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Investment in working capital and financial constraints

Empirical evidence on corporate performance

Fahmida Laghari
School of Accounting, Xijing University, Xi'an City, Shaanxi Province, China, and
Ye Chengang
Business School, Centre for International Business Ethics (CIBE), University of International Business and Economics (UIBE), Beijing, China

Abstract

Purpose – The purpose of this paper is to investigate the relationship between working capital management and corporate performance with financial constraints.
Design/methodology/approach – This study uses large panel sample of Chinese listed firms over the period 2005–2015 using system generalized method of moments (GMM) estimator that controls unobserved heterogeneity of individual firms well and GMM methodology is robust to address endogeneity issues.
Findings – Empirical evidence finds inverted U-shaped relationship between working capital and corporate performance and exhibits similar evidence for financially constrained firms. Evidence shows impact of high sales and discounts on early payments at low level of working capital and dominance of opportunity cost and cost of external finance at high level of working capital. The findings of the results show that optimal working capital level of financially constrained firms is relatively lower due to high cost of external capital and debt rationing. The results also indicate that on average *NET* is significantly lower for firms with Tobin's $Q > 1$ than firms with Tobin's $Q = 1$, and suggest that aggressive working capital management is significantly and positively associated with higher corporate values.
Originality/value – This paper is among few that complement the existing literature by providing evidence that inverted U-shaped relationship between working capital management and corporate performance also exists in the context of Chinese listed non-financial firms. Exclusively, the relationship of working capital and corporate performance with linkage of financial constraints is scant in the context of Chinese listed non-financial firms.

Keywords China, Performance, Working capital management, Financial constraints, Cost of external capital
Paper type Research paper

1. Introduction

Working capital management decisions affect firm performance (Schiff and Lieber, 1974; Kim and Chung, 1990), and influence company value, profitability and risk (Smith, 1980). Working capital is the difference of current assets and current liabilities, and it is also considered as measure for liquidity (Ding *et al.*, 2013). Corporate finance literature has mainly focused on long-term financial decisions such as dividends, capital structure, investment and company valuation but paid little attention to short-term financing decisions (De Almeida and Eid, 2014). Moreover, liabilities and liquid assets are indispensable part of company's overall assets and yet need to be properly analyzed in order to manage working capital requirements (WCRs).

Working capital management literature comprises two distinct views for investment in working capital. Under the opinion of one view, high investment in working capital allows a firm to enhance sales, acquire higher discounts for early payments and increase firm value (Deloof, 2003; Aktas *et al.*, 2015). Firms have great incentives of high investment in working capital, because high level of inventories reduces supply cost (Blinder and Maccini, 1991), provides hedge or shield against input price fluctuations (Fazzari and Petersen, 1993) and reduces sales loss due to possible stock-out (Corsten and Gruen, 2004). The supply of trade credit to customers enhances firm sales because it permits an effective price cut (Brennan

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et al., 1988; Petersen and Rajan, 1997), establishes long-term relationship with customers (Ng *et al.*, 1999; Wilner, 2000), offers quality products and services before payment (Smith, 1987; Lee and Stowe, 1993), benefits customers to obtain merchandise at the time of low demand (Emery, 1987) and reduces information asymmetry (Baños-Caballero *et al.*, 2012).

Under the second view, over-investment in working capital may put undesirable effects and harm shareholders value (Aktas *et al.*, 2015), because high investment in working capital needs financing, and firm's need for extra financing increases financing expenses and enhances probability of bankruptcy (Kieschnick *et al.*, 2011). Moreover, high investment in working capital locks funds in working capital (Deloof, 2003), due to this firms lose some value enhancing projects in short run (Ek and Guerin, 2011). Availability of stocks may increase costs; for instance, rent for warehouse, insurance and security expenses as the level of inventory rises (Kim and Chung, 1990). Consistent with these two views, the presence of potential benefits and costs suggests a non-linear relationship between working capital management and firm performance, and advocates firms to invest in working capital at optimal level. Therefore, working capital management at optimum can attain trade-off between risk and efficiency and capitalizes firm value (Smith, 1973, 1980; Deloof, 2003; Howorth and Westhead, 2003; Wasiuzzaman, 2015; Chauhan and Banerjee, 2018).

Strategies to adopt sound policy for management of working capital are highly crucial to any firm especially for firms operating in emerging economies. Mostly in emerging economies, firms are smaller in size, growing in life cycle, with limited capital market access and institutional funding for long-term resources (Chauhan and Banerjee, 2018), because emerging economies are characterized by imperfect capital markets, high information asymmetry, poor corporate governance and debt rationing. Firms in these economies rely heavily on internal sources for funds such as working capital (Allen *et al.*, 2012). Firms with financial constraints and small firms in these economies face intense competition from stronger players in the market. For that reason, these firms should adopt effective and efficient strategies to manage working capital prudently. However, it is not easy for these firms to effectively manage working capital at optimum, because these firms are new and may face several regulatory and future uncertainties. Therefore, despite the existence of optimum level of working capital, firms in these economies may not keenly pursue it followed by operational or financial constraints and varying strategic concern (Chauhan and Banerjee, 2018).

In this paper, we attempt to explore the non-linear relationship between working capital management and corporate performance using a large panel sample of Chinese non-financial firms from the period 2005 to 2015. We undertake the study of non-financial firms because of unique institutional contextual of China, there may possibly be state-owned companies that have soft budget restraints. Toward credit market of China, the government has a pivotal effect on the credit possessions distribution (Fang, 2007). For maximum number of cases, the government plays a decisive role for which company to deliver credits. Therefore, maximum number of credit is granted to companies of state-owned or closely held firms (Fang, 2007; Li *et al.*, 2009). As compared to firms owned by state, privately held companies find troublesome to acquire financial aid from banks. Even though by the 1998 most of the leading big Chinese banks were allowed to lend privately held firms, still firms held private are facing considerable difficulty to acquire external funds relative to state-owned enterprises (Allen *et al.*, 2005). In the course of obstructing financial constraints, privately held firms' investment depends heavily on internal funds compared to companies owned by state (Ding *et al.*, 2013). There is a positive link between economic expansion and financial growth (Levine, 2005), which performs as leading provisions in the growth of economies. As with short passage of time, the economy of China has under gone a massive economic development and is a case in point for researchers' astonishment even though having under-developed financial structure (Song *et al.*, 2011). Therefore, external financial market of China plays a limited part in providing

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finance and resource sharing out (Guariglia and Yang, 2016). As discussed by Guariglia *et al.* (2011), extraordinary growth puzzle of China roots to extremely fertile firms and their capability to generate sufficient cash flows. Moreover, they also declare that this growth miracle is driven by the Chinese firms' capability of having significant amount of internal funds and their ability to fund growth despite of limited external financial capital access. Hence, the solution of riddle for amazing economic growth of China is followed by well-governed strategies for working capital management, short-run liquid assets and internal financing.

Large body of research studies have considered to investigate the management of working capital and corporate performance relationship (De Almeida and Eid, 2014; Yazdanfar and Öhman, 2014; Lyngstadaas and Berg, 2016) from the context of economies that are well developed. Small number of studies have focused on less developed and emerging economies for management of working capital (García-Teruel and Martínez-Solano, 2007; Abuzayed, 2012; Baker *et al.*, 2017). Specifically few studies have focused on economy of China to examine firm's working capital investment and corporate performance relationship (Ding *et al.*, 2013; He *et al.*, 2017). Prior research studies mostly focused on linear relationship between working capital management and corporate performance (Jose *et al.*, 1996; Shin and Soenen, 1998; Wang, 2002; Deloof, 2003). A limited number of studies have paid attention to categorize target-following behavior of the companies with respect to working capital management. Baños-Caballero *et al.* (2010, 2012, 2014) and Aktas *et al.* (2015) examine the optimal working capital level and confirm the target behavior of firms for more developed western economies. Moreover, the target behavior of firms also confirm by Chauhan and Banerjee (2018) for the Indian manufacturing companies. To the best of our knowledge, rare studies have been conducted on this issue for the Chinese non-financial firms. We attempt to bridge this gap in this study.

Using a large sample panel of 1,528 listed firms with 16,802 firm-year observations of Chinese non-financial firms from the period 2005 to 2015, we study the relationship between working capital management and corporate performance. Specified noteworthy imperfections of capital market illustrating it and its deprived circumstance of corporate governance (Allen *et al.*, 2005), the background of China delivers an idyllic test center to study businesses choices of investment in the financial restraints existence. Following measurement specification of Shin and Soenen (1998) and Baños-Caballero *et al.* (2014), this study uses net trade cycle (NTC) as a measure for working capital management. Likewise, we use quadratic model used in the prior literature (Baños-Caballero *et al.*, 2014) to investigate the optimum level of NTC (*NET*), as a measure for working capital management by sample firms.

In this paper we also investigate the relationship between working capital management and corporate performance with linkage of financial constraints. This paper especially draws implications from imperfect capital markets view and financial constraints framework for working capital investment in order to explore the optimum level of working capital that maximizes firm value. As discussed by Fazzari and Petersen (1993), investment sensitivity in working capital to financial constraints is high as compared to investment in fixed capital. The investment of firms is highly dependent on financial factors; for instance, availability of internal finance, access to capital markets and external financing costs (Fazzari *et al.*, 1988). Following extent empirical papers (Kaplan and Zingales, 1997; Moyen, 2004; Whited and Wu, 2006; Hennessy *et al.*, 2007), this study classified firms as financially constrained to examine the effect of financial constraints on optimum level of working capital.

The highlight of our results is that the relationship between working capital management and corporate performance is non-linear and exhibits inverted U-shaped relationship. Next, we find that inverted U-shaped relationship between working capital

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management and corporate performance still holds for financially constrained firms. These findings also indicate that optimal level of working capital is relatively lower for financially constrained firms. Additionally, the findings of comparison of working capital management for divide sample indicate that on average working capital management measure (*NET*) is significantly lower for higher value firms. This shows that there is a positive and significant association of aggressive working capital management with higher corporate values (Wang, 2002).

We also conduct additional sensitivity tests to check the robustness of the main findings. In that regard we use alternative quantile estimator to find the relationship of working capital management and corporate performance. Our main findings are robust to this alternative quantile estimator and provide similar evidence of estimation with generalized method of moments (GMM) estimator. Second, we examined the potential effect of financial constraints on working capital management and corporate performance relationship by Kaplan and Zingales index and cash flow by GMM and fixed-effect estimators. After considering Kaplan and Zingles index and cash flow as alternate financial constraints criteria, the main results hold and show inverted U-shaped relationship for working capital management and corporate performance. Additionally, the results also confirm that optimal working capital level of financially constrained firms is relatively lower.

Our study is related to several streams of literature. First this paper is related to studies that investigate the working capital management and corporate performance relationship. For instance, Wang (2002) worked on firms of Japan and Taiwan and found that firms with high value hold lower investment in working capital than lower value firms. Kieschnick *et al.* (2011) worked on relationship between working capital management and firm value by using Faulkender and Wang (2006) framework and find that on average an extra dollar worth less is invested in net operating working capital compared to a dollar held in cash. Wasiuzzaman (2015) analyzed Malaysian firms to investigate the relationship between working capital efficiency and firm value with linkage of effect of financial constraints by using Fama and French (1998) valuation model. The study finds that corporate value can be increased by improving efficiency of working capital management by keeping working capital investment at lower levels. The study also declares that corporate value may not be increased with working capital efficiency for financially constrained firms. These prior research studies have provided ample insight for effect of working capital on corporate performance but they do not consider potential influence of working capital investment level and corporate performance relationship from non-linear perspective. Unlike other studies our study proposes that relationship between working capital management and corporate performance is non-linear inverted U-shaped.

This paper is also related to studies that investigate the effect of financial constraints on working capital management and corporate performance relationship. For instance, Baños-Caballero *et al.* (2014) find non-linear relationship between working capital management and corporate performance for the sample of UK non-financial firms. However, to the best of our knowledge, very limited studies have worked on non-linear relationship for working capital and corporate performance with the linkage of financial constraints. Especially in the context of Chinese non-financial firms, our study is among few to address working capital management and corporate performance relationship from non-linear perspective and with the linkage of financial constraints. The findings of our study provide novel results and suggest that financially constrained firms investment in working capital is highly sensitive to availability of funds.

At last, our study uses dynamic panel data methodology that controls unobserved heterogeneity of individual firms well (Hsiao, 2003). Panel data methodology is robust, supports more degrees of freedom and provides highly informative data and more efficiency and variability (Baltagi, 2005). And in the presence of omitted variables, consistent

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estimators can be obtained with panel data methodology (Wooldridge, 2002). Moreover, this paper uses system GMM methodology that is robust to capture the endogeneity issues.

The remainder of the paper is organized as follows. Section 2 discusses review of related literature and development of hypotheses. Section 3 represents sample, measures and proposed methodology. Section 4 includes empirical analysis of the study and Section 5 includes implications and conclusion.

2. Review of related literature and hypotheses development

The financial health of a company is reflected by its working capital which is directly linked to profitability and liquidity (Sagner, 2014). Working capital management is crucial and integral part of companies' financial management (Talonpoika *et al.*, 2016), and short-term financial performance. Working capital involves management of cash, inventories and accounts receivables (Yazdanfar and Öhman, 2014). Firm's working capital comprises current assets (mainly receivables, inventories and cash) minus current liabilities (chiefly payables and short-term debt), and it measures firm's net position in liquid assets (Fazzari and Petersen, 1993). Initially a considerable amount of literature investigates the individual components of working capital in segregation. The studies such as Long *et al.* (1993), Deloof and Jegers (1999) and Ng *et al.* (1999) examine the trade credit policy and discover support for contracting cost motive with receivables used as an indicator for product quality. However, Petersen and Rajan (1997) determined that receivables are directly tied to company's profitability and access to capital markets and Deloof and Jegers (1999) evaluated demand side of trade credit and demonstrate that payables are openly linked to financing deficits. In that regard, Hill *et al.* (2010) integrated the components of working capital to examine the dynamics impelling the net investment in working capital by WCR and declare that firms with high cost of external financing, low capacity to finance internally and limited access to capital markets encourage firms to follow more aggressive strategies of working capital. They further suggest that firms not only rely on industry averages but should also consider financing and operating circumstances in order to evaluate the behavior of working capital.

Most of the studies related to working capital management have used cash conversion cycle as measure for working capital management. The cash conversion cycle is a fundamental element to measure management of working capital (Gitman, 1974; Jose *et al.*, 1996; Deloof, 2003), and operational tool to measure firm's position of liquidity and performance (Richards and Laughlin, 1980). Cash conversion cycle is defined as time lag from purchase of raw material to cash inflow from sale of final goods (Pais and Gama, 2015), and measured as accounts receivables turning period plus inventory turning period minus accounts payables turning period. Pais and Gama (2015) declared that cash conversion cycle imitates inventory management decisions, credit granted to customers and credit acquired from suppliers. Yazdanfar and Öhman (2014) used cash conversion cycle as a measure for management of working capital, and analyzed its effect on firm performance. They used panel data of Swedish small and medium enterprises (SMEs) from the period 2008 to 2011 covering four industries. In the study they used estimation technique of seemingly unrelated regression to analyze panel cross-sectional data, and declared that firm profitability is highly influenced by working capital management, and lengthier duration of cash conversion cycle adversely affects firm profitability. On the other hand, a small number of studies have also preferred NTC as measure for working capital management (Shin and Soenen, 1998; Baños-Caballero *et al.*, 2014). For instance, Shin and Soenen (1998) investigated the relationship between working capital and profitability of firm with NTC as a measure of working capital management. They measured NTC as accounts receivables plus inventories minus accounts payables all three as percentage of sales. The empirical findings of their results declared negative relationship of length of working capital cycle

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with firm profitability. They further show that shorter NTC enhances firm value and suggest that shareholders value can be created by keeping NTC at reasonable minimum.

The established literature of working capital management, for instance, Soenen (1993), Beaumont and Begemann (1997), Shin and Soenen (1998), Wang (2002), Deloof (2003), Lazaridis and Tryfonidis (2006), García-Teruel and Martínez-Solano (2007), Ramachandran and Janakiraman (2009), Zariyawati *et al.* (2009) and Erasmus (2010a, b) to a great extent found significant negative relationship between working capital management and firm profitability. More recently, Ukaegbu (2014) examined the relationship of working capital efficiency and firm profitability using data of manufacturing firms. Their empirical results declared inverse relationship between cash conversion cycle and profitability for different industries types, and concluded that firm profitability drops with rise in cash conversion cycle. Moreover, study also suggests that firm value can be created by adopting a policy that reduces account receivables turning duration, inventory turning time period and lengthening payables to a potential that do not affect companies credit ratings. Enqvist *et al.* (2014) worked on working capital policies in the shadow of 2007–2008 economic recession using data of Finland firms. They focused influence of business cycle on the relationships of working capital and firm profitability. They find negative relationship between cash conversion cycle and firm profitability, and conclude that business cycle significantly influences relationship of cash conversion cycle and firm profitability more prominently during economic recession than boom. Pais and Gama (2015) examined Portuguese SMEs to investigate the relationship of working capital management and firm profitability by using panel data methodology and fixed effect estimation technique with instrumental variables. They showed that shortening the duration of accounts receivables, inventories and payables can enhance firm profitability, and declared that firms can improve their profitability by adopting more aggressive working capital policy. By working on SMEs of Norway, Lyngstadaas and Berg (2016) investigated the effect of working capital management on firm profitability using two-stage least square with panel data methodology and fixed effect estimation. The empirical findings of their study show that corporate profitability increases with decline in duration of cash conversion cycle and by pursuing aggressive working capital policy. Shrivastava *et al.* (2017) worked on Indian firms from the period 2003 to 2012 by applying Bayesian methodology to investigate the effect of working capital management on firm profitability. They declare that lengthier cash conversion cycle adversely influence firm profitability. Using Bayesian technique they showed that firms large in size are highly profitable and concluded that indicators that show financial soundness of firms significantly contribute in determining profitability of firms.

Conversely, studies related to working capital management also found significant positive relationship between working capital and firm performance. By using food industry in Greece, Lyroudi and Lazaridis (2000) used cash conversion cycle as indicator for liquidity in order to investigate its relationship with current and quick ratios, and analyzed implications of cash conversion cycle in terms of profitability. The empirical analysis of their study specifies that cash conversion cycle is significantly positively associated with traditional liquidity measures current and quick ratios, and also with return on assets and net profit margin. Using panel data methodology, GMM, fixed effect and random effect estimation techniques, Abuzayed (2012) empirically analyzed firms listed on Amman Stock Exchange of Jordan to investigate the influence of working capital management on firm performance. Empirical analysis of the study found significant positive association between cash conversion cycle and firm profitability, and suggests that management of working capital is least choice of firms that enjoy higher returns.

Predominantly literature has declared linear relationship between working capital and firm performance. However, recently literature also concluded non-linear concave relationship between level of working capital investment and profitability of firms, and

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suggests that firms hold an optimum working capital level that maximizes their performance (Silva, 2011; Gomes, 2013). The significant number of studies have incorporated rationality of quadratic equation to establish the non-linear relationship (see Lensink and Murinde, 2006; Baños-Caballero *et al.*, 2010, 2014, 2016; Jeanneret, 2015; Ben-Nasr, 2016). Correspondingly, Baños-Caballero *et al.* (2012) worked on Spanish SMEs to investigate the effect of working capital management on SMEs profitability and declared non-linear relationship between working capital and firm profitability. Moreover, the results find non-monotonic relationship between working capital and firm's profitability, which suggests that SMEs should maintain optimal level of working capital in order to maximize their profits. Aktas *et al.* (2015) worked on US firms to investigate the effect of working capital management on corporate value and operating performance. Their study finds that there is an optimal level of investment in working capital, and companies by maintaining optimal level of investment in working capital can enhance stock value and operating performance. They also document that efficient working capital management can help to fund growth investment opportunities and by adopting aggressive working capital policy firms might expose to risk enhancement. Ben-Nasr (2016) worked on management of working capital through value perspective and concluded that firms controlled by government with lower investment in net working capital exhibit steeper curve of firm value to networking capital as compared to privately held counterparts. The study also finds that firms controlled by government with less financial constraints show steeper curve of corporate value and net working capital relationship relative to their counterparts more constrained financially.

2.1 Working capital management and corporate performance

Working capital management significantly influences corporate profitability, liquidity (Shin and Soenen, 1998), value (Smith, 1980) and performance (Aktas *et al.*, 2015). The working capital management progressively obtained prominence due to its contribution to shareholders value by managing a trade-off between profitability and risk (Wang, 2002; Deloof, 2003; Chiou *et al.*, 2006; Lazaridis and Tryfonidis, 2006; García-Teruel and Martínez-Solano, 2007; Narender *et al.*, 2008; Nazir and Afza, 2009; Baños-Caballero *et al.*, 2010; Mansoori and Muhammad, 2012; Kieschnick *et al.*, 2013; de Almeida and Eid, 2014; Ukaegbu, 2014). The management of current assets and current liabilities is essential to efficient liquidity management which eliminates risk of inability to meet due short-term obligations while avoiding too much investment in current assets, and this eventually depends on its influence on firm profitability (Wasiuzzaman, 2015).

A significant body of literature about working capital management and firm performance worked on linear relationship between working capital and firm performance (Jose *et al.*, 1996; Shin and Soenen, 1998; Wang, 2002; Deloof, 2003; García-Teruel and Martínez-Solano, 2007; Ramachandran and Janakiraman, 2009; Zariyawati *et al.*, 2009; Erasmus, 2010a, b; Lyngstadaas and Berg, 2016; Tran *et al.*, 2017). These studies find that lower investment in working capital leads firms to higher profitability. Firms have great incentives of high investment in working capital; this is because it allows firms to grow by enhancing sales and earnings (Aktas *et al.*, 2015). Besides, low investment in working capital may lead firms toward loss of sales and disruptions in production process, because the aggressive strategy of working capital management stimulates sales, and by increasing accounts receivables and inventories improves firm performance (Baños-Caballero *et al.*, 2012). Primarily, performance of companies increases by investing high in lengthy trade credit and inventories. As large inventories deliver hedge against input price fluctuations (Fazzari and Petersen, 1993), loss of sales be minimized due to potential stock-outs (Corsten and Gruen, 2004), and reduce supply cost (Blinder and Maccini, 1991). Trade credit also increases firm sales, provides an effective price cut

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(Brennan *et al.*, 1988; Petersen and Rajan, 1997), builds long-term relationship with customers (Ng *et al.*, 1999; Wilner, 2000), ensures high-quality products (Smith, 1987; Lee and Stowe, 1993), acquires merchandise at low demand time (Emery, 1987) and reduces information asymmetry (Baños-Caballero *et al.*, 2012).

Working capital investment at high levels may have hostile effects on firm value, because high level of stock stimulates additional costs for firms; for instance, rent on warehouse, security and insurance expenses due to increase in inventory (Kim and Chung, 1990). High investment in working capital may block firm's funds (Deloof, 2003), consequently firms may expose to liquidity shortage and lose some potential projects in short run (Ek and Guerin, 2011). According to Smith (1980), firms may not balance risk of financial constraints with superior performance at above optimum working capital level. Therefore, firms can maximize value by maintaining working capital at optimum level. These pros and cons of investment in working capital suggest tradeoff. Therefore, firms need to maintain optimal working capital level by balancing cost and benefits that maximizes shareholders wealth. The empirical findings of Baños-Caballero *et al.* (2012) declared non-linear relationship between working capital and companies' profitability.

A firm with conservative strategy of working capital management by holding more current assets may have to undergo high liquidity costs, while an aggressive strategy of working capital management by holding less current assets may drive firms to face high cost of illiquidity thus both issues may harm profitability (Panda and Nanda, 2018). These positive and negative effects indicate tradeoff between cost and benefits of investment in working capital. The management of working capital at optimum can influence working capital management efficiency (Schall and Haley, 1980; Kaur, 2010), and firms can increase profitability with the help of an efficient management of current assets and current liability without creating problem of liquidity (Yunos *et al.*, 2015). Consistent with this, Baños-Caballero *et al.* (2012, 2014, 2016) used quadratic functional form to investigate the relationship of working capital management and firm performance. Additionally, Aktas *et al.* (2015) also concluded non-linear relationship between excess net working capital and stock performance. The corporate performance increases by maintaining working capital at optimal level and above this level firms may experience decline in performance. Therefore, companies must maintain optimal level of working capital by balancing costs and benefits that maximizes their value. Thus, conclusively we expect inverted U-shaped relationship between working capital management and firm performance. Hence, the hypothesis is stated as follows:

H1. There is a non-linear relationship between working capital and corporate performance. Therefore, at low level (high level) of working capital, the relationship between working capital and firm performance is positive (negative).

2.2 Investment in working capital and financial constraints

As argued by Modigliani and Miller (1958), in the absence of market imperfections, companies can always gain outside financing without difficulties, and, henceforth, investment of companies is not dependent on the availability of internal funds. In such a situation, there is no opportunity cost associated with higher investment in working capital and firms can obtain external finance without any problem and at discounted price. According to Chauhan and Banerjee (2018), this situation may not exist in reality as investment decisions are influenced by constraints of external funds availability, which are limited and costlier than firms' internal funds. They also conclude that in this state firms reduce cost of financing by optimizing the level of working capital and enhance availability of internal funds for investment projects. Additionally, in this manner, companies attempt to achieve trade-off between risk and efficiency in order to maximize their value. Consistent

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with this, Greenwald *et al.* (1984) and Myers and Majluf (1984) also suggest that internal and external finance may not be perfect substitutes due to capital market imperfections and external finance becomes more expensive than internal finance. Similarly, if a firm faces difficulty to raise external funds, then firm investment shows great sensitivity toward availability of internal funds (Whited, 1992).

Significant number of literature outlined that financial constraints instigated by information asymmetries and agency problem have noteworthy influence on a firm's undertakings, together with fixed capital investment (Fazzari *et al.*, 1988), and inventory investment (Carpenter *et al.*, 1994, 1998). And so, financially constrained firms face difficulty to raise external capital, and these firms exclusively rely on their own internal finance because of pecking order of financing costs (Myers and Majluf, 1984). Therefore, firms with financial constraints are unable to choose their optimal capital structure and are restricted to make optimal decisions on their real activities. Due to this, financially constrained firms may let go some profitable opportunities of investment followed by lack of internal funds (Chen and Guariglia, 2013), and this situation may cause reduction in firm's performance and distort the efficient allocation of resources.

According to the findings of Fazzari and Petersen (1993) and Ding *et al.* (2013), firms having high liquidity position show less sensitivity toward fixed investment to cash flow relative to firms with low level of liquidity. Firms settle fixed investment decisions ahead of time; therefore, in this situation firms will try to maintain a stable fixed investment path; however, due to fluctuations of cash flow, firms may need external finance. Consistent with this, firms facing financial constraints may not be able to get external funds due to high cost of external capital; therefore, in this scenario, firms find substitute sources, one of them being working capital which allows the release of short-term liquidity and is reversible due to its short-term nature (Wasiuzzaman, 2015). A study by Buchmann *et al.* (2008) claimed the supremacy of net working capital as one of the prospective source of capitals, which is often neglected by firms.

In the opinion of investors, market frictions cost high to firms and thus they reward firms of high liquidity with significantly higher valuation (Faulkender and Wang, 2006). Additionally, financial constraints significantly influence net working capital valuation (Kieschnick *et al.*, 2013). Investment in working capital is dependent on financial factors, for instance, financing cost, capital markets access and availability of internal finance (Fazzari *et al.*, 1988). A study by Almeida *et al.* (2004) discussed that if a firm is not restricted to access external capital, then it has no need of saving cash for future investment needs because it would be inappropriate for firms to save liquidity. In contrast, if a firm faces financing resistance or constrained to access external capital then corporate policy must focuses on liquidity management.

As discussed by Chan (2014), working capital accounts for considerable amount of financial needs of firms and it is therefore likely to be a significant path by which financial constraints can distress firm behavior. Followed by Fazzari and Petersen (1993) and Hill *et al.* (2010), who propose that working capital investment is highly sensitive to firms access of capital market, Baños-Caballero *et al.* (2014) also investigated whether firms financing constraints effect optimal level of investment in working capital. The findings of their study declare that financially constrained firms optimal working capital level is lower compared to less constrained firms. Moreover, as discussed by Kieschnick *et al.* (2013), over-investment in working capital by firms means additional resources being tied up in working capital which possess some opportunity cost and let firms toward decline in value. Therefore, firms incur high interest expense with high level of working capital at one point and on the other hand encounter with issues to finance some potential value-enhancing projects at least over the short run (Chauhan and Banerjee, 2018). These viewpoints explain the influence of internally generated funds and the firms' external financing access on their investment in working

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capital decisions. Therefore, financially constrained firms should keep lower investment in working capital and financially unconstrained firms can maintain higher investment in working capital (Baños-Caballero *et al.*, 2014). In sum, as literature suggests, financially constrained firm's investment in working capital is highly sensitive to availability of funds and these firms should keep investment in working capital at lower levels. However, financially unconstrained firms can maintain investment in working capital at higher level due to their financial flexibility. Hence, the hypothesis is formulated as follows:

H2. In the presence of financial constraints, there is a positive (negative) relationship between working capital and corporate performance at low level (high level) of working capital investment.

3. Sample and measures

3.1 Data and sample

The data used in this study are drawn from the China Stock Market and Accounting Research (CSMAR) database of A-share companies listed on Shanghai Stock Exchange and Shenzhen Stock Exchange. Specifically, we use CSMAR China Financial Information Database and China Listed Companies' Financial Ratio Research Database. The sample for this study consists of non-financial firm's data from the period 2005 to 2015. The information contained in the data is refined and financial institutions are excluded from the sample because their operating, investing and financing activities are different from the accounting measure of other companies (Deloof, 2003; Hill *et al.*, 2010). We delete firms with negative values in their main variables, such as, current assets, fixed assets and sales (Hill *et al.*, 2010; Afrifa, 2016). We have further winsorized observations of main variables of analysis up to one percent tail to reduce potential influence of outliers (García-Teruel and Martínez-Solano, 2007; Hill *et al.*, 2010). We included firms that have at least five years of consecutive data which is essential condition of number of observations of periods to test for second-order serial correlation (Baños-Caballero *et al.*, 2014). The final panel left with 1,528 listed firms with 16,802 firm-year observations.

3.2 Tobin's Q and return on assets (ROA)

In the study, Tobin's *Q* and return on assets (*ROA*) are measures for dependent variable corporate performance. Tobin's *Q* is defined as firm's value of capital market divided by its asset's replacement value (Wernerfelt and Montgomery, 1988). A number of studies use Tobin's *Q* to measure firm performance, because Tobin's *Q* combines value of firm with accounting value (Himmelberg *et al.*, 1999). Following Jose *et al.* (1996), Wang (2002) and García-Teruel and Martínez-Solano (2007), this study uses return on assets (*ROA*) to measure performance. Return on asset (*ROA*) is a ratio of earnings before interest and taxes (*EBIT*) to total assets. Return on asset (*ROA*) measures overall profitability of companies (Enqvist *et al.*, 2014).

3.3 Net trade cycle and control variables

NTC (*NET*) and square of NTC (NET^2) are independent variables in the study. Following measurement specification of Shin and Soenen (1998), this study uses NTC as a measure for working capital management. NTC is measured as follows:

$$NET = (\text{Accounts Receivables/Sales}) \times 365 + (\text{Inventories/Sales}) \times 365 - (\text{Accounts Payable/Sales}) \times 365. \quad (1)$$

The shorter NTC makes firms more efficient toward managing the working capital, decreases need for external financing and increases firm performance (Shin and Soenen, 1998).

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Following prior studies, such as Deloof (2003), García-Teruel and Martínez-Solano (2007), Hill *et al.* (2010) and Baños-Caballero *et al.* (2014), this study uses firm size (*Size*), financial leverage (*FL*), growth (*Gr*) and cash flow (*CF*) as control variables. This study uses natural logarithm of total assets as measure for size (*Size*), total debt to total asset ratio as measure for financial leverage (*FL*), growth (*Gr*) as the ratio of book value of intangible assets to total assets and cash flow (*CF*) as operating income before depreciation and amortization minus interest expense and income tax expense to total assets.

3.4 Financial constraints variables

In this study firms are classified as financially constrained and unconstrained to examine the effect of financial constraints on optimum level of working capital. The literature related to financial constraints has suggested several measures (e.g. Kaplan and Zingales, 1997; Moyen, 2004; Whited and Wu, 2006; Hennessy *et al.*, 2007) to separate firms that are financially constrained from those that are not, but still it is difficult to differentiate which measure is the best. In that regard following Almeida *et al.* (2004) and Baños-Caballero *et al.* (2014), this study has charted to classify firms on Altman's (1968) Z-score, interest coverage ratio, size, cost of external finance, dividends, Kaplan and Zingales (1997) index and cash flows as measures or proxies to detect financial constraints.

3.5 Summary statistics and correlation analysis

Table I reports the summary statistics and correlation analysis of main variables. The mean value of Tobin's *Q* is 1.94, with standard deviation of 2.03. The sample represents on average 70 days of NTC (*NET*) for Chinese non-financial companies. The average size (*Size*) of the companies is 21.77.

The average value of growth opportunities (*Gr*) is 5.05. The mean value of companies leverage (*FL*) is 53.19, with standard deviation of 25.52. The average return on assets (*ROA*) of Chinese companies is 2.47. The cash flow (*CF*) shows mean value of 9.68, with standard deviation of 16.71. Table I also represents the correlation matrix for the analysis variables. The correlation results indicate significant and negative association between *NET* and Tobin's *Q* at the 1 percent level, consistent with the results of Afrifa (2016). The results indicate significant and negative association between *NET* and *ROA* at the 1 percent level, consistent with the results of Deloof (2003) and García-Teruel and Martínez-Solano (2007). Finally, correlations among the analysis variables indicate that multicollinearity should not be the problem in regression, as all the correlation values are far below the limit of 0.80 suggested by Field (2005). Yet there might be some degree of multicollinearity that still exists as suggested by Myers (1990) despite none of correlation coefficients results are

	Mean	SD	*Q*	*NET*	*Size*	*Gr*	*FL*	*ROA*	*CF*
Q	1.9442	2.0316	1.0000						
NET	70.0013	7.8668	−0.2348***	1.0000					
Size	21.7746	1.3500	−0.4707***	0.4258***	1.0000				
Gr	5.0491	7.7668	0.0620***	−0.1803***	−0.0713***	1.0000			
FL	53.1947	25.5194	−0.1525***	−0.0024	0.0754***	0.0276**	1.0000		
ROA	2.4726	3.5154	−0.1030***	0.0722***	0.0975***	−0.0291***	−0.0654***	1.0000	
CF	9.6854	16.7124	0.0945***	0.0147*	0.0791***	−0.0149**	−0.0824***	0.1741***	1.0000

Table I.
Summary statistics and correlation analysis

Notes: The table shows the results of summary statistics and correlation analysis. The *Q* is Tobin's *Q*; *NET* is net trade cycle; *Size* shows the natural logarithm of total assets; *Gr* shows growth opportunities of firms; *FL* is leverage; *ROA* represents return on assets; and *CF* represents cash flow. *,**,***Indicate level of significance at 10, 5, and 1 percent, respectively

المنارة للاستشارات
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very large. In that regard, formal test of variance inflation factor for each independent variable in the models was done to check existence of multicollinearity. The findings of the results were far below the threshold level of 10 suggested by Field (2005), which confirms that there is no problem of multicollinearity in our sample.

4. Empirical analysis

4.1 Specification and estimation

The relationship between working capital and corporate performance can be non-monotonic and can exhibit a concave relationship. The study scrutinizes the quadratic model in order to address the proper functional form. The model of the study is as follows:

$$P_{i,t} = \beta_0 + \beta_1 P_{i,t-1} + \beta_2 NET_{i,t} + \beta_3 NET_{i,t}^2 + \beta_4 Size_{i,t} + \beta_5 Gr_{i,t} + \beta_6 FL_{i,t} + \beta_7 CF_{i,t} + \lambda_t + \eta_i + \varepsilon_{i,t}. \quad (2)$$

In Equation (2) corporate performance ($P_{i,t}$) is regressed opposite NTC (*NET*) and square of NTC (NET^2). Tobin's *Q* and return on asset (*ROA*) are measures for dependent variable corporate performance ($P_{i,t}$). Firm size (*Size*), growth (*Gr*), financial leverage (*FL*) and cash flow (*CF*) are control variables. In the model parameter λ_t is a variable for time dummy. The main purpose of time dummy is to capture the influence of economic factors that may affect performance and are hard to control by the companies. The parameter η_i is an unobserved factor of each individual firm or unobservable heterogeneity and is difficult to control for each firm's specific characteristics. Finally, the parameter $\varepsilon_{i,t}$ is a random variable. We have also used industry dummy variable to control the industry effects. To investigate the effect of financing constraints on working capital management, Equation (2) is extended by adding financial constraints variables. The study uses dummy variable indicated by 1 for financially constrained firms and 0 otherwise to differentiate financially constrained firms from unconstrained firms. The optimum point for financially constrained firms come from $(-\beta_1 + \delta_1)/2(\beta_2 + \delta_2)$.

Our baseline model follows the well-established GMM (Arellano and Bond, 1991). Following Arellano and Bover (1995) and Blundell and Bond (1998), the study uses system GMM for estimation because of its significant advantages. GMM model controls serial correlation and potential endogeneity problem that might affect the estimators. This is also effective when the time period is small with large number of observations. Firms are scattered, and this and many unobserved factors can influence the behaviors of firms that are difficult to attain and measure (Himmelberg *et al.*, 1999). Therefore, the study uses two-step estimator by considering all right-hand side variables as endogenous and lagged dependent variables as instrument. In the GMM estimation Hansen test checks over identification restrictions and the absence of correlation between error term and the instruments used in the model. The m_2 is the test statistic for second-order autocorrelations in residuals, distributed as standard normal $N(0, 1)$ under the null hypothesis of no serial correlation.

4.2 Investment in working capital and firm performance

First of all we estimate the baseline model of the study which aims to estimate the functional form.

Table II reports results for Equation (2) using system GMM estimator. In Columns 1 through 2, dependent variables are *ROA* and Tobin's *Q*, respectively. In Columns 1 and 2, the coefficients of *NET* are positive and significant and coefficients of NET^2 are negative and significant. These results indicate that there is inverted U-shaped relationship between working capital management and corporate performance. This evidence suggests that there is an optimal level of working capital which maximizes performance.

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	ROA (1)	Tobin's *Q* (2)
NET	0.1515* (1.90)	7.9123** (2.07)
NET^2	−0.0067*** (−2.63)	−1.2635** (−2.21)
Size	0.8718*** (2.71)	−1.3337*** (−5.49)
Gr	−0.1355*** (−2.99)	−0.2223*** (−4.77)
FL	−0.0217** (−2.23)	0.0020 (0.39)
CF	0.0002 (0.02)	0.0095** (2.05)
Wald test (Prob. $> F$)	11.99 (0.000)	56.50 (0.000)
Year fixed effects	Yes	Yes
Industry fixed effects	Yes	Yes
p-value of m_2	0.285	0.398
F1	3.61	4.30
F2	6.94	4.87
Hansen test	159.45 (174)	429.43 (180)
Hansen test diff. (p-value)	0.145	0.180
Obs.	14,797	13,744

Notes: The t-statistics are in parentheses. The m_2 test represents the test for residual's second-order serial correlation in the differenced equation, asymptotically distributed as (0, N) under the hypothesis of no serial correlation. Hansen test represents the test for over-identifying restriction asymptotically distributed as χ^2 under the null of instrument validity, and degrees of freedom are reported in parentheses. The p-values of difference in Hansen test show exogeneity of instruments subset. Wald test represents joint significance test of all independent variables. F1 and F2 tests are for linear restrictions under the null of H_0: ($\beta_1 = 0$), and H_0: ($\beta_2 = 0$), respectively. *,**,***Indicate level of significance at 10, 5 and 1 percent, respectively

Table II.
Functional form estimation results

Collectively, the results from Table II suggest that firm's higher sales and discounts on early payments dominate if working capital is below the optimal level. Conversely, above the optimum level, companies need financing that can increase their financing expenses thus leading firms to financial distress. These results strongly support inverted U-shaped relationship between working capital management and corporate performance and are in line with the findings of Baños-Caballero *et al.* (2014). The coefficients for variables of NTC also determine the inflection point in the relationship of NTC and corporate performance. This optimum comes from the coefficients of *NET* and NET^2 ($-\beta_1/2\beta_2$). We find inflection point of 11.31 and 3.13 for *ROA* and Tobin's *Q*, respectively. Finally, we check robustness of the estimated results by applying different tests. We test the joint significance of main variables with Wald test, which verifies the validity of the selected variables in the model. In the study Wald test confirms the validity of regressors and it rejected the null hypothesis of all parameters equal to zero in the estimation. In the study m_2 test confirms no second-order serial correlation with significance level of (p-value > 0.05). The Hansen test and Hansen difference test also confirm the instruments validity.

4.3 Financial constraint evidence

4.3.1 Working capital management in financially distressed firms and performance. Financially distressed firms more likely face financial constraints and their optimal working capital level is considerably low as compared to firms that do not face financial constraints (Baños-Caballero *et al.*, 2014). Following prior studies, we use two measures, Altman's (1968) Z-score and interest coverage ratio, as proxies for likelihood of financial distress (e.g. Baños-Caballero *et al.*, 2014). In this regard, we follow Begley *et al.*'s (1996) specification for modeling Altman's (1968) Z-score to measure financial distress of firms as financial constraints criterion. Financially constrained firms fall below median with low Z-score. Interest coverage ratio is used by considerable body of literature as a measure for financial constraint (e.g. Whited, 1992; Hill *et al.*, 2010). The higher interest coverage ratio indicates

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firms that face fewer problems to repay debt. Thus, we consider that firms with an interest coverage ratio below (above) sample median are assumed to be more (less) likely to face financial constraints.

In Table III the dependent variables are *ROA* and Tobin's *Q*. Columns 1 and 3 represent the results for Altman's Z-score group. In Column 1, the coefficient of $NET \times Z$-Score is negative and significant and coefficient of $NET^2 \times Z$-Score is significant and positive. In Column 3, the coefficient of $NET \times Z$-Score is positive and significant and coefficient of $NET^2 \times Z$-Score is significant and negative. Columns 2 and 4 in Table III represent the results for interest coverage ratio group. In Column 2, coefficient of $NET \times ICR$ is significant and negative and coefficient of $NET^2 \times ICR$ is significant and positive. In Column 4, coefficient of $NET \times ICR$ is significant and positive and coefficient of $NET^2 \times ICR$ is significant and negative. The findings of the results indicate U-shaped relationship between working capital and return on asset (*ROA*) for financially constrained firms. On the other hand, evidence of results specifies inverted U-shaped relationship between working capital and Tobin's Q for financially constrained firms.

Collectively, the results from Table III indicate that financial constraints play significant role in working capital investment, and support the view that optimal level of working capital for firms more likely to be financially constrained is lower. Conclusively, financially distressed firms have limited financial slack and ability to generate cash, and firms investment in working capital can be reduced due to strained financial distress and in turn firms may tight credit terms, collect receivables, liquidate present inventory, and suppliers may stretch granted credit terms (Hill *et al.*, 2010).

	ROA		Tobin's *Q*	
	Z-score group (1)	Interest coverage ratio group (2)	*Z*-score group (3)	Interest coverage ratio group (4)
NET	0.5813** (2.05)	0.4294** (2.28)	16.1793** (2.13)	22.5511* (1.90)
NET^2	−0.0288** (−2.48)	−0.01561** (−2.10)	−2.3353* (−1.95)	−3.2900* (−1.75)
$NET \times Z$-score	−0.4479* (−1.82)		1.3659** (2.32)	
$NET^2 \times Z$-score	0.0216* (1.71)		−0.4175** (−2.43)	
$NET \times ICR$		−0.4075** (−2.24)		4.2203** (2.24)
$NET^2 \times ICR$		0.0146* (1.69)		−1.2445** (−2.24)
Size	−0.0768 (−0.44)	−0.7252*** (−5.01)	−0.4505*** (−3.33)	−0.7675*** (−3.82)
Gr	−0.0023 (−0.03)	−0.0100 (−0.45)	0.2183*** (2.98)	−0.2112** (−2.37)
FL	−0.0183* (−1.78)	−0.0145** (−2.29)	−0.0407*** (−2.85)	−0.0123 (−0.43)
CF	0.0079** (2.17)	0.0042 (0.41)	0.0061** (2.18)	−0.0483*** (−4.56)
Wald test (Prob. $> F$)	2.92 (0.000)	4.43 (0.000)	36.21 (0.000)	18.49 (0.000)
Year fixed effects	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
p-value of m_2	0.303	0.848	0.919	0.759
F1	3.32	5.01	5.40	5.02
F2	2.92	2.86	5.91	5.01
Hansen test	236.99 (214)	74.57 (74)	729.24 (102)	465.16 (118)
Hansen test diff. (p-value)	0.998	0.940	0.733	0.999
Obs.	13,270	13,276	12,229	12,303

Notes: The *t*-statistics are in parentheses. The m_2 test represents the test for residual's second-order serial correlation in the differenced equation, asymptotically distributed as (0, *N*) under the hypothesis of no serial correlation. Hansen test represents the test for over-identifying restriction asymptotically distributed as χ^2 under the null of instrument validity, and degrees of freedom are reported in parentheses. The p-values of difference in Hansen test show exogeneity of instruments subset. Wald test represents joint significance test of all independent variables. F1 and F2 tests are for linear restrictions under the null of H_0: $(\beta_1 + \delta_1) = 0$, and H_0: $(\beta_2 + \delta_2) = 0$, respectively. *,**,***Indicate level of significance at 10, 5 and 1 percent, respectively

Table III.
Financial distress estimation results

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4.3.2 Working capital management in financially constrained firms, access to capital markets and performance. Financially constrained firms face difficulty to access capital markets and face higher information asymmetry. The literature of financial constraints indicates that external financing costs and financing frictions significantly affect operating decisions of firms, such as timing of investment and real assets allocations (Whited, 1992, 2006; Chava and Roberts, 2008). The firms with limited access to capital markets show high investment sensitivity in working capital (Fazzari and Petersen, 1993; Hill *et al.*, 2010). The study uses size, cost of external finance and dividends as proxies for likelihood of financial constraints. Firm size below (above) sample median considered more (less) likely to be financially constrained. The firms that face costly external finance are considered as financially constrained (Fazzari *et al.*, 1988). Firms with ratio above median are more likely to be financially constrained. Following Fazzari *et al.* (1988), this study uses dividend to distinguish firms as financially constrained. Firms that do not pay dividends are considered as financially constrained.

In Table IV, the dependent variables are *ROA* and Tobin's *Q*. Columns 1 and 4 report results for size group. In Column 1, coefficient of $NET \times Size$ is significant and negative, and coefficient of $NET^2 \times Size$ is significant and positive. In Column 4, coefficient of $NET \times Size$ is significant and positive, and coefficient of $NET^2 \times Size$ is significant and negative. Columns 2 and 5 report results for external financing cost group. In Column 2, coefficient of $NET \times EFC$ is significant and negative, and coefficient of $NET^2 \times EFC$ is significant and positive. In Column 5, coefficient of $NET \times EFC$ is significant and positive, and coefficient of $NET^2 \times EFC$ is significant and negative. Columns 3 and 6 report results for dividends group. In Column 3, coefficient of $NET \times Div$ is significant and negative, and coefficient of $NET^2 \times Div$ is significant and positive. In Column 5, coefficient of $NET \times Div$ is significant and positive, and coefficient of $NET^2 \times Div$ is significant and negative.

Collectively, the results from Table IV report inverted U-shaped relationship between working capital and performance and indicate that optimal level of working capital for firms more likely to be financially constrained is lower. These results imply that firms small in size are more vulnerable to market imperfections as these firms are young and less known by many in the market. Therefore, firms small in size face difficulty to raise funds from external markets, pay higher opportunity cost of funds and face high information asymmetry. Moreover, financially constrained firms do not pay dividend or pay less dividend to reduce the probability of raising external capital for future needs and maintain lower optimal working capital level.

4.4 Robustness check

4.4.1 Working capital management and performance: quantile estimator. To check the robustness of results we applied quantile estimator on Equation (2). We run quantile regressions on 25th, median and 60th quantile. The significant benefit of using quantile estimator is that it facilitates to observe how working capital influences performance of firms at different levels.

In Table V dependent variables are *ROA* and Tobin's *Q*. Columns 1 through 3 present results for *NET* and performance (Tobin's *Q*) relationship. Columns 4 through 6 present results for *NET* and performance (*ROA*) relationship. In Columns 1 through 6, the coefficients of *NET* are significant and positive, and coefficients of NET^2 are significant and negative. The results are consistent with the prior findings that at the low level of working capital the relationship between *NET* and corporate performance is positive. On the other hand, at the high level of working capital the relationship between NET^2 and corporate performance is negative; hence, supporting the inverted U-shaped relationship between working capital and corporate performance. The *p*-values of test for equality of coefficients of right-hand side variables show significant results. This evidence indicates robustness of our previous section's estimation results.

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Table IV. Capital market access estimation results

	ROA			Tobin's Q		
	Size group (1)	External financing cost group (2)	Dividend group (3)	Size group (4)	External financing cost group (5)	Dividend group (6)
NET	0.6198* (1.90)	0.3532*** (3.26)	1.6778*** (2.89)	7.5813** (2.35)	16.9501** (2.23)	29.1414*** (3.35)
NET^2	−0.0227** (−1.99)	−0.0125*** (−3.16)	−0.0847*** (−2.57)	−1.2452** (−2.46)	−2.1944* (−1.83)	−4.2722*** (−3.18)
$NET \times Sz$	−0.7855** (−1.99)			1.4280*** (2.64)		
$NET^2 \times Sz$	0.02435* (1.92)			−0.2634** (−2.25)		
$NET \times EFC$		−0.5370*** (−2.70)			3.2783** (2.05)	
$NET^2 \times EFC$		0.0160* (1.74)			−1.2683*** (−2.68)	
$NET \times Div$			−1.1439* (−1.80)			1.4238** (1.96)
$NET^2 \times Div$			0.0690* (1.86)			−0.4757** (−2.33)
$Size$	−0.8061* (−1.82)	−0.3045* (−1.73)	−0.8155*** (−2.95)	0.2305 (0.71)	−0.6668*** (−3.18)	−0.6187*** (−2.65)
Gr	0.2991** (2.28)	−0.1182* (−1.71)	−0.1912** (−1.89)	−0.1012* (−1.90)	−0.2032** (−2.42)	0.1719* (1.87)
FL	−0.0009 (−0.07)	−0.0158* (−1.78)	−0.0556*** (−2.49)	−0.0265* (−1.86)	0.0508 (1.94)	−0.0584*** (−2.67)
CF	0.2991** (2.28)	0.0064 (−1.51)	−0.0084** (2.22)	0.0049** (2.25)	−0.0155 (−1.30)	−0.0070 (0.47)
Wald test (Prob. > F)	4.69 (0.000)	4.08 (0.000)	3.18 (0.000)	40.12 (0.000)	31.7 (0.000)	34.19 (0.000)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
p-value of m_2	0.604	0.650	0.203	0.533	0.680	0.230
F1	4.50	7.29	3.25	6.99	4.20	3.86
F2	3.68	3.04	3.46	5.07	7.20	5.45
Hansen test	217.56 (237)	124.22 (99)	73.02 (73)	774.50 (137)	485.29 (150)	604.48 (78)
Hansen test diff. (p-value)	0.186	0.479	0.601	0.903	0.991	0.141
Obs.	14,797	14,797	13,270	12,231	12,304	12,007

Notes: The t-statistics are in parentheses. The m_2 test represents the test for residual's second-order serial correlation in the differenced equation, asymptotically distributed normally under as (0, N), under the hypothesis of no serial correlation. Hansen test represents the test for over-identifying restriction asymptotically distributed as χ^2 under the null of instrument validity, and degrees of freedom are reported in parentheses. The p-values of difference in Hansen test show exogeneity of instruments subset. Wald test represents joint significance test of all independent variables. F1 and F2 tests are for linear restrictions under the null of H_0: $(\beta_1 + \delta_1) = 0$, and H_0: $(\beta_2 + \delta_2)$, respectively. *,**,***Indicate level of significance at 10, 5, and 1 percent, respectively

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Table V.
Quantile regression results

	Tobin's Q 25 quant (1)	Tobin's Q 50 quant (2)	Tobin's Q 60 quant (3)	*ROA* 25 quant (4)	*ROA* 50 quant (5)	*ROA* 60 quant (6)
NET	0.5224*** (2.80)	0.8457*** (2.99)	0.9010* (1.91)	0.0056*** (5.62)	0.1787*** (5.39)	0.0837*** (3.46)
NET^2	−0.0924*** (−3.02)	−0.1320*** (−2.95)	−0.1443** (−1.97)	−0.00026*** (−3.12)	−0.0084*** (−6.27)	−0.0055*** ((−4.62)
Size	−0.1825*** (−31.11)	−0.3179*** (−42.88)	−0.3882*** (−43.11)	0.0108*** (14.26)	0.3975*** (8.13)	0.2735*** (6.83)
Gr	0.0056*** (5.65)	0.0104*** (6.28)	0.0118*** (5.78)	−0.0002 (−1.49)	−0.0296*** (−4.18)	−0.0166** (−2.07)
FL	−0.0112*** (−29.53)	−0.0143*** (−33.18)	−0.0156*** (−23.50)	−0.0011*** (−16.54)	0.0077*** (3.41)	−0.0000 (−0.03)
CF	0.0068*** (7.59)	0.0084*** (11.87)	0.0099*** (13.35)	0.0056*** (40.09)	0.0169*** (6.89)	0.0366*** (22.45)
Constant	4.6732*** (16.42)	7.6426*** (17.54)	9.4504*** (12.65)	−0.1862*** (−13.01)	−7.5067*** (−7.00)	−2.96*** (−3.50)
Pseudo-R^2	12.72	14.56	15.23	0.0114	0.0173	0.0233
Wald test (Diff.)	0.00***	0.00***	0.00***	0.00***	0.00***	0.00***
Obs.	15,516	15,516	15,516	16,332	16,332	16,332

Notes: The table shows the results of quantile estimator. We run separate regression for 25th, median and 60th quantiles with 1,000 repetitions of bootstrapped standard error. The *t*-statistics are in parentheses. All variables are asymptotically robust from heteroscedasticity in the regression. The dependent variables are Tobin's Q and return on asset represents dependent variable corporate performance; *NET* is net trade cycle; NET^2 is square of net trade cycle; *Size* shows the natural logarithm of total assets; *Gr* shows growth opportunities of firms; *FL* is leverage; *CF* represents cash flow. Wald test represents joint significance test of all independent variables. *,**,***Indicate level of significance at 10, 5 and 1 percent, respectively

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4.4.2 Additional analysis of financial constraints: Kaplan and Zingales index and cash flow. To check the robustness of results for financial constraints we applied additional analysis. We use two measures Kaplan and Zingales (1997) index and cash flows as proxies for likelihood of financial constraints. The study uses specifications of Lamont *et al.* (2001) by using linearization of KZ-index for financially constrained firms. Firms that fall in the top (bottom) three deciles of the KZ index are considered as financially constrained (unconstrained). Following Moyen (2004), firms are classified as financially constrained based on their cash flows. Firms with a cash flow above the sample median are assumed to be less likely to to face financing constraints.

In Table VI the dependent variables are *ROA* and Tobin's *Q*. Columns 1 through 4 report results for GMM estimation and Columns 5 through 8 report results for fixed-effect estimation. Columns 1, 3, 5 and 7 represent results for KZ-Index group. In Columns 1 and 5, coefficients of $NET \times KZ$ are significant and negative, and coefficients of $NET^2 \times KZ$ are significant and positive. In Columns 3 and 7, coefficients of $NET \times KZ$ are significant and positive, and coefficients of $NET^2 \times KZ$ are significant and negative. Columns 2, 4, 6 and 8 represent results for cash flow group. In Columns 2 and 6, coefficients of $NET \times CF$ are significant and negative, and coefficients of $NET^2 \times CF$ are significant and positive. In Columns 4 and 8, coefficients of $NET \times CF$ are significant and positive, and coefficients of $NET^2 \times CF$ are significant and negative.

Collectively, the results from Table VI are consistent with previous sections results and report inverted U-shaped relationship between NTC and firm performance (Tobin's *Q*). The results show U-shaped relationship between NTC and firm performance (*ROA*). The results also indicate lower optimal level of working capital for financially constrained firms. This evidence indicates robustness of our previous section's estimation results for effect of financial constraints on optimal working capital level.

4.5 The comparison of working capital management, corporate performance for divided sample

To compare working capital management and corporate performance, following Wang (2002) we divide the sample into two groups on the basis of cut-off point of Tobin's $Q = 1$. Table VII reports results for comparison of working capital management on the basis of two sub sample groups of Tobin's $Q > 1$, and Tobin's $Q \leqslant 1$. In Columns 1 and 2, the results for Tobin's $Q > 1$ indicate that on average *NET* is significantly lower for firms with Tobin's $Q > 1$ than firms with Tobin's $Q \leqslant 1$. These results are consistent with the results of Wang (2002), and they further explained that this may be due to the positive and significant association of aggressive working capital management with higher corporate values. Furthermore, firm size, leverage and *ROA* are also significantly lower for firms with Tobin's $Q > 1$ than firms with Tobin's $Q \leqslant 1$. Firm growth and cash flows are significantly higher for firms with Tobin's $Q > 1$ than firms with Tobin's $Q \leqslant 1$.

5. Implications and conclusion

5.1 Theoretical contributions

This research study endured to signify some striking implications to working capital management, corporate performance and linking financial constraints literature specifically in the settings of economy of China. First, this study used the NTC paradigm from Shin and Soenen (1998) and Baños-Caballero *et al.* (2014) to support the research model in working capital management and corporate performance settings. Theoretical studies related to working capital management suggest two opinions; under the opinion of one view, high investment in working capital lets firms to enhance their sales, gain higher discounts for early payments and increase firm value (Deloof, 2003; Aktas *et al.*, 2015). Under the second

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Table VI.
Estimation results of additional analysis for financial constraints

	GMM estimation				Fixed effect estimation			
	ROA		Tobin's *Q*		*ROA*		Tobin's *Q*	
	KZ-index group (1)	Cash flow group (2)	KZ-index group (3)	Cash flow group (4)	KZ-index group (5)	Cash flow group (6)	KZ-index group (7)	Cash flow group (8)
NET	0.7102** (2.49)	1.043*** (2.80)	16.8581* (1.93)	10.1599** (2.49)	2.5896* (1.70)	0.2925*** (8.06)	1.0904** (2.19)	1.3282** (2.16)
NET^2	−0.0310** (−2.41)	−0.0491** (−2.15)	−2.6702* (−1.95)	−1.6261** (−2.54)	−0.4317* (−1.81)	−0.0121*** (−6.54)	−0.2590*** (−3.33)	1.3282*** (−3.43)
$NET \times KZ$	−0.9173** (−2.24)		1.9647** (2.13)		−0.0509*** (−3.38)		0.1009*** (12.91)	
$NET^2 \times KZ$	0.0454** (2.22)		−0.4700* (−1.77)		0.0016** (2.34)		−0.0005** (−2.31)	
$NET \times CF$		−1.2773** (−2.51)		1.2349*** (3.01)		−0.4100*** (−12.24)		0.3866*** (5.08)
$NET^2 \times CF$		0.0566** (2.27)		−0.2597** (−2.26)		0.0147*** (7.84)		−0.1232*** (−5.56)
Size	−0.0819 (−0.44)	−0.0371 (−0.12)	−0.5181** (−3.75)	−0.6929*** (−3.76)	0.2070*** (3.85)	0.3244*** (6.59)	−1.1228*** (−56.28)	−0.6802*** (−33.31)
Gr	−0.0721 (−1.18)	−0.1283 (−1.31)	0.0742 (1.38)	−0.1216* (−1.71)	−0.0185** (−2.38)	−0.0079 (−1.18)	−0.0032 (−1.25)	0.0052* (1.67)
FL	−0.04515*** (−3.65)	−0.0481*** (−2.60)	−0.0511** (−2.01)	−0.0410** (−2.24)	−0.0111*** (−5.55)	−0.0087*** (−5.22)	−0.0081*** (−11.90)	−0.0094*** (−11.34)
CF	0.0439*** (3.80)	−0.0107** (−3.27)	−0.0248*** (−3.15)	0.0047 (0.47)	−0.0056*** (−2.96)	0.0276*** (15.74)	0.0110*** (16.43)	0.0079*** (10.02)
Wald test (Prob. > *F*)	8.48 (0.000)	4.90 (0.000)	27.79 (0.000)	32.38 (0.000)	8.27 (0.0000)	47.57 (0.0000)	347.24 (0.0000)	279.88 (0.0000)
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2					0.0130	0.0523	0.2299	0.2641
p-value of m_2	0.197	0.182	0.818	0.451				
F1	5.04	6.33	4.52	9.06	2.89	64.94	4.79	4.67
F2	4.93	5.15	3.13	5.12	3.26	42.82	11.10	11.75
Hansen test	163.23 (146)	86.99 (73)	570.20 (102)	643.69 (106)				
Hansen test diff. (*P*-value)	0.880	0.412	0.250	0.771				
Obs.	13,273	13,276	12,228	12,231	14,468	16,332	15,516	13,971

Notes: The *t*-statistics are in parentheses. The m_2 test represents the test for residual's second-order serial correlation in the differenced equation, asymptotically distributed as (0, *N*) under the hypothesis of no serial correlation. Hansen test represents the test for over-identifying restriction asymptotically distributed as χ^2 under the null of instrument validity, and degrees of freedom are reported in parentheses. The *p*-values of difference in Hansen test show exogeneity of instruments subset. Wald test represents joint significance test of all independent variables. F1 and F2 tests are for linear restrictions under the null of H_0: H_0: $(\beta_1 + \delta_1) = 0$, and H_0: $(\beta_2 + \delta_2)$, respectively. *,**,***Indicate level of significance at 10, 5 and 1 percent, respectively

المنارة للاستشارات
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view, over-investment in working capital may put undesirable effects and lead to value destruction for shareholders (Aktas *et al.*, 2015). However, high investment in working capital needs financing and firm's need of extra financing increases financing expenses and enhances probability of bankruptcy (Kieschnick *et al.*, 2011).

Additionally, empirical investigations also suggest that lower investment in working capital enhances firm profitability (Jose *et al.*, 1996; Shin and Soenen, 1998; Wang, 2002; Deloof, 2003; García-Teruel and Martínez-Solano, 2007; Ramachandran and Janakiraman, 2009; Zariyawati *et al.*, 2009; Erasmus, 2010a, b; Lyngstadaas and Berg, 2016; Tran *et al.*, 2017). However, these studies worked on linear relationship between working capital management and corporate performance. Unlike these research studies, our study focused on adopting quadratic functional form to investigate the relationship of working capital management and firm performance (Baños-Caballero *et al.*, 2014), and declared inverted U-shaped relationship. By developing quadratic model of working capital and corporate performance to investigate nonlinear (concave) relationship, our study has enhanced understanding of investment in working capital.

Second, prior research studies investigated effect of financial constraints on various other corporate settings for investment and financing. Theoretical understandings of the effect of financial constraints on working capital investment are promising, but the theory is empirically less developed in the context of China. Some empirical studies in working capital investment and financial constraints interactions have investigated the effect of firms' access to external funds and financial distress (Baños-Caballero *et al.*, 2014). However, we may also generalize those findings to explain the role of firms' access to external funds and financial distress in the context of China also. Therefore, firm's investment is influenced by financial factors, for instance, availability of internal funds, firm's access to capital markets and cost of external financing (Fazzari *et al.*, 1988). Contrary to prior research studies on working capital investment, this study contributes to the literature by taking a unique research initiative and investigates investment in working capital from the perspective of Chinese settings for the corporate financing and investment in the presence of financial constraints.

The theoretical conceptualizations suggest that financially constrained firm's investment in working capital is highly sensitive to availability of funds and these firms should keep investment in working capital at low levels. However, financially unconstrained firms can maintain investment in working capital at high level due to their financial flexibility. Fazzari and Petersen (1993) and Hill *et al.* (2010) propose that working capital investment is highly sensitive to firms' access of capital market. In addition, Baños-Caballero *et al.* (2014) also investigate whether firms financing constraints affect optimal level of investment in working capital. The findings of their study declare that financially constrained firms optimal working capital level is lower relative to financially unconstrained firms. Therefore, the present study addresses this line of research, extends the prevailing relationship of financial constraints and examines the nonlinear relationship between working capital and corporate performance with interactions of financial constraints. The interaction effects of

Variables	Tobin's $Q > 1$	Tobin's $Q \leqslant 1$	Difference	*t*-statistics
NET	68.8609	71.9111	−3.0502***	−24.4949
Size	21.3569	22.4874	−1.1305***	−55.5588
Gr	5.3729	4.4960	0.8768***	6.7953
FL	47.5962	62.7498	−15.1535***	−42.2958
ROA	2.3874	2.6181	−0.2306***	−4.1143
CF	10.7314	7.8985	2.8329***	11.1813

Note: ***Indicates level of significance at 1 percent

Table VII. The comparison of working capital management, corporate performance for divided sample

المنارة للاستشارات

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financial constraints on investment in working capital and corporate relationship declared that financial constraints play significant role in working capital investment, and support the view that optimal level of working capital for firms more likely to be financially constrained is lower in the context of Chinese non-financial firms also. Third, the literature suggests that aggressive working capital management is significantly and positively associated with higher corporate values (Wang, 2002). Consistent with this view, our study also finds that higher value non-financial firms have lower NTC relative to lower value non-financial firms, because the findings indicate that aggressive working capital management is significantly and positively association with higher corporate values for Chinese settings.

Overall, this study extends the role of working capital management (in terms of internal finance) and its context (in terms of imperfect capital market). Finally, in terms of the location of the study, China has shown the splendid economic growth, corporate innovation and financial development in the emerging economies. As with short span of time, the economy of China has undergone an immense economic growth and is a case in point for researchers' amazement even though having under-developed financial arrangement (Song *et al.*, 2011). Therefore, external financial markets of China play a limited part in providing finance and resource sharing out (Guariglia and Yang, 2016). Hence, the resolution of puzzle for remarkable economic development of China is tracked by well-administrated policies for short-term assets and well-organized management of working capital. In this regard, the findings from the fastest emergent economy of the world can be generalized to a widespread group of populations.

5.2 Practical implications

This study provides important practical and managerial implications for the corporate sectors investment and financing decisions to enhance their performance. Most of the research studies on investment in working capital have focused on its relationship with profitability. This study has focused on working capital investment, its contribution to corporate value by linking financial constraints in the context of China, a fundamental issue not yet studied widely in emerging markets context for corporate financing and investment. Practically, this study suggests that there is an optimal level of working capital that needs to be maintained in order to maximize firm value. Moreover, the study finds that optimal level of working capital for financially constrained firms is relatively lower. Therefore, the findings of this study suggest that investors look investment in working capital as important in determining firm value and prefer it to be at its possible minimum level.

Thus, at the professional front, the presence of non-monotonic relationship between working capital management and corporate performance which occurs as a result of investment in working capital requires some proper policy implications by managers to maintain the optimum level of working capital by efficiently balancing costs and benefits and maximizes firm performance. The empirical findings suggest that companies especially with limited capital market access, high volatility of cash flows and high risk of bankruptcy should maintain working capital at its optimum best that enhances corporate performance and maximizes shareholders value. Hence, investment in working capital does considerably affect corporate performance and value. Therefore, it is essential for investors and portfolio managers to actively evaluate companies policies regarding working capital prior to making investment in these companies along with dividend polices, firm leverage and capital budgeting policies.

5.3 Conclusion

This paper provides empirical evidence for the relationship of working capital and corporate performance by taking financial constraints into consideration. The study uses panel data of Chinese listed non-financial firms over the period 2005–2015 using system GMM method of estimation. With hypotheses derived from the working capital theories and financial constraints framework, we developed an empirical approach to examine the potential effect

المنارة للاستشارات

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of working capital investment decisions on corporate performance. We find inverted U-shaped relationship between working capital and corporate performance. This evidence implies that there is an optimal level of working capital that needs to be maintained that maximizes firm value. Moreover, the study finds that optimal level of working capital for financially constrained firms is relatively lower. The results for comparison of working capital management and corporate performance for divide sample indicate that on average NTC is significantly lower for firms with Tobin's $Q > 1$ than firms with Tobin's $Q \leqslant 1$.

The empirical results are consistent with the view that at low level of working capital, high sales and discounts on early payments significantly impact and exhibit positive relationship between working capital and firm performance. Significant negative relationship at high level of working capital shows dominance of opportunity cost and high cost of external finance. Collectively, the results provide new insight concerning the relationship between working capital and corporate performance with financial constraints. The empirical investigations of this study support the vital role of financial constraints in working capital investment decisions because high cost of external capital and debt rationing increase investment sensitivity in working capital for more financially constrained firms and in turn these firms maintain optimal working capital at lower levels. Additionally, the findings of the results also imply that aggressive working capital management is significantly and positively associated with higher corporate values.

5.4 Study limitations and directions for future research

This study is major contribution toward the research of working capital management and corporate performance relationship in the settings of Chinese market. However, this study does not consider a few things which can be worked on in future research. This study uses two measures for firm performance namely: return on assets (*ROA*) and Tobin's *Q*. However, other indicators of firm performance can also be included that are important in strategic implications research and may provide useful insights. The unavailability of data is a major constraint due to exit and entry of the firms in the sample period.

This research is based on secondary data; however, primary data can also be used to understand and get the appropriate knowledge by combining both archival and survey data to increase the robustness of study and its findings. This research focuses firm's monetary performance whereas non-monetary performance can also be considered as outcome variable.

From the academics work fronts, the results of the study support further investigations for firms' investment behavior in working capital by relating economy and financial circumstances. Thus, the empirical investigations of this study support the vital role of financial constraints in investment decisions. Moreover, there is a need to further explore the influence of financing constraints on working capital investment by taking market imperfections into consideration in the framework of emerging economies.

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Corresponding author
Fahmida Laghari can be contacted at: fahmida.laghari@yahoo.com

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