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Role of Bank Credit and External Commercial Borrowings in Working Capital Financing: Evidence from Indian Manufacturing Firms

Daitri Tiwary [1,*] and Samit Paul [2]

[1] Birla Institute of Management Technology, Greater Noida 201306, India
[2] Indian Institute of Management Calcutta, Kolkata 700104, India; samit@iimcal.ac.in
* Correspondence: daitri.tiwary@bimtech.ac.in

Abstract: Determinants and levels of working capital financing (WCF) in the manufacturing sector have been empirically proven to impact firm profitability across emerging as well as developed nations. With time, firms adjust toward financing their working capital requirement (WCR), although the speed of adjustment, financing constraints, and bargaining power are subject to variations. In this study, we estimate the effect of bank credit and firm foreign currency borrowing on working capital financing with three distinct models for manufacturing firms in India. We examine the relationship between short-term foreign currency borrowings and WCF. Further, we investigate if the internal capital market affects WCF in the form of business group affiliation; lastly, we assess the impact of bank dependency and financial distress on WCF. We conclude that the debt–equity ratio becomes relevant, whereas firm characteristics such as age, size, and asset tangibility become irrelevant. Our original contribution to the literature is the finding that even smaller emerging market firms with well-managed, low debt exposure have improved access to WCF. Our results support that financial distress negatively impacts WCF but deviates from macroeconomic fundamentals, such as the GDP growth rate. This indicates deterioration in the health of Indian manufacturing, as a capital-intensive sector. Bank dependency remains significant, wherein smaller firms and those without a dividend pay-out continue to have longer cash conversion cycles and less efficient WCR. As a unique finding, we note foreign currency borrowings significantly contribute to WCF in the case of less developed credit markets in emerging economies such as India.

Keywords: working capital financing; cash conversion cycle; external commercial borrowing; two step least square models

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1. Introduction

In credit deficient emerging markets, working capital financing (WCF) poses a less acclaimed and under-researched challenge to firms' growth due to its short-term and routine occurrence. Challenges in financing working capital (WC) are profound for sectors such as manufacturing, where the WC holdings are high and the net trade cycles are long (Chancharat and Kumpamool 2022). While extant research in this field focuses on firm-level working capital policies (WCPs) and their impact on firm performance, emerging market firms need to understand the evolving credit supply landscape to finance their working capital requirement (WCR).

In the macroeconomic context, empirical investigations have established that aggregate bank credit as a measure of credit supply is positively impacted by economic activity and has a negative impact on financing costs, which in turn affects WCR. In contrast to industrialized nations with developed financial markets, where WCP is led by endogenous borrowing decisions, the institutional credit supply of emerging market economies (EMEs) is often punctuated by macroeconomic stress, impacting WCF as an exogenous factor. Institutional credit in the context of EME is dominated by bank credit and its role in WCM

has been sporadically investigated at the firm level. Beyond its impact on firm performance, there is limited knowledge and a lack of firm-level empirical evidence in the context of EMEs on how WCR changes when bank credit supply is insufficient.

A less researched topic in this domain is the impact of alternate external sources of WCF for EMEs, such as firm foreign currency debt. Short-term non-concessional borrowing extended by commercial creditors, including banks as well as suppliers of goods, for the financing of specific projects and/or general imports to developing nations, has fueled economic growth but its impact on WCR and firm profitability is yet to be investigated. (Shyam-Sunder and Myers 1999).

Further, idiosyncratic financial constraints of the firm seeking credit complicate the WCF need of a firm. Platt and Platt (2008) describe that firm-level financial distress may be subject to international divergence due to different lending practices, accounting rules, and management skills. Particularly in capital-intensive sectors, including manufacturing, access to bank credit, especially short-term debt, is impacted by the state of financial distress that a firm might be in. This may lead to a higher cost of WC and weigh down WCF. Empirical investigations show that Indian manufacturing firms, predominantly driven by imported inputs, have experienced high financial distress, with higher friction, costly trade credit, and a crunch in WC (Devalkar and Krishnan 2019; Pant et al. 2023). Hence, it is pertinent to examine how firm foreign currency borrowings drive working capital financing to compensate for credit crunch amidst financial distress.

We tried to explore these research gaps using a data set of 8450 firms with 85,365 firm-year observations sourced from the Prowess IQ database for the period 1997 to 2018. We applied three empirical model specifications to check the robustness of our results. Overall, results of our study suggest that firms with higher bank credit have longer cash conversion cycles and exhibit a greater working capital requirement. Our sub-sample analysis shows that firms with a business group affiliation have a shorter cash conversion cycle and a lower working capital requirement compared to firms with no business group affiliation. Moreover, financially distressed firms have longer cash conversion cycles and a higher working capital requirement compared to non-distressed firms. Our study also documents the significant negative impact of external borrowings on the cash conversion cycle.

We contribute to the existing knowledge base by answering how working capital financing evolved for EME manufacturing firms while considering the effect of bank credit supply and firm-level financial distress. While the existing literature proposes that the size of a firm is a determinant of its access to credit (Moussa 2019; Lefebvre 2023), our study empirically proves that the debt–equity ratio becomes more relevant than firm characteristics such as age, size, and asset tangibility. Our novel finding suggests that smaller firms with well-managed, low debt exposure have improved access to WCF. We capture the limiting factors in the sustenance, expansion, and progress of the Indian manufacturing sector by summarizing how WCF has been affected by bank credit, ECB, and microeconomic financial distress beyond firm characteristics. From the methodological standpoint, we make two novel contributions. Firstly, we derive consistency across three linear panel regression models, providing robust results. Secondly, with bank credit as our explanatory variable, we check for endogeneity by introducing an instrumental variable in our two-step least square model. This instrumental variable is conceptualized by us as the change in deposit growth of banks; it is introduced in the second step of our 2SLS model to control for bank credit as a supply-side factor.

From practitioners' and industry perspectives, this study has four fundamental contributions. Firstly, for EME firms, we empirically prove that flexibility in working capital management by including alternate sources of finance such as external borrowing reduces dependency on institutional credit and improves liquidity. Secondly, by taking cognizance of the role of bank credit, borrowers may adjust inventory levels, improve the operating cycle, and lower short-term debt exposure to mitigate financial distress. Further, for banks and institutional lenders, we find that misallocation of credit by limiting access to smaller or financially distressed firms is debilitating for capital-intensive sectors. Finally,

for credit research, we pave the way for measuring and forecasting bank credit supply, which may be used to predict exogenous shocks and financial distress, modeled with macroeconomic indicators.

The study commences with a review of the literature and identification of research gaps in working capital financing, bank credit, and short-term foreign currency commercial borrowings. We identify attributes of firms and working capital financing (WCF) from the distinct approaches and empirical models of the existing literature to construct testable hypotheses. In the third section of this paper, we discuss the methodology, identified variables, and the data source. Our analysis is presented in the fourth section: firstly, we examine the relationship between the availability of bank credit and WCF for the manufacturing firms in India; secondly, we examine the relationship between short-term foreign currency borrowings and WCF; thirdly, we investigate if the internal capital market affects WCF; lastly, we assess the impact of financial distress on WCF. Further, we discuss our findings and interpretation in the fifth section. Finally, we conclude with the implications of bank credit, short-term foreign currency borrowings, the internal capital market effect, and financial distress on WCF over the study period.

2. Perspectives on the Working Capital Requirement, Financing, and Management

Leverage is an established measure of risk in corporate finance, but research contributions have been predominantly focused on long-term debts and capital budgeting. Short-term financing, especially working capital management (WCM), has attracted less academic interest due to the routine nature of the working capital requirement and the reversibility of financing, although empirical models have linked WCM to financial distress and bankruptcy of firms (Ogachi et al. 2020). The published literature is replete with empirical investigation of "*working capital*" as a constituent of debt and antecedent of firm profitability. We refer to 2253 SCOPUS-indexed journal articles and 170 book chapters based on a keyword-based search for "*working capital*". These literature references were further refined for keywords "*working capital management*", "*working capital requirement*", and "*working capital financing*", yielding 65 highly cited impactful publications.

Seminal literature by Kingshott (1968) initially focused on the need to manage WCR during unprecedented negative cash flow generation, but Lewis (1992) explains WCF as a "*structuralist feature*" of segmented credit markets of developing countries. Following the 2008 global financial crisis, WCM attracted renewed academic interest owing to mismanagement and lack of resilience at the firm level (Haron and Nomran 2016). Formative research by Jose et al. (1996); Deloof (2003); Padachi (2006); García-Teruel and Martinez-Solano (2007); and Nobanee et al. (2011) focuses on the impact of WCM on firm performance and profitability. This premise itself presents a conceptual literature gap regarding the role and availability of bank credit, which has been generally considered a pre-condition before measuring the effect of WCM policies. This gap in the literature is exacerbated contextually for EME firms, wherein aggregate models outnumber firm-level studies, which are further limited to public listed firms (Padachi 2006; Napompech 2012; Anton and Afloarei Nucu 2020; Ogachi et al. 2020; Chancharat and Kumpamool 2022; Eldomiaty et al. 2023). The role of bank credit in working capital requirement (WCR) is yet to be explored, specifically in the context of the manufacturing sector of emerging economies where firm-level financial distress is high, operating cycles tend to be longer, and liquidity is low with limited access to institutional finance. We arrive at our research question: how has the working capital of firms been affected by bank credit supply and external commercial borrowings, considering firm-level financial distress, in the manufacturing sector of India as an emerging economy?

In the past two decades, WCR has evolved from firms' liquidity measure to a measure of the firm-level impact of technological shocks (Rouillard 2018), money supply (Marjit and Bhattacharyya 2022), and taxation (Sharma 2022). However, we note that credit supply and its effect on EME firms continue to be deficient in empirical findings. We discuss theoretical approaches to working capital, measures with empirical evidence, and the potential scope of extending the existing literature in the following section.

2.1. Working Capital Management: Liquidity versus Operating Cycle

Working capital by definition is the difference between the firm's current assets and current liabilities. It can be viewed through two different lenses: (a) liquidity, where the proportion of current assets matched to the current liabilities reflects the firm's ability to meet its short-term obligations; (b) operating cycle, where working capital is a measure of duration between the time of investment made in inventories until the time of realization of cash from the sale of the finished goods. Although initially defined from the perspective of liquidity as a "*balance*" of current assets and liabilities by Pass and Pike (1987), WCM became more focused on the operating cycle post-global financial crisis, wherein WC has been measured in terms of the *cash-conversion-cycle (CCC)*; in contrast to the current assets matching current liabilities in *working capital financing* ($WCF = \frac{Short\ term\ debt}{Working\ Capital}$), CCC was impacted by the size of firms as well as its effectiveness in the holding and utilization of working capital (Padachi 2006; Nobanee et al. 2011; Altaf and Ahmad 2019). The recent literature associates CCC with profitability of firms in terms of return-on-assets (RoA), implying that an optimized CCC may improve RoA. However, this empirical evidence is limited to listed firms in industrialized nations (Eldomiaty et al. 2023). While there have been acclaimed firm-level studies of WCM practices (Viskari et al. 2011; Lind et al. 2012), Pratap Singh and Kumar (2014) infer in their structured literature review of WC that there exists a considerable literature gap in WCM in the context of developing economies at the disaggregate level. With Deloof (2003) establishing an empirical relationship between firm profitability and WCM, firm-level studies in developing economies are yet to explore beyond the statistical analysis of WC determinants and sectoral WC practices.

From the perspective of liquidity, high working capital enables firms to access short-term bank credit. Metzler (1941) states that fluctuations in inventory holdings affect the liquidity of firms, which impacts access to short-term bank credit. Hence, better liquidity indicators facilitate higher bank credit usage in terms of time as well as quantity (Apak et al. 2016). In the CCC approach, the operating cycle of WCM reflects the number of days for which the firm requires funding to meet short-term capital (STC). Hypothetically, a firm's optimal CCC is zero; it is most efficient when the CCC is less than zero. Negative CCC implies a higher credit period from suppliers (exceeding the inventory and receivable days), which ensures no working capital requirement for the firm. Thus, CCC dictates the number of days for which the firm needs short-term capital; however, the volume of the credit would depend on the size and scale of operations. Hence, the higher the CCC, the greater the requirement of STC, and the higher the effect of access to bank credit. In emerging economies, CCC and cash-holding strategies are further dented by macroeconomic factors, especially interest rates and inflation (Wang et al. 2014). A pre-condition in this narrative of measuring WCR through CCC is the underlying assumption of the availability of bank credit. This presents an evident research gap as supply-side factors of WCR remain insufficiently researched (Chen and Kieschnick 2018). In line with the perspectives of liquidity, research in WCM based on the CCC approach also undermines access to bank credit.

While both liquidity and operating cycle-based approaches to WCM presume the availability of bank credit, disruptions in credit supply may impact WCF. Identifying a research gap in measuring firms' WCR adjustments due to the inaccessibility of credit in lesser-developed EME financial markets, we hypothesize:

H_1. *Availability of bank credit increases the cash conversion cycle and working capital requirement.*

2.2. Supply of Bank Credit

Firms tend to adjust towards an optimum level of working capital requirement (WCR) with varying speeds of adjustment depending on financial constraints, level of internal funding, and micro-financial indicators (Panda and Nanda 2018; Wasiuzzaman 2015; Baños-Caballero et al. 2013). The period for which working capital is required depends on the operating cycle, whereas the quantum of working capital depends on the scale of business and availability of credit. Bank credit usage by firms, apart from the CCC, is also dependent

on the timely availability of finance from banks. This credit availability is skewed since large and listed firms have more access to capital markets and banks than small and private firms (Apak et al. 2016). Apart from the creditworthiness of the borrower, access to credit is contingent on the financial condition of the lender. Lack of access diminishes the supply of credit. Supply of credit is further impacted by a higher cost of capital or pre-requisite levels of capital mandated by the country's central banks to foster stability of the financial system. Extant research finds tapered credit growth due to higher capital requirements, which leads to higher interest rates (De Jonghe et al. 2020). Baoko et al. (2017) show that broad money supply, bank assets, real lending rate, and bank deposits are significant determinants of bank credit to firms in both the short and long run.

There is a sectoral disparity in access to bank credit, due to varying capital intensity and the length of the operating cycle. In credit-deficient emerging economies, this disparity is further heightened between unlisted smaller firms compared to public listed firms. The literature cites that credit supply to firms continues to be an unobservable variable and can be gauged through aggregate commercial lending by banks (Chen and Kieschnick 2018). Dependence on bank credit is higher for smaller firms in manufacturing sectors in EMEs such as India due to the import of inputs, higher cost of capital, and lower export competitiveness (Debroy and Nayyar 2020). This is profound for smaller unlisted firms without any business group affiliation, as they solely rely on bank credit in the absence of an internal capital market. Empirical evidence further indicates the presence of information asymmetry between such firms and commercial lenders, yet the impact on WCF as short-term debt is yet to be investigated (Song et al. 2020). Moreover, the relationship between bank loans and working capital financing in group and standalone firms is yet to be explored in emerging economies. To understand the effect of WCR across varying levels of dependency of firms on bank credit, we hypothesize:

H_2. *Firms' dependency on bank credit has a significant positive impact on the cash conversion cycle and working capital requirement.*

H_3. *Firms with business group affiliation have shorter cash conversion cycle and lower working capital requirement compared to firms with no business group affiliation.*

2.3. Credit Supply during Firms' Financial Distress

Hofmann (2004) explored the determinants of aggregate bank credit in industrialized countries. Earlier literature documented the coincidence of credit cycles with cycles in economic activity and property markets. Hofmann's study suggested that property prices are an important determinant of the long-run borrowing capacity of the private sector, which needs to be taken into account to explain the long-run movements of bank lending. We infer that both bank credit and private-sector borrowing are susceptible to prevailing macroeconomic conditions. This is iterated by Stepanyan and Guo (2011), who examined changes in bank credit across emerging markets and showed a positive contribution of domestic and foreign funding to credit growth. Their results also indicated a connection between monetary conditions, banking sector health, and credit. Following Stepanyan and Guo's (2011) findings, Imran and Nishat (2013) used a supply-side approach to estimating bank credit to firms, finding that the liquidity of banks also plays a vital role in loan determination. In the longer run, foreign liabilities, domestic deposits, economic growth, exchange rates, and monetary conditions have significantly affected bank credit (Akinlo and Oni 2015; Shijaku and Kalluci 2013). Thus, macroeconomic factors interact with the credit supply and, in turn, affect the financial health of firms. Apart from exogenous shocks to credit supply, firms in financial distress may trigger write-offs, reducing a bank's capital and therefore its ability to supply credit to businesses. This is in line with the observations of the global financial crisis where the write-off of loans preceded stress on the supply of credit to commercial and industrial firms (Chen and Kieschnick 2018). While determinants of WCM are replete in the literature, investment and financing patterns need to be further researched from the perspective of firm-level financial distress.

Contrary to credit-surplus developed economies, EMEs such as India follow a supply-led approach to their banking policy to ensure an adequate flow of credit to borrowers who are underserved by the banking system (Chavan and Gambacorta 2016). Recent literature shows that SMEs prefer bank credit for financing cash budgets and WCR (Konak and Güner 2016; Vu Thi and Phung 2021). However, the Indian manufacturing sector is predominated by small and medium enterprises, wherein working capital financing continues to be a challenge with limited access to institutional finance. Indian SMEs in the manufacturing sector have a limited presence in capital markets; bank credit is a major source of financing WC. Further, we refer to Chen and Kieschnick (2018) to understand how firms respond to bank credit in WCR. They explain that bank credit influences cash holdings, trade credit, prepayment of trade credit, and investment in inventories by public firms in industrialized economies, with a significant impact on micro-level financial distress. Identifying a contextual literature gap for emerging economies, we hypothesize:

H_4. *Financially distressed firms have longer cash conversion cycles and higher working capital requirements compared to financially non-distressed firms.*

2.4. Role of External Commercial Borrowings in Working Capital

When credit supply is constrained, firms borrow abroad to finance their investments. While we explore the role of bank credit in WCM in Indian manufacturing firms, we identify the unique role of funding short-term debt through foreign currency borrowings or external commercial borrowing (ECB). Manufacturing firms in India are allowed to receive ECB in proportion to the ECB liability–equity ratio (the ECB amount will include all outstanding amounts of all ECB (other than Indian rupee-denominated) and the proposed one (only outstanding ECB amounts in the case of refinancing), while equity will include the paid-up capital and free reserves (including the share premium received in foreign currency) as per the latest audited balance sheet.) Entities may be listed or unlisted and eligibility is as per extant foreign direct investment guidelines (RBI 2023). Singh (2007) argues that while ECBs are characterized by smaller-size loans in international markets, their role in funding WC has diminished. On the contrary, in a firm-level study focused on the manufacturing sector accessing ECB, Pradhan and Hiremath (2021) observe its significant interaction with the inventory-to-sales ratio. With inventory including raw materials, work-in-progress, and finished goods, CCC has an evident impact. We infer that ECB and its significant balance sheet effect have a bearing on the liquidity position of manufacturing firms. However, the impact of external commercial borrowing on WCF is yet to be empirically investigated. To understand if ECB can drive working capital financing as a complement to bank credit, if not a substitute, we hypothesize:

H_5. *External commercial borrowing (ECB) has a significant negative impact on cash conversion cycle and working capital financing.*

The aforementioned perspectives and gaps in the literature led us to empirically investigate how WCM has been affected over the years by the financially constrained Indian manufacturing sector in a unique EME context; our study estimates the effect of bank credit and external commercial borrowing on WCM within micro-level financial distress for standalone and group firms.

3. Methodology

We aim to estimate the effect of bank credit and external commercial borrowing on working capital requirement. To begin, we study the changes in the working capital requirements of the firms based on the availability of credit supply. Our empirical model estimates the effect of firms' financial indicators on different working capital components.

3.1. Background

Findings from developed economies may not be extended to emerging markets as the quality of the countries' institutions affects firms' financial indicators. Debt and eq-

uity transaction costs are higher and adjustment speed is lower in countries with weaker institutions (Öztekin 2015). Degryse et al. (2019) posit that country-specific factors such as creditor rights protection, bond market development, and economic growth have a significant influence on corporate capital structure, and countries with a better legal environment and more stable economic conditions take more debt. Factors such as corporate governance, corporate and personal tax systems, laws and regulations, and development of the capital and debt markets are country specific. Firms in emerging economies might behave differently than the firms in the developed countries, as many emerging economies have historically been dominated by state-owned enterprises and family-controlled firms, with widespread information asymmetry. Financial instruments available in emerging markets are also limited compared to in developed counterparts (Demirgüç-Kunt and Maksimovic 1996). We investigate Indian manufacturing firms as our precedent EME research context. Indian companies also play the role of financial intermediaries, wherein business groups act as internal capital markets. Companies extend financial support to a financially stressed member of the same group and group firms are less financially constrained than stand-alone firms. The business performance of a member firm, affiliated with a diversified Indian business group, increases with an increase in group diversification. With its divergent practices for a capital-intensive manufacturing sector operating within sovereign controls, India provides a critical research context to test the portability of the findings of firms' financial structure in developed countries.

3.2. Data

We used the Prowess IQ database, which is developed and maintained by the Centre for Monitoring Indian Economy (CMIE). Our raw sample data covered the period 1997 to 2018[1], with 16,585 manufacturing firms. Firm-level data of 2019 onwards have been excluded due to two exogenous shocks, i.e., first, high rupee volatility commencing from the year 2018, which impacted firms' foreign currency borrowings; and second, COVID-19 pandemic-induced shocks, resulting in economic slowdown and punctuations in WCF (Zimon and Tarighi 2021). We filtered the data to retain a complete and consistent data set of 8450 firms with 85,365 yearly observations (CMIE 2022a). We further classified the manufacturing firms into 9 industry groups according to the National Industrial Classification (NIC) code of the Central Statistical Organisation, Ministry of Statistics and Programme Implementation, Government of India (see Table 1). The industry representation of the panel data constructed for firm-level year-wise observations is depicted in Table 2 (Central Statistical Organisation 2008).

Table 1. Classification of manufacturing firms into 9 industry groups according to the National Industrial Classification (NIC) code of the Government of India.

Sr. No.	Code	Description	Firms	Observations
1	1.1	Manufacture of food products, beverages, tobacco products	1225	12,143
2	1.2	Textiles, wearing apparel, leather, and related products	1082	11,160
3	1.3	Manufacturing of coke and refined petroleum products, chemicals	949	10,242
4	1.4	Pharmaceuticals	473	5132
5	1.5	Manufacturing of rubber and plastic products and other non-metallic mineral products	865	9133
6	1.6	Manufacturing of basic metals, and fabricated metal products, except machinery and equipment	1308	13,135
7	1.7	Electronic and electrical	734	6936
8	1.8	Manufacturing of machinery and equipment, motor vehicles, trailers and semi-trailers, and other transport equipment	1166	11,254
9	1.9	Others	648	6230
		Total	8450	85,365

Table 2. Industry-wise percentage of firm-level year-wise observations.

Number of Firms (Industry Wise % Distribution)										
Year	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**	**1.7**	**1.8**	**1.9**	**Total Number of Firms**
1997	12.84	l5.17	14.09	6.42	12.53	12.22	7.66	12.48	6.58	1.931
1998	12.98	15.15	14.13	6.68	11.88	13.12	7.37	1 1.92	6.77	2.172
1999	14.6	13.97	13.45	6.41	11.26	14.17	7.72	11.66	6.76	2.513
2000	14.83	13.88	13. 14	6.33	11.08	14.02	7.43	12.62	6.66	2.717
2001	15.07	13.78	12.72	6.32	10.95	14.19	7.64	12.46	6.87	2.721
2002	15.36	14.27	12.78	6.18	10.66	14.02	7.63	1208	7.03	2.832
2003	15.42	14.39	13.55	5.96	10.81	13.04	7.74	11.74	7.35	3.321
2004	15.03	12.99	13.33	6.39	11.4	13.41	8.01	11.79	7.64	3.519
2005	15.09	13.09	12.84	6.22	11.35	14.56	7.53	1 1.47	7.86	3.957
2006	14.82	13.57	12.39	6.07	10.87	15.64	7.34	11.5	7.81	4.252
2007	14.76	13.68	12	6.04	10.69	16.09	7.5	11.75	7.48	4.451
2008	14.58	13.81	11.72	5.97	10.63	16.43	7.6	11.68	7.58	4.59
2009	14.58	13.57	11.45	5.9	10.73	16.59	7.7	11.72	7.75	4.725
2010	14.81	13.46	11.36	5.9	10.46	16.72	7.68	11.86	7.75	4.867
2011	14.62	13.18	11.46	6.12	10.69	15.98	7.98	12.29	7.68	4.938
2012	14.51	12.78	11.42	6	10.42	15.94	8.67	12.82	7.45	5.087
2013	13.79	12.78	11.57	5.98	10.3	16.52	8.59	13.46	7.02	5.031
2014	13.52	11.93	11,07	5.54	10.22	16.15	8.92	15.64	7	6.086
2015	13.06	11.39	11.09	5.76	10.12	15.94	9.23	16.38	7.03	5.69
2016	12.85	11.54	11.02	5.68	10.19	15.75	9.42	16.62	6.93	5.338
2017	12.71	11.41	11.20	5.86	10.37	15.52	8.64	17.12	7.18	4.627
Average	14.28	13.32	12.28	6.08	10.84	15.05	8	12.91	7.25	

3.3. Variables and Measures

Based on the review of the literature, we identified the variables depicted in the Table 3 to test our hypotheses. Measures of the key variables are outlined in Table 4. We assess the role of bank credit and ECB in WCF with a multi-model comparison, wherein our first two models are fixed effect panel estimations of the cash conversion cycle and working capital requirement as distinct functions of firm-level financial indicators and macroeconomic indicators, with financial distress and a group effect.

Table 3. Identified variables with reference to the existing literature on working capital, bank credit, and ECB.

Firm Characteristics: Size, Age, Asset Tangibility, group	Erdogan (2015) Baños-Caballero et al. (2013)
Firm Performance: Sales volatility, Profitability, Return on Assets (RoA), Gross Profit Margin, Profit Before Interest and Tax (PBIT), Operating Cash Flow, Research and Development (R&D) Intensity, Price/Book Value	Hill et al. (2010) Chen and Kieschnick (2018) Eldomiaty et al. (2023)
Working Capital: WCF, WCR, CCC, Days in Inventory, Accounts Receivable Days, Payable Days, Inventory Turnover Ratio	Ding et al. (2013) Chen and Kieschnick (2018) Altaf and Ahmad (2019)
Bank Credit: Leverage, Debt: Equity Ratio, Interest Coverage Ratio, Financial Cost, Bank Loan	Autukaite and Molay (2011) Chen and Kieschnick (2018)
External Commercial Borrowing: ECB	Singh (2007) Pradhan and Hiremath (2021)
Others: Financial Distress, GDP, Bank Rate, Deposit growth, Volatility Index (VIX)	Hill et al. (2010) Baños-Caballero et al. (2013) Stepanyan and Guo (2011) Imran and Nishat (2013) NSE (2022)

Table 4. Measures of the key variables.

Sr. No.	Variable	Measure
1	Cash conversion cycle (CCC)	Inventory days + (Accounts receivable days—Accounts payable days)
2	Age	(Current year—Company incorporation year) + 1
3	Asset tangibility	$\frac{\text{Gross fixed assets}}{\text{Total assets}}$
4	Size	Log (Total Assets)
5	Working capital requirement	$\frac{(\text{Inventory} + \text{Accounts receivable} - \text{Accounts payable})}{\text{Total Assets}}$
6	Change in Bank Loan	Percentage change in Short-term bank loan
7	Fixed claim	$\frac{\text{Total loans}}{\text{Total assets}}$
8	R&D intensity	$\frac{\text{R\&D expense}}{\text{Total assets}}$
9	External commercial borrowing (ECB)	Amount of ECB taken
10	Cash flow volatility	Rolling Standard Deviation of operating cash flow over 5 years
11	Sales volatility	Rolling Standard Deviation of sales over 5 years
12	Leverage	$\frac{\text{Total borrowings}}{\text{Total liabilities} - \text{Accounts Payables}}$
13	Return on Assets	$\frac{\text{Profit after tax}}{\text{Total Assets}}$

As a novel method to explore the role of bank credit in WCF, we introduce a third model to estimate how the ratio of bank loans to total assets of firms is impacted by firm foreign currency borrowing, firm-level financial indicators, macroeconomic indicators, financial distress, and the group effect. Since our explanatory variable bank credit is a supply-side factor, we need to control for endogeneity. Following Kenkel (2016) and Greene (2003) with reference to the conceptualizations of James and Singh (1978), we control for endogeneity by implementing a two-step least square model, wherein an ordinary least square (OLS) panel regression is run twice, i.e., by including an instrumental variable in the second step. This instrumental variable should be conceptually excluded from the covariates of the first step of OLS panel regression. We refer to Chen and Kieschnick (2018), wherein the write-off of existing loans was taken as an instrumental variable since it impacts the supply of bank credit. With a similar rationale, we argue that a change in the growth rate of deposits in commercial banks impacts the supply of bank credit. Hence, we introduce the growth rate of deposits accepted by commercial banks as our instrumental variable to check for endogenous regressors with bank credit. Computed from the addendum information of liabilities reported by Indian commercial banks, it captures the change in the growth of deposits accepted by banks from customers (CMIE 2022b).

To understand a financially distressed firm's working capital requirement, we introduce a dummy variable, distress_dummy (FD). Firms are classified as not financially distressed when FD has a value of zero, wherein the firm's Altman Z score is higher than 18; otherwise for financially distressed firms, FD is assigned a value of one (Altman et al. 2017). Similarly, to understand the working capital financing of bank-dependent firms, BankDep_dummy (BD) is our second dummy variable. A firm is bank dependent if it falls within the bottom three deciles of the firm size distribution (see Table 4) and pays no dividends. Bank-dependent firms are assigned a BD value of 1, whereas non-bank-dependent firms are assigned a BD value of zero (Chen and Kieschnick 2018). We present the *t*-test between bank-dependent and non-bank-dependent firms in Table 5 to show significant *p*-values in all firm attributes, except in R&D intensity.

Table 5. *t*-Test between bank-dependent and non-bank-dependent firms.

	***t*-Test between Bank Dependent and Not-Bank Dependent Groups**					
	Mean	**Mean**	**Difference in Mean**			**Pr(|T| > |t|)**
	Bank Dependent	**Not-Bank Dependent**	**(Bank Dependent—Not-Bank Dependent)**	**T Value**	**DOF**	***p* Value**
Age	21.421	26.368	−4.947	35.834	40,469	0.000
Size	2.006	4.717	−2.711	345.420	65,491	0.000
Debt to Equity Ratio	0.979	1.369	−0.391	11.516	31,922	0.000
Asset Tangibility	0.695	0.576	0.119	−38.115	29,857	0.000
Return on Assets	−0.010	0.029	−0.039	45.939	31,078	0.000
Cash Flow Volatility	0.016	0.001	0.015	−67.486	19,745	0.000
Sales Volatility	0.355	0.282	0.074	−26.876	25,711	0.000
R&D intensity	0.009	0.010	−0.001	1.355	1369	0.176
External Commercial Borrowing (ECB)	0.009	11.443	−11.434	17.386	63,449	0.000
Working Capital Requirement	0.286	0.257	0.029	−9.413	27,817	0.000
Cash Conversion Cycle	111.249	104.706	6.544	−4.066	28,823	0.000
Number of Observations	21,916	63,448				

3.4. Estimation and Analysis

We commence our analysis by estimating the correlation between explanatory variables and the dependent variables cash conversion cycle and working capital requirement (see Table 6). Our first model is a fixed effect panel estimation of CCC as a function of firm-level financial indicators and macroeconomic indicators (Chauhan and Banerjee 2018), with financial distress (distress_dummy) and group effect (group_dummy, 1 = firm is associated with a business group; 0 = standalone firm).

$$CCC_{it} = \alpha + \beta_1 p_{it} + \beta_2 q_t + \beta_3 ECB + \beta_4 BankDep_{dummy} + \beta_5 distress_{dummy} + \beta_6 group_{dummy} + IndustryFE_{n=1-9} + YearFE_{(1997-2017)} + \varepsilon 1_{it} \quad (1)$$

Our second model is a fixed effect panel estimate of working capital requirement, wherein

$$WCR_{it} = \vartheta + \omega_1 p_{it} + \omega_2 q_t + \omega_3 ECB + \omega_4 BankDep_{dummy} + \omega_5 distress_{dummy} + \omega_6 group_{dummy} + IndustryFE_{n=1-9} + YearFE_{(1997-2017)} + \varepsilon 2_{it} \quad (2)$$

Here, is p_{it} a vector of firm characteristics and firm performance (see Table 3); q_{it} is a vector of macroeconomic indicators, i.e., bank rate, GDP growth, and volatility index; and IndustryFE captures the industry classifications presented in Table 1. The result of the model depicted by Equations (1) and (2) is presented in Table 7.

Finally, to assess the impact of bank dependency and financial distress on WCF, we construct our third model. With bank credit as our explanatory variable, we construct a two-step least square (2SLS) estimation with deposit_growth as our instrumental variable. We check for endogeneity by introducing this instrumental variable. In our 2SLS estimation, the first step is an ordinary least square model, wherein the dependent variable $\frac{Bank\ Loan}{Total\ Assets} = BL\_TA$ is obtained as Equation (3).

$$BL\_TA = \gamma_0 + \gamma_1 p_{it} + \gamma_2 q_t + \gamma_3 ECB + \gamma_4 BankDep_{dummy} + \gamma_5 distress_{dummy} + \gamma_6 group_{dummy} + \varepsilon 3_{it} \quad (3)$$

Table 6. Correlation of variables.

	Age	Size	Debt to Equity Ratio	Asset Tangibility	Return on Assets	Cash Flow Volatility	Sales Volatility	R&D Intensity	External Commercial Borrowing (ECB)	Working Capital Requirement	Cash Conversion Cycle
Age	1										
Size	0.221 ***	1									
Debt to Equity Ratio	−0.00250	0.0481 ***	1								
Asset Tangibility	0.0611 ***	−0.102 ***	0.00762	1							
Return on Assets	0.0167 *	0.128 ***	−0.0333 ***	−0.254 ***	1						
Cash Flow Volatility	−0.0485 ***	−0.322 ***	−0.0480 ***	0.0956 ***	−0.102 ***	1					
Sales Volatility	−0.161 ***	−0.190 ***	−0.0379 ***	−0.101 ***	0.0880 ***	0.111 ***	1				
R&D intensity	−0.109 ***	−0.00401	−0.0510 ***	−0.0793 ***	0.126 ***	0.0265 ***	0.00191	1			
External Commercial Borrowing(ECB)	0.0532 ***	0.190 ***	0.0117	−0.0396 ***	−0.00313	−0.0208 **	−0.0437 ***	0.00849	1		
Working Capital Requirement	−0.0858 ***	−0.0376 ***	0.0610 ***	−0.221 ***	−0.0978 ***	−0.0431 ***	−0.197 ***	0.0255 **	−0.0336 ***	1	
Cash Conversion Cycle	−0.0644 ***	−0.0254 **	0.0509 ***	−0.179 ***	−0.0622 ***	−0.0381 ***	−0.179 ***	0.0204 **	−0.0338 ***	0.890 ***	1

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

In the second step, the OLS model is run again including the two-stage least square estimator of γ (see Equation (4)), to include deposit_growth as our instrument variable (Kenkel 2016). (See Table 8)

$$\gamma_{2sls} = \left[X^t \times X^{-1}\right] \times \Omega \times X^t \times \Omega^{-1} \times BL\_TA \quad (4)$$

where Ω is expressed as $[Z\,(Z^tZ)^{-1}Z^t]^{-1}$, where Z is the N × q matrix of the instrument variable deposit_growth.

Table 7. Results of the model depicted in Equations (1) and (2).

	Dependent Variable: Cash Conversion Cycle			**Working Capital Requirement**		
	Estimate	**t-Statistics**	***p* Value**	**Estimate**	**t-Statistics**	***p* Value**
Predicted Bank Loan	210.158	3.28	0.001	0.451	3.08	0.002
Age	−0.237	−5.66	0	−0.001	−6.95	0
Size	−0.615	−0.65	0.519	−0.005	−2.53	0.011
Debt to Equity Ratio	0.762	1.66	0.098	0.002	2.5	0.012
Asset Tangibility	−80.956	−21.05	0	−0.21	−23.36	0
Return on Assets	−53.307	−3.49	0	−0.232	−6.41	0
Cash Flow Volatility	−537.57	−2.72	0.006	−1.563	−2.93	0.003
Sales Volatility	129.002	−22.06	0	−0.3	−23.110	0
R&D intensity	259.506	4.26	0	0.475	3.84	0
External Commercial Borrowing (ECB)	−0.015	−6.75	0	0	−6.27	0
Financial Distress	20.021	6.11	0	0.04233	5.89	0
Group Firm	−16.975	−6.52	0	−0.036	−6.11	0. 000
VIX	0.476	2.25	0.025	0.001	1.08	0.281
GDP Growth Rate	−0.494	−0.49	0.623	−0.002	−0.96	0.338
Bank Interest	5.029	4.45	0	0.007	2.84	0.004
Constant	123.717	5.57	0	0.387	7.88	0
Industry Fixed Effects		YES			YES	
Year Fixed Effects		YES			YES	
Number of Observations		16,306			16,306	
Prob > F		0.000			0.000	
R-squared		0.144			0.181	

Table 8. Result of two-step least square (2SLS) estimation with deposit_growth as our instrumental variable.

Dependent Variable: Bank Loan/Total Asset—2SLS	**Estimate**	**t-Statistics**	***p*-Value**
Deposit Growth (Instrumental Variable)	0.00294	6.99	0
Leverage	0.036	0.64	0.522
Size	−0.007	−10.92	0
Asset Tangibility	−0.045	−4.46	0

Table 8. *Cont.*

Dependent Variable: Bank Loan/Total Asset—2SLS	**Estimate**	**t-Statistics**	***p*-Value**
Profitability	−0.07	−2.42	0.016
Cash Flow Volatility	−0.115	−0.19	0.853
R&D Intensity	−0.552	−6.44	0
Interest Coverage Ratio	0	7.45	0
Financial Distress	0.024	2.66	0.008
Group Firm	−0.029	−1.480	0
Constant	0.2	11.730	0
Number of Observation	16,306		
Prob > Chi^2	0.000		
R-Squared	0.206		

4. Findings and Interpretation

Our study presents three distinct empirical models to understand the role of bank credit and ECB in working capital financing, from which the findings are consistent across all models (see Table 9); this ascertains the robustness of results. Based on this robustness, we underscore the accuracy of our measure of bank credit supply as the growth rate of deposits accepted by commercial banks. As our instrumental variable, it captures the change in the growth of deposits accepted by banks from customers, indicating an otherwise unobservable supply factor. Robust results across models further indicate the contextual difference between working capital management policies to be adopted for developed versus emerging market firms. In the EME context, bank credit and external borrowings play an evident role in both the liquidity perspectives of WCR and the net trade cycle of CCC. Firm-level WCP thus needs to monitor and mitigate exogenous shocks to credit supply. This is in agreement with the role of money supply as a macroeconomic antecedent of WCR discussed by Marjit and Bhattacharyya (2022). Our empirical models explain the convex relationship between WCF and the profitability of emerging market firms, as observed by Panda and Nanda (2018). We argue that since bank credit and external borrowings play a significant role in both CCC and WCR, considering endogenous factors such as price margin, leverage level, and ownership structure in isolation from the supply of credit will be insufficient to explain the non-linear relationship between working capital and profitability in the extant literature (Mahmood et al. 2023; Pratap Singh and Kumar 2014). Our findings support recent empirical models of Ogachi et al. (2020), wherein measures of working capital emerged as one of the most significant factors of predicting firms' sustenance and a predictor of corporate bankruptcy. In agreement with Platt and Platt (2008), our model of CCC empirically proves that shorter operating cycles and higher working capital turnover may reduce the risk of financial distress of firms.

Firm Characteristics, Performance, and Bank Credit: Cross-Model Comparison

Considering that domestic deposit growth is related to the supply of bank credit in terms of lending to firms, factoring deposit_growth through bank loans improves the predictability of CCC and working capital requirement. Firm characteristics such as firm age and asset tangibility become insignificant in our 2SLS model, reaffirming the need for EME firms to frame flexible working capital policies beyond endogenous firm characteristics.

While CCC and WCR are different for different firm types, our findings corroborate H_1, i.e., the quantity of bank loans received increases the cash conversion cycle and working capital requirement. This is in agreement with the empirical model presented by Zeballos et al. (2013), which shows that short-term debt inhibitions, as a characteristic of EME firms, may inflate working capital requirement. We hypothesized in H_2 that de-

pendency on bank loans has a significant positive impact on the cash conversion cycle and working capital requirement. This is corroborated by our findings, as firms with higher bank dependency have longer cash conversion cycles and more working capital requirement. At the firm level, this reflects the need for an alternative source of financing for WCR, including supply chain financing and novel sources such as platform credit financing (Marak and Pillai 2018; Rath et al. 2021). With the significant negative effect of group affiliation, we accept H_3 that firms with business group affiliation have a shorter cash conversion cycle and lower working capital requirement compared to firms with no business group affiliation. The internal capital market does emerge as a positive contributor to WCM. We accept H_4 that financially distressed firms have a longer cash conversion cycle and higher working capital requirement compared to non-distressed firms. This implicates the role of banks in worsening credit misallocation, wherein higher costs or lack of access to credit may exacerbate financial distress in smaller EME firms, leading to sectoral disruptions (Li 2018).

Table 9. Findings from Model 1: Fixed Effect Panel Estimate of CCC; Model 2: Fixed Effect Panel Estimate of WCR; and Model 3: 2SLS to Predict Change in Bank Loan.

Variables	Model 1: Fixed Effect Panel Estimate of CCC	Model 2: Fixed Effect Panel Estimate of WCR	Model 3: 2SLS to Predict Change in Bank Loan
Firm Characteristics: Size, Age, Asset Tangibility, group	Significant and negative		Firm Size is insignificant
Firm Performance: Sales volatility, Profitability, RoA, Gross Profit Margin, PBIT, Operating Cash Flow, R&D Intensity, Price/Book Value	R&D intensity is significant and positive		
Bank Credit: Leverage, Debt: Equity Ratio, Interest Coverage Ratio, Financial Cost, Bank Loan, Bank Dependency	Debt to Equity insignificant Bank dependency is significant and positive	Debt to Equity insignificant	Debt to Equity is significant and positive
External Commercial Borrowing: ECB	Bank dependency is significant and negative	Bank dependency is significant and positive	
Others: Financial Distress, GDP growth	GDP growth is insignificant However financial distress is significant	Significant and negative	

A novel empirical finding of consistency across the three models is the significance of external commercial borrowing (ECB). Corroborating H_5, our study presents the significant negative impact of external borrowings on the cash conversion cycle. However, international credit markets may lead to higher productivity and improved export competitiveness in Indian manufacturing firms, thus indicating higher working capital financing in Model 2 and increased access to bank credit in Model 3.

5. Conclusions

The novel conceptual advancement of our research is the consideration of credit supply as a determinant of working capital requirement instead of an antecedent. In unlisted standalone emerging market firms, bank credit may not be considered as a precursor for modeling working capital requirement. Further, the role of bank credit is accentuated for EME firms by their access (or lack of it) to international capital markets.

The industry implications of our research are threefold. Empirically, our findings present a unique perspective that firms' age and size are negatively correlated with CCC and WCR. Our measure of working capital in terms of CCC is high for younger and smaller firms, implying practical challenges in securing WC with lesser influence in ne-

gotiating credit terms as borrowers. In other words, they are less efficient in managing working capital.

Secondly, since asset tangibility is also negatively correlated with CCC and WCR, we note that access to capital is more difficult for firms when fixed assets, which serve as security/collateral in securing loans, are less. This has further implications for small-scale manufacturers who run a rented asset model. Due to RoA's negative impact on CCC and WCR, firms with higher operating profits and higher returns can fund their WC through internal accrual. This is consistent with neo-classical theories of firm efficiency, in which firms with higher economies of scale are more efficient in fund utilization. Highlighting the role of bank credit, we recommend that emerging market firms, especially manufacturing sector borrowers, adjust inventory levels, improve the operating cycle, and lower short-term debt exposure to mitigate financial distress.

Finally, we show that access to and usage of foreign currency borrowings boost the internationalization of the firms, which further improves competitiveness and efficacy, in addition to improving working capital requirement. Hence, firms with external borrowings have shorter CCC and reduced WCR. Our empirical models prove that flexibility in working capital management by including alternate sources of finance such as external borrowing reduces dependency on institutional credit and improves liquidity. However short-term external borrowing for WCF may create higher friction due to exchange rate conversion, resulting in costlier trade credit (Devalkar and Krishnan 2019). To mitigate the risk of currency mismatch, we recommend that firms hedge these short-term foreign currency borrowings as part of the internal working capital financing policy. Firms may also consider diversification and natural hedges, such as services and information technology-enabled services, to cushion against foreign exchange depreciations (Paramati et al. 2016).

We make important methodological contributions to modeling working capital requirement. Our 2-SLS model provides robust results when we combine CCC and WCR. Through this model we note that the debt–equity ratio becomes relevant, whereas firm characteristics such as age, size, and asset tangibility, which are widely used as determinant of WCR in empirical investigations, become irrelevant. Contrary to the existing research of Mahmood et al. (2023); Moussa (2019); and Pathak (2019), this is an important finding that emphasizes that even smaller firms with well-managed, low debt exposure may have improved access to WCF. Bank dependency remains significant, wherein smaller firms and those with no dividend payout continue to have longer CCC and less efficient WCR. The use of external borrowings to finance WC is significant due to the less developed credit markets in EMEs such as India; this also implies capital expenditure, import of capital goods, and imported inputs in manufacturing. Hence the impact on the manufacturing sector is significant. Methodologically, we are able to advance WCR modeling by factoring in exogenous shocks and the idiosyncratic financial distress of firms.

For institutional lenders, we note that misallocation of credit is limiting access to bank credit for smaller as well as financially distressed firms. As a phenomenon, the misallocation may be more profound for banks in developing nations compared to those in developed nations (Singh and Gupta 2017). However, it constitutes a systemic inhibition to domestic manufacturing as a sector. Access to bank credit may be increased to revive firms with performance-linked lending schemes. To mitigate exogenous credit supply shocks, our measure of bank credit supply may be used to predict inflection points and financial distress, modeled with macroeconomic indicators such as interest rates, exchange rates, and money supply.

5.1. Policy Implications

Our study has important policy implications for the manufacturing sectors of EMEs. First, our results indicate that WCF is negatively impacted by financial distress but deviates from macroeconomic fundamentals, such as the GDP growth rate. This indicates a unique plight of emerging markets plagued by deteriorating sectoral health of capital-intensive sectors such as Indian manufacturing, despite an upward trend of GDP. Policy makers

thus need to revive manufacturing firms with a sectoral focus. Further, we show that bank credit and external borrowings play a significant role in both the liquidity perspectives of WCR and the net trade cycle of CCC. Emerging market regulators and decision makers thus need to educate firms, especially smaller enterprises, about the needs as well as the channels of monitoring and mitigating exogenous shocks to credit supply. Specifically, at the firm level, this reflects the need for awareness about alternative sources of financing for WCR, including supply chain financing and novel sources such as platform credit financing. Policymakers in this sector should encourage such alternate sources of financing, especially for the small and medium enterprises who need more WC to grow. Finally, business group affiliation and the level of distress of manufacturing firms also have a significant impact on WCR. Separate policies for working capital financing should be promoted by policy makers to be adopted by lenders for firms of these different sub-groups to maintain the solvency of the firms and protect their shareholders' interests.

5.2. Limitations and Scope of Future Research

We followed the definition of bank dependency of Chen and Kieschnick (2018). This definition is based on the size of firms and the dividend paid. Such a definition mainly implies that if a firm's size is small, its probability of being identified as bank dependent is greater compared to that of other firms. We believe that there is a scope to improve this identification logic. We can also refine the approach to understanding bank dependency based on the number of bankers that the firm reports in its annual financial statements.

In our sample set of firms, the percentage of firms that received external borrowings is not very high (~5%), and the use of such a channel of borrowing depends on other factors that may not be driven by the firm financials. Such external policy-related factors in firms' foreign currency borrowing for working capital financing are confounding in our analysis.

As a scope of future research, we may examine whether our findings hold for firms' constraints of financing. We can also estimate the model in a generalized method of moments (GMM) or quasi-likelihood framework for more robust findings and forecasting. We can study the components of working capital such as cash, inventory, and trade credit, and examine the factors that influence them.

In recent research, Barros et al. (2022) posit that shorter CCC and lower WCR have been associated with a higher allocation for Environmental, Social, and Governance (ESG) investing. Our study can be further extended to understand the role of bank credit in influencing ESG investment of firms by lowering working capital requirement.

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Note

[1] Accounting periods were considered, with financial years beginning April 1997 to March 2018.

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