the relationship between investment in working capital on firm performance, this study examines the impact of working capital financing on firm performance. Second, this study empirically tests the impact of financial constraints on the above-mentioned relationship. Third, we use the generalized method of moments (GMM) to control the potential problems of endogeneity. To our best knowledge, no such study has been previously done in Asian context in general and Indian context in particular. Further, it must be acknowledged that India has certain unique characteristics that provide a natural setting for testing the aforementioned relationships. For instance, financial market imperfections and information asymmetries (Altaf, 2016; Ghosh, 2006); under-developed capital markets and opaque financial reporting practices (Sasidharan *et al.*, 2015); limited role and size of the capital markets in allocating resources, under-utilized banking sector, incapable of providing demanded credit to the corporate sector (Ghosh, 2006). All these factors, along with the absence of empirical evidence on the working capital financing on firm performance relationship make India a unique country for testing these relationships.

Our results confirm that there is an inverted U-shaped relationship between working capital financing on firm performance and the optimal break-even point beyond which short-term debt financing has a negative effects turns out to be around 0.70. In addition, we find that this break-even point turns out to be high for firms that are likely to be low financially constrained.

The rest of the paper is divided into five 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 and Section 5 concludes the overall paper.

2. Review of theory and empirics

2.1 Working capital financing and firm performance

A firm's working capital requirements need to be financed, hence, greater the requirement more capital needs to be financed. In addition, a firm may either finance its working capital by short-term or long-term sources of finance. Each source of financing has its own costs and benefits attached to it. Thus, the manner in which working capital is financed affects the performance of an organization (Baños-Caballero *et al.*, 2016; Bei and Wijewardana, 2012; Al-Shubiri, 2011).

An attempt to decide about the level of investment and sources of financing working capital is known as the working capital policy. The prior literature asserts that firms can either be aggressive or conservative in its approach while financing working capital (Altaf and Shah, 2017; Baños-Caballero *et al.*, 2016; Temtime, 2016; Nyabuti and Alala, 2014; Sabri, 2012; Nazir and Afza, 2009). However, being aggressive or conservative is contingent upon the level of internal resources that a firm generates (Baños-Caballero *et al.*, 2016);

capital market access (Kaddumi and Ramadan, 2012); and the volatility of the market in which it operates, nature of internal operation and external market conditions (Kaddumi and Ramadan, 2012).

However, both conservative and aggressive working capital policy has its own benefits and costs. It is the finance manager's ability to align the working capital policies to the firm characteristics that would determine the ultimate impact of these policies on firm performance. A number of previous empirical studies provide support to the argument that working capital policies have a significant impact on firm performance. Al-Shubiri (2011) in an attempt to investigate the impact of working capital management policies on firm performance in 59 industrial companies from Jordan found that aggressive working capital investment policy and firm performance are inversely related. Another recent study by Bei and Wijewardana (2012) suggested that working capital policy has a significant impact on the firm performance of 155 Sri Lankan companies. In India, Vishnani and Shah (2007) analyzed the impact of working capital policies and practices on the profitability of firm in Indian Consumer Electronics Industry, suggested that firms must strike a balance between liquidity and profitability in order to improve performance. However, Afza and Nazir (2007) found no significant relationship between working capital management policy and financial performance for 208 firms from Pakistan.

An aggressive working capital policy is also known as high risk and return policy. This policy is suitable for firms that operate in relatively stable markets and generate a steady revenue (Awopetu, 2012). Under the aggressive working capital policy, a firm invests a little amount in current assets with heavy dependence on short-term credit or current liabilities (Temtime, 2016; Afza and Nazir, 2007; Nazir and Afza, 2009). Contrary to this a firm may adopt a conservative working capital policy, i.e., a low risk and return approach. This approach is suitable for firms operating in volatile market conditions and facing an uncertain demand curve (Awopetu, 2012). Under this approach, a firm invests heavily in current assets with minimal use of short-term credit or current liabilities (Temtime, 2016; Bei and Wijewardana, 2012).

Relying heavily on short-term credit for the financing of working capital has its advantages and risks. Accordingly, the percentage of working capital financed by short-term credit may impact the performance of the firm positively or negatively (Baños-Caballero *et al.*, 2016). The prior literature suggests that, using greater proportion of short-term credit to finance working capital may have the positive impact on firm's performance because short-term credit easily adjusts to firm's financial needs (Jun and Jen, 2003), short-term finance mitigates the agency problems (Baños-Caballero *et al.*, 2016), solves the problems of underinvestment because of periodic credit renewal (Ozkan, 2000), builds relations with the bank or with any other lender because of frequent renewals and is less costly because the nominal rate of interest is lower for short-term credit[1].

Contrary to the above arguments, greater reliance on short-term credit might also have a negative impact on firm's performance. The negative impact of the greater proportion of short-term financing can be because of refinancing and interest risk. It might be difficult for firms to renew their short-term loans and accordingly they might pay higher interest rates on new loans. Thus, having a negative impact on firm performance (Baños-Caballero *et al.*, 2016).

Based on the literature mentioned above, the positive and negative impact of utilizing short-term credit to finance working capital depends on the proportion of short-term credit used. When a low percentage of working capital is financed by short-term credit, the performance of the firm may increase because the benefits overweigh the costs and accordingly we may find a positive impact on firm performance. Contrary to this when the higher proportion of short-term credit is used to finance working capital, costs may overweigh benefits and accordingly firm performance may be negatively affected (Baños-Caballero *et al.*, 2016). Thus, there might be an inverted U-shape relationship

between working capital financing and firm performance. Accordingly, to our best knowledge, this study is a first attempt to explore this relationship in the Indian context, since the prior literature from India in general and Asia, in particular, has remained inclined toward investigating the impact of working capital management on firm performance and the impact of working capital management policies on firm performance.

2.2 Working capital financing and the effect of financial constraints

Since there are costs and benefits attached with the proportion of short-term debt used to finance working capital, it is imperative that beyond a specific percentage of working capital financed by short-term debt its relationship with firm performance becomes negative. Moreover, it needs to be acknowledged that the proportion of short-term debt used to finance working capital depends on the level of financial constraints faced by the firm. As suggested by Fazzari and Petersen (1993) that working capital investment is more sensitive to financing constraints than investments in fixed capital. Accordingly, firms that face lesser financial constraints are in a better position to obtain short-term bank loans on better terms and they face lower interest and refinancing risk (Baños-Caballero *et al.*, 2016). Based on this logic, it is expected that firms facing lower financial constraints may finance greater proportion of working capital by utilizing short-term debt.

To test the effect of financial constraints on the relationship between working capital financing and firm performance, we classify firms into various subsamples, classified on the basis of the likelihood of being financially constrained. The prior literature suggests numerous measures for dividing firms on the basis of the likelihood of being financially constrained. However, it is still a matter of debate as to which measure is best. In order to give robustness to our results, we have classified firms on the basis of three measures; size, Whited and Wu index and interest coverage ratio.

2.2.1 Size. Following Baños-Caballero *et al.* (2014) and Faulkender and Wang (2006) we have used firm size as an inverse proxy of financial constraints. The prior literature suggests that smaller firms are more financially constrained because they face higher agency costs and information asymmetry. In addition, Whited (1992) suggests that larger firms face lower borrowing and external financing costs and thus are categorized to faceless financial constraints. Thus firms with size above (below) the sample median are assumed to be less (more) financially constrained. Firm size is measured by taking the natural logarithm of total assets.

2.2.2 Whited and Wu index. Following Whited and Wu (2006), we split firms according to their Whited and Wu index score. Whited and Wu (2006) index is a linear combination of six factors: cash flow, a dividend payer dummy, leverage, firm size, industry sales growth and firm sales growth[2]. According to Whited and Wu (2006) firms with Whited and Wu index score below (above) the median is considered as less (more) financially constrained.

2.2.3 Interest coverage ratio. This ratio is calculated as the ratio of earnings before interest and tax to financial expenses. Interest coverage ratio measures the degree of bankruptcy risk and hence financial constraints. It is suggested that greater the ratio, it would be less 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 working capital financing on firm performance and to explore whether the firms financing of working capital with short-term debt depends on the likelihood of a firm being constrained 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 10 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 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. At last, 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 measure the impact of working capital financing on firm performance and to explore whether the firms financing of working capital with short-term debt depends on the likelihood of a firm being constrained, 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 WCF variable as a measure of the level of short-term debt used to finance working capital. In order to examine the non-linear relationship between WCF and firm performance, we incorporate WCF^2 as a variable in all the models. It is worth to mention that we followed Baños-Caballero *et al.* (2016) and included only those observations which have a positive working capital and, hence, the need to be financed. 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 are given in Table I.

3.3 Baseline specification and estimation methodology

3.3.1 Baseline specification. Based on the literature mentioned in Section 2.1, there are priori reasons to believe that the relationship between working capital financing and firm performance may be non-monotonic. Thus, in order to test the positive and negative effects of WCF on firm performance, we regress firm performance variables against WCF variable and its 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 as control variables. Therefore, we estimate the following model:

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

Variable	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		
Working capital financing	WCF	Short-term debt/working capital Where working capital = current assets − current liabilities
Working capital financing squared	WCF^2	Square of WCF ratio
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

Table I.
Variables definition

where all the variables incorporated in Equation (1) are same as mentioned in Table I. In addition, the variable γ_t is a time dummy variable, δ_i the firm's unobservable individual effects, and $\epsilon_{i,t}$ the random disturbance.

The second model includes all the same independent variables; however, the dependent variable is the market-based performance measure Q. Accordingly the following model is estimated:

$$Q_{i,t} = \beta_0 + \beta_1 \mathrm{WCF}_{i,t} + \beta_2 \mathrm{WCF}_{i,t}^2 + \beta_3 \mathrm{Size}_{i,t} + \beta_4 \mathrm{Growth}_{i,t} + \beta_5 \mathrm{AT}_{i,t} + \beta_6 \mathrm{Age}_{i,t}$$

$$+ \beta_7 \mathrm{Lev}_{i,t} + \beta_8 \mathrm{CR}_{i,t} + \gamma_t + \delta_i + \epsilon_{i,t}. \quad (2)$$

As mentioned in Section 2.1, by utilizing the lower percentage of short-term debt to finance working capital, firm performance may increase because benefits overweigh costs. However, beyond a certain point utilizing short-term debt may backfire and costs overweigh benefits. Accordingly, we expect a positive coefficient on WCF variable and a negative coefficient on WCF^2 variable. Further, the inflection point or break-even point beyond which the short-term debt financing has the negative impact on firm performance is given by following expression: $-\beta_1/2\beta_2$.

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). At last, 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 WCF variable 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.

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 (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 WCF variable is (0.425), implying that on average Indian firms finance 42.5 percent of their working capital from short-term debt. An important thing to note here is the maximum and minimum value of WCF variable that varies substantially from 0.995 to 0, reflecting the heterogeneity of working capital financing policy across firms. 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 36.91years 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 done in Indian context (see e.g. Bhatia and Srivastava, 2016; Singhania *et al.*, 2014).

In order to ensure that multicollinearity is unlikely a problem, Pearson correlations and variance inflation factor (VIFs) for all the independent variables in Equations (1) and (2) were calculated. These results are reported in Table III. It is evident from Table III that none of the coefficients among independent variables exceed the threshold 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. To further confirm this proposition, we follow Chatterjee and Hadi (2012) and calculate VIFs to detect the problems of multicollinearity. It is evident from the Table III that none of the VIF is larger than the threshold value of 10, implying that multicollinearity is unlikely a problem in our analysis.

	Mean	SD	Max.	Min.
ROA	0.161	0.439	2.69	−1.93
Q	0.242	0.659	4.04	0.90
WCF	0.425	0.156	0.993	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

Table II.
Descriptive statistics

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

	ROA	*Q*	WCF	Size	Growth	AT	Age	Lev	CR	VIFs
ROA	1.00									
Q	0.935*	1.00								
WCF	0.02**	0.04*	1.00							1.15
Size	0.076*	0.081**	−0.21*	1.00						1.20
Growth	0.024*	0.005*	0.011	−0.02	1.00					1.00
AT	0.078***	0.084*	−0.15*	−0.03**	0.019	1.00				1.10
Age	0.262*	0.258**	0.045*	0.27*	0.01	−0.05*	1.00			1.11
Lev	−0.084**	−0.055*	0.10*	−0.08*	−0.004	0.04*	−0.03*	1.00		1.03
CR	0.003**	−0.016**	−0.19*	−0.01	0.035*	0.09*	−0.10*	−0.10*	1.00	1.07

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

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

4.1 Multiple regression analysis

4.1.1 The effect of working capital financing on firm performance. In order to test the relationship between WCF and firm performance, we first estimate Equations (1) and (2) by two-step GMM estimator proposed by Arellano and Bond. The results obtained from GMM estimation are reported in Columns 2 and 4 of Table IV, respectively. The *p*-values for the m_2 statistics as presented in Columns (2), (3), (4) and (5) is a test for the absence of AR(2) process serial correlation in the first difference residuals. This *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), (3), (4) and (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.

Taking ROA as the dependent variable, we found that the coefficient on WCF variable is positive and significant at 1 percent level of significance and the coefficient on WCF^2 variable is negative and significant at 1 percent level of significance. This confirms that there is a non-monotonic (inverted U-shape) relationship between WCF and firm's performance. In addition, the results do not change when we take *Q* as a dependent variable.

These results imply that when the low level of working capital is financed with short-term bank debt, firms performance may increase because, firms might reduce their interest costs and more specifically mitigate agency costs (Baños-Caballero *et al.*, 2016). However, as firms tend to finance the higher percentage of working capital with short-term debt, firm performance decreases because firms may face refinancing and interest risk, that may turn into high financial distress costs (Jun and Jen, 2003). Thus, utilizing lower proportion of short-term debt to finance working capital, firm performance may increase, compared to utilization of higher proportion of short-term debt. We further analyze the brea-keven point beyond which the firm performance tends to decrease. The break-even point is given by $-\beta_1/2\beta_2$ and is around 0.70 in all the specifications.

	Dependent variable: ROA		Dependent variable: *Q*	
	GMM	GMM	GMM	GMM
	b/(z)	b/(z)	b/(z)	b/(z)
(1)	(2)	(3)	(4)	(5)
WCF	1.22* (6.80)		1.92* (6.38)	
WCF^2	−0.870* (−3.60)		−1.34* (−3.60)	
WCF		0.561* (8.90)		0.796* (8.04)
$(WCF_{i,t}-WCF^*_{i,t})Z$		−1.02* (−3.17)		−1.43* (−3.01)
Size	−0.001** (−1.96)	−0.004** (−2.12)	−0.010** (−2.20)	−0.018** (−2.34)
Growth	0.006 (0.83)	0.007 (0.88)	0.008 (0.70)	0.009 (0.76)
AT	−0.042* (−2.95)	−0.043* (−3.03)	−0.036*** (−1.62)	−0.038*** (−1.70)
Ge	0.003 (1.08)	0.003 (1.15)	0.0043 (0.93)	0.004 (1.00)
Lev	0.133* (3.04)	0.131* (2.99)	0.190* (2.85)	0.186* (2.81)
CR	−0.002*** (−1.68)	−0.0030*** (−1.72)	−0.005** (−2.82)	−0.005** (−2.86)
m_2	0.134	0.136	0.145	0.149
Sargan	0.414	0.421	0.422	0.498

Notes: This table reports empirical results after estimating Equations (1), (2), (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. *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 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 working capital financing and firm performance

Further, in order to give robustness to the results, we follow Pattillo *et al.* (2002) and use alternative research design based on spline regressions. Accordingly, we transform Equations (1) and (2) as follows:

$$\mathrm{ROA}_{i,t} = \beta_0 + \beta_1 \mathrm{WCF}_{i,t} + \beta_2 \left(\mathrm{WCF}_{i,t} - \mathrm{WCF}^*_{i,t}\right) Z + \beta_3 \mathrm{Size}_{i,t} + \beta_4 \mathrm{Growth}_{i,t} + \beta_5 \mathrm{AT}_{i,t} + \beta_6 \mathrm{Age}_{i,t} + \beta_7 \mathrm{Lev}_{i,t} + \beta_8 \mathrm{CR}_{i,t} + \gamma_t + \delta_i + \epsilon_{i,t}, \quad (3)$$

$$Q_{i,t} = \beta_0 + \beta_1 \mathrm{WCF}_{i,t} + \beta_2 \left(\mathrm{WCF}_{i,t} - \mathrm{WCF}^*_{i,t}\right) Z + \beta_3 \mathrm{Size}_{i,t} + \beta_4 \mathrm{Growth}_{i,t} + \beta_5 \mathrm{AT}_{i,t} + \beta_6 \mathrm{Age}_{i,t} + \beta_7 \mathrm{Lev}_{i,t} + \beta_8 \mathrm{CR}_{i,t} + \gamma_t + \delta_i + \epsilon_{i,t}. \quad (4)$$

All the variables are same as defined in Table I. Further, $\mathrm{WCF}^*_{i,t}$ represents the threshold or break-even point obtained after estimating Equations (1) and (2) and Z is a dummy that takes the value of 1 if WCF is above $\mathrm{WCF}^*_{i,t}$ (and 0 otherwise). More specifically, to prove an inverted U-shape relation between WCF and firm performance, we expect a positive coefficient on $\mathrm{WCF}_{i,t}$ and a negative coefficient on $(\mathrm{WCF}_{i,t} - \mathrm{WCF}^*_{i,t})Z$.

The results of spline regressions are presented in Columns 3 and 5 of Table IV. Consistent with the results obtained from Equations (1) and (2), we find similar results after estimating Equations (3) and (4). To further elaborate, we find a significant and positive coefficient on WCF variable and a significant and negative coefficient on $(\mathrm{WCF}_{i,t} - \mathrm{WCF}^*_{i,t})Z$ after taking ROA as well as Q as a dependent variable. Thus, our results are robust across all the specifications and it can be concluded that with the lower level of short-term debt investment in working capital firm performance is improved while as its effect becomes negative at high levels.

4.2 The effect of financial constraints on the relationship between working capital financing and firm performance

Having verified the existence of inverted U-shape relationship between working capital financing and firm performance, we further explore the possible effects of financial constraints on this relationship. As mentioned in Section 2.2 that sensitivity of working capital investment is more than that of fixed capital, accordingly, firms facing lesser financial constraints, are in a better position to obtain short-term bank loans on better terms.

In order to test whether or not the break-even point changes with the level of financial constraints faced by the firm, we classify firms according to three proxies, i.e., firm size; Whited and Wu index and interest coverage ratio. Accordingly, Equations (1) and (2) are extended by incorporating a dummy variable that distinguishes between firms more likely to face financing constraints and those that are less likely according to the above-mentioned classifications. More specifically, the degree of financial constraints (DFC) is a dummy variable that takes a value of 1 for firms less financially constrained (and 0 otherwise). After incorporating dummies Equations (1) and (2) can be rewritten as follows:

$$\mathrm{ROA}_{i,t} = \beta_0 + \left(\beta_1 + \varphi_1 \mathrm{DFC}_{i,t}\right) \mathrm{WCF}_{i,t} + \left(\beta_2 + \varphi_2 \mathrm{DFC}_{i,t}\right) \mathrm{WCF}^2_{i,t} + \beta_3 \mathrm{Size}_{i,t} + \beta_4 \mathrm{Growth}_{i,t} + \beta_5 \mathrm{AT}_{i,t} + \beta_6 \mathrm{Age}_{i,t} + \beta_7 \mathrm{Lev}_{i,t} + \beta_8 \mathrm{CR}_{i,t} + \gamma_t + \delta_i + \epsilon_{i,t}, \quad (5)$$

$$Q_{i,t} = \beta_0 + \left(\beta_1 + \varphi_1 \mathrm{DFC}_{i,t}\right) \mathrm{WCF}_{i,t} + \left(\beta_2 + \varphi_2 \mathrm{DFC}_{i,t}\right) \mathrm{WCF}^2_{i,t} + \beta_3 \mathrm{Size}_{i,t} + \beta_4 \mathrm{Growth}_{i,t} + \beta_5 \mathrm{AT}_{i,t} + \beta_6 \mathrm{Age}_{i,t} + \beta_7 \mathrm{Lev}_{i,t} + \beta_8 \mathrm{CR}_{i,t} + \gamma_t + \delta_i + \epsilon_{i,t}. \quad (6)$$

All the variables are same as defined in Table I. By construction the break-even point for more financially constrained firm is measured by $-\beta_1/2\beta_2$. The break-even point for less financially constrained firm comes from the following expression: $-(\beta_1 + \varphi_1)/2(\beta_2 + \varphi_2)$.

Estimates of Equations (5) and (6) are presented in Table V. The p-values for the m_2 statistics are non-significant in all specifications implying that there is no second-order serial correlation. In addition, the p-values of Sargan test are also non-significant, in all the specifications made implying the absence of correlation between instruments and error term.

Further, in all the specifications, we found that the coefficient on WCF is significant and positive, while as the coefficient on WCF^2 is significant and negative, implying that the inverted U-shape relationship exists between WCF and firm performance. In addition, we found that the break-even point for firms likely to face lower financial constraints is higher, which confirms our proposition, that firms with low financial constraints can finance greater proportion of their working capital using short-term debt without harming performance. This may be because firms that are likely to be low financially constrained may find it easy to obtain funds from the financial institution and with better credit conditions and also face lower interest risk.

5. Conclusions

Acknowledging that the empirical evidence on the relationship between working capital financing on firm performance is largely absent in general and India in particular, this study attempts to advance the understanding of working capital management in the following ways. First, by developing the understanding of the impact of working capital financing on firm performance. Second, by testing the impact of financial constraints on the above-mentioned relationship. Third, using the GMM to control the potential problems of endogeneity. By such estimations we expect to achieve reliable estimates about the working capital financing–firm performance relationship.

Given the robustness of our empirical evidence to alternative estimation approaches, we conclude that working capital financing and firm performance relationship is guided by inverted U-shape specification, i.e., when firms finance working capital with lower levels of short-term debt firm performance improves while with the higher level of short-term debt used to finance working capital, firm performance decreases. Further, the optimal break-even point beyond which short-term debt financing has a negative effect turns out to be around 0.70. However, this break-even point turns out to be high for firms likely to be low financially constrained. This implies that firms facing lower financial constraint can finance greater proportion of their working capital by short-term sources without hurting performance. These results are consistent with the results of Baños-Caballero *et al.* (2016), only study conducted on analyzing the relationship between working capital financing and firm performance. They also found an inverted U-shape relationship between working capital financing and firm performance for Spanish firms.

This study while providing new evidence with regard to the impact of working capital financing on firm performance and also the impact of financial constraints on this relationship. These results highlight the importance of good WCM for firms in bringing trade-off between the cost and benefits while financing working capital. In addition, results also suggest that a firm should always aim at being close to the optimal WCF and avoid the possible deviations on both sides, in order to achieve performance optimization. In addition, this study can be used as a guide for testing the relationship between working capital financing and performance in subsequent studies.

No study is without limitation and this study is no exception. Although much attention has been paid while designing and executing this study, still some limitations exist. This study has used the sample from Indian economy and Indian economy is a typical example of

Table V.
Impact of financial constraints on the relationship between working capital financing and firm performance

	Dependent variable: ROA			Dependent variable: Q		
(1)	Firm size grouping (2)	Whited and Wu index grouping (3)	Interest coverage grouping (4)	Firm size grouping (5)	Whited and Wu index grouping (6)	Interest coverage grouping (7)
WCF	0.840* (4.67)	0.864* (4.42)	0.918* (4.78)	1.75* (4.12)	1.77* (3.86)	1.72* (4.27)
WCF × DFC	−0.540** (−2.06)	−0.544* (−2.45)	−0.783* (−2.44)	−0.912** (−2.33)	−0.923*** (−1.77)	−0.918*** (1.69)
WCF^2	−1.48** (−1.92)	−1.51*** (−1.85)	−1.562** (−2.10)	−1.70*** (−1.78)	−1.732*** (−1.70)	−1.813** (−1.97)
WCF^2 × DFC	1.41** (2.47)	1.30*** (1.89)	1.49** (2.12)	1.029* (2.58)	1.07** (2.05)	1.17* (2.23)
Size	−0.002*** (1.77)	−0.001*** (1.84)	−0.007*** (1.92)	−0.007*** (−1.74)	−0.009*** (−1.77)	−0.011*** (−1.92)
Growth	0.007 (0.94)	0.007 (0.87)	0.007 (0.91)	0.009 (0.76)	0.009 (0.74)	0.009 (0.78)
AT	−0.0411* (−2.87)	−0.040* (−2.86)	−0.041* (−2.88)	−0.034** (−1.99)	−0.034** (−1.98)	−0.034** (−1.96)
Age	0.003 (1.10)	0.003 (1.12)	0.003 (1.12)	0.0043 (0.95)	0.004 (0.97)	0.004 (0.97)
Lev	0.130* (3.00)	0.130* (3.01)	0.129* (2.98)	0.184* (2.79)	0.185* (2.80)	0.182* (2.78)
CR	−0.003*** (−1.84)	−0.003*** (−1.79)	−0.003*** (−1.79)	−0.006** (−1.97)	−0.006*** (−1.91)	−0.006*** (−1.93)
m_2	0.176	0.176	0.176	0.177	0.177	0.177
Sargan	0.115	0.119	0.117	0.154	0.147	0.120

Notes: This table reports empirical results after estimating Equations (5) and (6). 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_2 refer to *p*-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

developing or emerging economy, our findings are, to some extent, generalizable to markets owning similar characteristics. For this reason, we believe that it is desirable for further research to seek to understand how the relationship between working capital financing and firm performance varies across countries with different institutional characteristics and financial systems.

Notes

1. The nominal rate of interest is lower for short-term debt because default and inflation premiums tend to increase as the increase in debt maturity (Jun and Jen, 2003).
2. The Whited and Wu (2006) index is given by:
$-0.091\mathrm{CF}_{i,t} - 0.062\mathrm{DIVPOS}_{i,t} + 0.021\mathrm{TLTD}_{i,t} - 0.044\mathrm{LNTA}_{i,t} + 0.102\mathrm{ISG}_{i,t} - 0.035\mathrm{SG}_{i,t}$,
CF is the ratio of cash flow to total assets; DIVPOS the dummy variable that takes the value of 1 if the firm pays cash dividends; TLTD the ratio of the long-term debt to total assets; LNTA the natural logarithm of total assets; ISG the firm's industry sales growth; and SG the firm sales growth.

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