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Capital investment, working capital management, and firm performance: Role of managerial ability in US logistics industry

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ABSTRACT

This paper studies the interlinkage between capital investment, efficiency in working capital management, managerial ability, and firm performance, for a sample of transportation and logistics firms from US between the period 1988 to 2018. Our results indicate that able managers increase the investment in CAPEX and also concurrently engage in more efficient working capital management. We also show these managers help achieve greater firm performance through visible mediation effects of enhanced CAPEX and optimum use of working capital. We posit that managers with higher ability are in continuous pursual of optimizing firm performance, which motivates them to engage in higher levels of CAPEX vide a trade-off with short-term investment in working capital. Given the challenges and costs of raising external funds, able managers contemporaneously engage in more efficient working capital management to release excess working capital funds, and utilize them for enhancing CAPEX levels. Additionally, we show that the efficiency in working capital management emanates from efficiency in managing inventory, managing receivables as well as managing payables simultaneously. Our results are robust and remains unaltered after controlling for several firm-specific and macroeconomic parameters as well as potential endogeneity concerns.

1. Introduction

This paper studies the interlinkage between capital investment (CAPEX henceforth), efficiency in working-capital-management (WCM henceforth) and the role of managerial ability (MA henceforth) in maximizing firm performance for a sample of transportation and logistics firms from US between the period 1988–2018. Fazzari and Petersen (1993) highlight the linkage between CAPEX and WCM and posit that, although altering the levels of investment in CAPEX may be difficult due to higher costs, it is not so with investments in working capital. Therefore, firms can choose to alter the levels of investment in working-capital, based on their requirement of CAPEX. Other extant literature has separately studied the relationship between MA and investments (Petrou and Procopiou, 2016; Andreou et al., 2017) and MA with WCM (Ujah et al., 2020). In this paper, we argue that there is an interlinkage between CAPEX, WCM, MA, and firm performance, and hence all these dimensions should be studied jointly.

Despite the significance of MA in understanding the contributions of managers in business, there are different perspectives regarding the influence of individual managers' actions on investment decisions. The 'Upper echelon' (UE) theory emphasizes that managers' characteristics, beliefs, and actions are important determinants of firm outcomes (Hambrick and Mason, 1984). This theory

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recognizes that complex and uncertain situations are subject to interpretation due to bounded rationality and external forces (Hambrick, 2007; DiMaggio and Powell, 1983). The arguments of the UE theory also substantiate the 'agency theory' (Jensen and Meckling, 1976; Jensen, 1986) viewpoint that, managerial self-interest may lead to actions that are not in the best interests of the company's investments, leading to either overinvestment or underinvestment. The problems of moral hazard and adverse selection create information asymmetry between managers and capital providers, which in turn affects investment decisions. Some papers claim that managers overinvest for their personal benefits (Fluck and Lynch 1999; Jensen and Meckling 1976; Stulz 1990) but some other studies suggest that managers underinvest when their reputation is at stake from their investments or their payout horizon is limited (Campbell et al., 1989; Hirshleifer and Thakor 1992; Smith and Watts, 1992). In this paper, we show that more able managers strike a fine balance between short-term (internal) working capital investments and long-term (external) capital investments which leads to higher firm performance.

It is necessary to study the interrelationships between capital investment, working capital management efficiency, the role of top management personnel, and enterprise performance, especially in the context of logistics and transportation industry. This is because the logistics and transportation industry is a capital-intensive industry and the effective management of capital is critical for the success of firms operating in this industry. Ding et al. (2013) demonstrate that efficient WCM can allow firms to channelize their excess financial resources towards capital investments and alleviate financial constraints. Corporate finance literature (McConnell and Muscarella, 1985; Trueman, 1986; Copeland et al., 1994), emphasizes the importance of investing in positive NPV projects to provide firms with access to cutting-edge knowledge, products, and technology, thereby maintaining their competitive advantage and maximizing firm performance. More able managers are expected to possess a value-oriented assessment of investment activities (Jian and Lee,2011; Falato et al., 2015; Andreou et al., 2017) and thus engage in more CAPEX. Investments in value-enhancing projects need deployment of scarce capital where WCM can play a crucial part because it frees up a part of the scarce capital (Buchmann et al., 2008; Frankel et al., 2017). WCM's significance lies in its direct impact on a firm's liquidity and profitability, which, in turn, influences the primary goal of maximizing firm value (Aktas et al., 2015; Laghari and Chengang, 2019). As suggested by Ek and Guerin (2011), many companies have substantial opportunities to enhance their WCM efficiency. Ineffective management of working capital increases the need for expensive external financing, thereby curtailing investment opportunities (Hill et al., 2010) and amplifying credit risk (Aktas et al., 2015). It is thus very much likely that the dimensions of efficient WCM, CAPEX, managerial ability, and firm performance are all interrelated. Despite WCM's critical role, the existing literature has neither adequately emphasized it nor examined the inter-linkage between WCM and CAPEX and the role of managerial ability to optimally use these resources, especially for a capital-intensive industry like transportation and logistics industry. The current study aims to make a contribution in this context.

We specifically choose the logistics industry to examine these interlinkages, and the reasons for the same are as follows: *First,* the rapidly growing contribution and critical importance of the logistics industry to macro-economic developments in most economies[1], have drawn considerable attention of the academic researchers to it. An emerging body of research, indicates that the development of the logistics and transportation sector has a direct and positive effect on economic development. This is because access to logistics infrastructure, like seaports, roadways, and airports, lends support to industrial growth by efficient allocation of goods and services (Saidi et al., 2020). Also, the business location and the scale of business chosen by a firm is contingent on the transport cost (Fujita and Krugman, 2004) which is affected by the availability of transportation and logistics infrastructure. Further, increased efficiency in the logistics operation boosts international trade between countries, by reducing time and costs of production, thereby enhancing the manufacturing process and harmonising the flow of information (Behar and Venables, 2011). *Second,* we pick our choice on the premise that CAPEX potentially should be higher in transportation and logistics industry in the form of fixed assets such as vehicles, warehouses, and technology infrastructure, because of some visible advantages that CAPEX generates here (Alexandridis et al., 2018). For example, CAPEX in transportation and logistics industry frequently involves investing in proprietary and advanced technology like blockchain, RFID, satellite-based GPS navigation systems, smart logistics, and other AI enabled devices etc. (Harris et al., 2015; Hastig and Sodhi, 2020; Toennissen and Teuteberg, 2020), acquisition of competing firms, engaging in strategic partnerships etc. which can provide a significant competitive advantage to investing firms (Thatcher and Oliver, 2001). Further, the generic advantages of CAPEX like creation of larger tangible assets and enhanced balance sheet size to generate increased debt capacity, (Campello, 2006)[2], easing of financial constraints (Almeida and Campello, 2007), more bargaining power with suppliers and customers, and bigger depreciation tax shields resulting in higher reported profits (Petersen and Rajan, 1997; Wasiuzzaman and Arumugam, 2013), are also critical in transportation and logistics industry like any other firm.[3] In fact, preliminary analysis of our data shows that average CAPEX is

[1] According to some recent research reports "the global logistics industry was worth 10.32 Billion USD in 2017 and it is estimated to grow to 12.68 Billion USD by 2023 with a CAGR (compound annual growth rate) of 3.49% between 2017 and 2023." Increased global trades and advancements in information and transportation technology in recent years is the primary identified reason for such predicted growth. Although the Asia-pacific region is estimated to be the leading player in this growth story, the US is also expected to play a major role in it. Also, the US economy is expected to be critically impacted by its logistics and transportation industry, employing almost 7% of all US jobs in future.https://www.prnewswire.com/news-releases/global-logistics-market-2017–2018–2023—market-is-estimated-to-grow-to-12–6-bn-300708730.htmlhttps://www.statista.com/statistics/255341/leading-economies-ranked-by-logistics-performance-index/https://www.bls.gov/news.release/pdf/ocwage.pdf.

[2] Balance sheet size can also be increased with additional investment in working capital. But excess working capital can arguably have an adverse impact on profitability and can pose increased threat of financial distress and bankruptcy (Ek & Guerin, 2011).

[3] One can argue that operating lease could be a possible alternative of CAPEX in the logistics industry (Imhoff Jr et al., 1997) and create an avenue to generate tax benefits in the form of lease rentals. However, as mentioned above, investment in CAPEX has several other advantages, which probably outweigh the advantages of such alternatives.

relatively higher in the transportation and logistics industry compared to other industries. Hence, effective working capital management can help optimize the use of these capital assets and reduce the need for external financing, improving profitability and firm performance.[4]

Third, seasonal fluctuations in demand are typically more in logistics and transportation industry (Kantari et al., 2021) which can result in uneven cash flows, and effective working capital management can help maintain sufficient cash reserves to avoid cash shortages. Working capital management is thus vital for logistics and transportation firms due to these unique aspects of their operations. Effective management of working capital also requires strong managerial ability, including planning, execution, monitoring, and controlling the short-term financial resources. Hence, learning about the interlinkage between managerial ability, working capital management, leading to firm value maximization can help logistics firms identify and develop necessary skills, attract investment capital, and succeed in a highly competitive industry. These considerations motivate us to make the transportation and logistics industry a choice for our analysis.

Demerjian, Lev, and McVay (2012) argue that MA is demonstrated through the capacity of managers to create, manage, and improve firm performance. The performance of the firm, in turn, is contingent upon its productivity, as higher productivity enables the production of more output with fewer inputs, ultimately enhancing shareholder value (Copeland et al., 1994). Moreover, Copeland et al. (1994) contend that capable and qualified managers often engage in investment activities like CAPEX which fosters growth and that align with the firm's overall objective. Consequently, we posit that managers with higher ability are more likely to undertake increased CAPEX in their continuous pursuit of augmenting firm value. However, accessing funds for value-enhancing CAPEX primarily relies on external sources such as capital market transactions or internally generated funds. The proponents of the "Pecking order theory" (Myers and Majluf, 1984) predict that, due to information asymmetry, raising external funds tends to incur higher costs and challenges compared to utilizing internally available funds. Therefore, it is only natural for managers (with higher ability) to often seek to generate internal funds by efficient WCM to release locked-up funds. Consequently, it is highly plausible that MA, CAPEX WCM, and firm performance are interconnected dimensions. Surprisingly, as already mentioned before, no previous studies have adequately addressed this issue, particularly within the transportation and logistics industry. Thus, the current study draws its primary motivation from this premise to fill this research gap and provide insights into the relationships between MA, CAPEX, WCM, and firm performance. Using a sample of 3,811 US logistics firm-year observations from 1988 to 2018 attempts to explore these inter-linkages. We specifically ask the following questions: *First,* whether MA enhances the firm performance for logistics firms? *Second,* whether CAPEX and WCM efficiency of logistic firms are positively associated with MA? *Third,* whether such relationships between MA and firm performance are mediated through CAPEX and efficient WCM channels? The idea behind bringing all these dimensions together is to get a holistic understanding of whether able managers contemporaneously modulate long-term and short-term investments and how it impacts the firm performance.

We use MA score computed by Demerjian et al. (2012) for all these firm-year observations as the proxy for MA. We measure WCM efficiency by estimating cash-conversion-cycle (CCC henceforth) in line with extant literature (Tong and Wei, 2011; Ding et al. 2013; Wang, 2019) and Tobin's Q as the proxy for firm performance. We document some interesting findings concerning the questions highlighted above. Our primary results show that MA and firm performance are positively related i.e., managers with greater ability, engage in maximising firm performance. Simultaneously, we also find that MA and CAPEX are positively related and MA and CCC are negatively related. This indicates that managers with higher ability undertake higher investments in CAPEX and simultaneously engage in more efficient management of working-capital (reduced CCC). We also show that more able managers achieve greater firm performance through the mediation effects of enhanced CAPEX and efficient WCM. This analysis helps to highlight the importance of capital investment and efficient use of working-capital-management in enhancing firm performance in the presence of able managers in the logistics and transportation sector. Further, we also show that the efficiency in WCM emanates from efficiency in managing inventory, accounts receivables as well as payables. These findings highlight the importance of inventory, customer and vendor management for firms and can have critical implications for stakeholders in logistics and transportation industry. Our results remain robust after controlling for several firm specific variables and macroeconomic parameters as well as potential endogeneity concerns.

Our study is different from some of the related previous studies and makes multiple contributions. *First,* corporate finance theory posits that managers ideally must focus on three vital financial dimensions of their firm: working-capital, capital-structure, and capital-budgeting. Although there are many studies that examine the association of both capital-budgeting and capital-structure with MA (Andreou et al., 2017; Habib and Hasan, 2017; Jian and Lee, 2011); that is not the case for working-capital. We make an attempt to address this gap in the literature by studying the relationship between MA and WCM. Literature on agency theory of firms posit that managers on the average, engage in satisfying their vested interests and rent-seeking actions, resulting in a net benefit for themselves (Chari et al., 2019; Jensen 1986; Jensen and Meckling 1976; Myers and Majluf 1984). But it is also suggested that, managers with more ability may be focused on long-term goals than short-term. Thus, they might be more focussed on the long-term CAPEX and ignore the short-term WCM. However, our findings indicate that MA is positively associated with CAPEX as well as WCM efficiency. We show that higher MA leads to undertaking more CAPEX, which in turn leads to conscious efforts to manage working-capital better and free locked up funds. This particular result, we think, is new to the literature. These findings hint at critical managerial insights specifically for the capital-intensive logistics and transportation industry (Alexandridis et al., 2018). The findings highlight that able managers do tend to engage significantly in CAPEX such as new technology, equipment, and facilities to increase capacity, efficiency, and quality of service, which is vital for the survival of firms in the highly competitive logistics and transportation industry. Further, it is also highlighted that

[4] The mean (median) of CAPEX scaled by total assets of all U.S. firms during our study period is 5.6% (5.3%), whereas that for the transportation and logistics industry is way higher at 9.9% (7.3%).

effective WCM helps firms manage their liquidity, release scarce resources tied up in operations for such critical investments and other strategic purposes. Prior research on logistics industry did explore some finance issues in the past, (capital structure issues, role of ownership concentration or corporate governance on firm performance, performance of IPOs etc.) but the questions addressed in this paper remain mostly unexplored. The findings of this study should therefore, contribute to the extant literature on logistics, supply-chain and operations management. *Second,* we delve deeper into the association of MA with WCM, by breaking down CCC into its components, namely the inventory-period, the receivables-period and the payables-period and establish that efficiency in overall WCM emanates from efficiency in each of these components. We think that this particular result is not reported before, specifically in the context of logistics and transportation industry. *Third,* we establish that these relations hold even after controlling for additional firm level and macro-economic factors like financial constraints, proximity to financial distress, macro-economic uncertainty and geopolitical risks. Impact of some of these factors also, have not been explored before in extant literature.

In summary, the findings of the study have practical implications for the logistics industry, emphasizing the importance of effective WCM and strategic CAPEX decisions, and advancing our understanding of managerial ability in financial decision-making process in the industry. To the best of our knowledge, such elaborate exploration of the interlinkages between four critical dimensions namely: MA, CAPEX, WCM efficiency, and firm performance specifically for logistics industry firms, have not been undertaken before. We hope these findings, will augment the existing literature on MA, CAPEX, WCM, and logistics and operations management.

The remainder of the paper is structured as follows. The next section presents the background theory, related literature, and hypotheses. Section 3 discusses the data and methodology used; Section 4 offers the main empirical results and discussions of the results; Section 5 offers additional analysis and robustness check. Section 6 discusses the managerial insights and Section 7 concludes the paper followed by references, tables and appendices.

2. Theoretical underpinning, related literature and hypotheses

2.1. Theoretical underpinning

According to the 'behavioral theory' of firms developed by Cyert and March (1963), organizations can be defined as a "coalition of managers" who possess opportunistic tendencies and make decisions based on their ability to conform to or alter the process of organizational flow. Building upon this theoretical framework, the 'dynamic capability theory' asserts that firms operating in a rapidly evolving technological environment create wealth by leveraging the ability of managers to adopt and integrate internal and external resources (Teece et al., 1997). The agency theory (Jensen and Meckling, 1976; Jensen, 1986) posits that managers play a critical role in allocating and managing financial resources and act as agents with significant control over these resources (Augier and Teece, 2009). Furthermore, two competing theories – the 'efficient contracting hypothesis (Williamson, 1975) argue that managers consider the long-term goal of the organization and take the decision that economizes the transaction costs and improves the firm performance. Whereas the 'rent extraction hypothesis' (Jensen, 1986) argues that managers try to extract economic rent from the organization by making suboptimal investment decisions for their own private benefit, leading to the loss of the value of the firm. In this paper, we argue that more able managers possess a better knowledge of the business environment, and estimate better investment timings (Demerjian et al., 2013) thereby improving the firm performance (Chemmanur et al., 2009). Low-ability managers, on the contrary, are more likely to engage in opportunistic behaviour, and seek personal benefits resulting in suboptimal investments and firm performance.

The Upper Echelon (UE) theory, as proposed by Hambrick and Mason in 1984, functions as a unifying framework that connects and integrates these theoretical arguments. The UE theory posits that the characteristics, beliefs, and actions of managers significantly influence a firm's choices and outcomes. It is widely acknowledged as the dominant framework for understanding the concept of managerial ability (Anggraini and Sholihin, 2023) which is one of the main considerations of our paper. Previous studies applying the UE theory have found that managerial ability plays a crucial role in various aspects of firm performance, including corporate investment decisions (Gan, 2019), firm disclosure (García-Sánchez and Martínez-Ferrero, 2019), reporting quality (Abernathy et al., 2018; Demerjian et al., 2020), firm performance (Fernando et al., 2020), corporate social responsibility (Yuan et al., 2019) and dividend policy (Sarwar et al., 2020). Managerial ability thus plays a crucial role in the strategic allocation of financial resources and in achieving the firm's objective of maximizing shareholder wealth.

2.2. Working capital management, managerial ability and firm performance

In addition to capital budgeting, capital structure, and pay-out policies, WCM is another major policy issue within the domain of corporate finance (Buchmann et al. 2008; Frankel et al., 2017). WCM has a direct impact on a firm's liquidity and profitability and hence can critically impact the objective of maximizing firm value (Aktas et al., 2015; Laghari and Chengang, 2019). However, this fact lacks acknowledgment in extant literature (Baker et al., 2017), and there seems to be a lack of emphasis on WCM in the corporate finance literature, compared to capital structure and capital budgeting which are more extensively studied. This could send a wrong signal that managers are relatively less concerned about a firm's day-to-day operating activities.

Extant literature on WCM advocates practising two distinctive tactics for WCM: aggressive and conservative. The aggressive approach proposes a decrease in the firm's investments in working capital, while the conservative approach proposes the reverse. Proponents of the conservative approach claim that, incremental investment in working capital should affect firm performance positively, particularly for firms operating currently at lower levels of working capital. They argue that an enhanced working-capital levels help firms to grow by escalating sales and earnings and also reduce the marginal cost of inventory procurement, input price

volatility and stock-out costs (Fazzari and Petersen 1993; Corsten and Gruen 2004). Adopting a relatively lenient credit policy may positively affect a firm's top-line growth because it grants for price differentiation, serves as an assurance of product quality, and reinforces long-term customer relationships (Brennan et al., 1988; Long et al. 1993). On the contrary, proponents of the aggressive approach posit that, excessive investment in working capital may adversely impact firms. Additional investments in working-capital involve incremental financing and opportunity costs (Kieschnick et. al. 2013). A large quantum of funds locked up in working-capital might also encumber firms from taking-up value-enhancing CAPEX (Ek and Guerin, 2011). Kieschnick et. al. (2013) highlight that investment in working-capital could reduce current free-cash-flow, but it can critically impact future free-cash-flow. A well devised WCM policy is thus critical in integrating this misalignment. These latent benefits and costs of aggressive and conservative WCM indicate the criticality of striking an optimal level of working-capital by firms and highlight the quintessential need for efficient WCM. It is unlikely that efficient managers will not take notice of that proposition. Ujah et al. (2020) posit that able managers should have a greater knowledge of a firms' operating situation and hence they should be able to recognize the significance of efficiently managing their firms' working-capital, because WCM is clearly a critical component of the firms' operating environment. Working from this premise we present the following hypotheses:

Hypothesis 1. WCM efficiency (reduced CCC) is positively associated with MA.

Hypothesis 2. Efficient working capital management (reduced CCC) improves the firm performance.

Hypothesis 3. Efficient WCM (manifested through reduced CCC) mediates the relationship between MA and firm performance (Tobin's Q).

2.3. Managerial ability, capital expenditure (CAPEX) and firm performance

Corporate finance literature proclaims that investments in positive NPV[5] projects increase firm-value. CAPEX and R&D expenditures are expected to provide the firm, with access to cutting-edge knowledge, products, and technology, so that they can maintain their competitive advantage and maximise value (Copeland et al., 1994). Copeland et al. (1994), also suggest that more able managers usually possess a value-oriented assessment of investment activities and respond to the prospective investments in a way that can generate incremental value for the firm. Empirically, it has been established that even announcements of CAPEX by firms tend to have an immediate positive impact on firm performance (McConnell and Muscarella, 1985, Trueman,1986). Agency theory proclaims that managers are supposed to enhance firm performance and thus undertaking CAPEX might act as a signal of MA. Some studies argue that more able managers may not exhibit opportunistic rent-seeking behaviour that impairs firm value, since such activities could stain their public image (Falato et al., 2015; Andreou et al., 2017). They show that there is a positive relationship between MA and capital investment undertaken, particularly during crisis periods, when external resources are scarce. They argue that, these managers mitigate the underinvestment problems during crisis periods, by using their enhanced ability to access valuable resources and generate additional firm value. Jian and Lee (2011), show that the market's reaction to announcements of CAPEX is higher for firms with more capable managers. Thus, to protect their reputation, managers with greater ability are likely to consider CAPEX decisions more seriously to enhance firm-value and signal their quality to outside world (Gan, 2019; Habib and Hasan, 2017). A counter argument is also posited in extant literature that, apparently more able managers may be overly sensitive to their reputation and may even chase risky investments or undertake earnings-management to preserve their reputation, although these actions could be detrimental for the firm (Petrou and Procopiou, 2016). In summary, extant literature makes multiple arguments, that MA is expected to be associated with the quality and efficiency of CAPEX undertaken by firms and that could be in order to enhance firm value. Working from this premise we present our next set of hypotheses:

Hypothesis 4. Capital expenditure undertaken (CAPEX) is positively associated with MA.

Hypothesis 5. Capital expenditure undertaken (CAPEX) improves the firm performance.

Hypothesis 6. Capital expenditure (CAPEX) mediates the relationship between MA and firm performance (Tobin's Q).

2.4. Mutual influence of WCM, CAPEX, MA and firm performance

The theoretical framework of CAPEX suggests that this investment decision is irreversible in nature (Bernanke, 1983; Dixit et al., 1994) whereas the short-term working capital are more flexible and reversible (Fazzari and Petersen, 1993; Appuhami, 2008). Later in the survey paper Graham and Harvey (2001) show that managers consider 'financial flexibility' as one the most crucial elements when they take their investment decisions. 'Financial flexibility' helps the firm to reduce the dependency on external financing in the event of exogenous shocks (Gamba and Triantis, 2008), thus 'financial flexibility is also considered to be an important constituent of capital structure decisions (DeAngelo and DeAngelo, 2007).

The theory of 'investment under uncertainty' postulate that the irreversible nature of capital investment is one of the major drivers of capital investment decisions (Dixit et al., 1994). Managers modulate the short-term working capital (which is relatively more reversible in nature) to finance their capital investment, especially in capital-intensive industries like asset-heavy logistics and

[5] Net present value.

transportation (Fazzari and Petersen, 1993). While designing the financial policies of the firm, managers often consider this financial flexibility (Graham and Harvey, 2001; Almeida and Campello, 2010).

We find very few studies exploring the relationship between WCM and CAPEX. Appuhami (2008) and Ding et al. (2013) report a negative relation between investment in working-capital and CAPEX of the firms, and posit that working-capital competes with CAPEX due to the limited pool of available funds. In a frictionless perfect capital market, firms have unlimited availability to external finance, which becomes a perfect substitute for internal funds (Modigliani and Miller,1958). However, in practice, limited availability and challenges of raising external funds, put a constraint on a firm's capital investment decisions. In this state, working-capital funds compete with tangible fixed investments and demands for its optimal usage. Ek and Guerin (2011) posit that there is an enormous opportunity for enhancing the efficiency of WCM in many companies[6]. Inappropriate management of working capital increases the requirements of costly external financing and thus reduces the investment opportunities (Hill et at., 2010) and subsequently increases the credit risk of the firm (Aktas et al., 2015). The reversible nature of working-capital can help firms to strike a balance in their short-term and long-term investment decisions and enhance firm-value. The basic argument is that, firms try to maintain a stable fixed-investment path, ceteris-paribas, as it is expensive to change the level of irreversible fixed investment. The scarcity of external funds, may hamper this objective even further.

Following this argument, Ding et al. (2013) show that aggressive management of working capital helps firms to channel the slack financial resources to capital investments and helps to mitigate financial constraints. In a more recent paper, Boisjoly et al. (2020) show that there is a strong monotonic decline of net working capital in the transportation industry over the past three decades. Banerjee and Dutta (2022) suggest that firms switch their investments from working capital to CAPEX when the economic environment is more favourable for investments.

Thus, we argue that able managers exploit this complementarity between short-term working capital funds to finance long-term capital investments simultaneously. Based on the above discussion we hypothesize that.

Hypothesis 7. CAPEX minus NWC (net working capital) is positively associated with MA.

Hypothesis 8. CAPEX minus NWC (net working capital) improves the firm performance.

Hypothesis 9. CAPEX minus NWC (net working capital) mediates the relationship between MA and firm performance (Tobin's Q).

Based on the above literature review, and the hypotheses formulated, we posit the flow of linkages between the principal dimensions of interest in this study as depicted in Fig. 1 below:

As shown in the figure, we posit a strong interlinkage between MA and firm performance (proxied by Tobin's Q in this study). However, higher MA may also lead to efficient WCM (reduced CCC) and investment in CAPEX, which may also act as mediators to enhance firm performance.

2.5. Previous research on logistics industry concerning corporate finance issues:

Although we find some studies which looked at equity market performance, systematic risks, and related questions specifically for logistics industry firms (Merikas et al., 2009; Kavussanos et al., 2003), research concerning the fundamental corporate finance issues, namely capital structure, capital budgeting, dividend policy and WCM, specifically within logistics industry remains few and far in between. Jing et al. (2012) examined financing patterns in a distribution channel with capital constraints and show that to improve the overall supply chain efficiency, through bank financing. Lu et al. (2012), demonstrate that corporate governance has a significant impact on performance of firms in US airline industry. Similar results are presented by Andreou et al. (2014) using a sample of firms from the US maritime industry. Drobetz et al. (2016) highlight how cash flow shocks influence the financing and investment decisions of shipping firms in different economic environments. Ahrends et al. (2018) show that shipping firms are more conservative as far as cash holdings are concerned compared to their peers from other industries. Hu (2017) presents a theoretical model to demonstrate the interlinkage between debt maturity structure and inventory management of firms. Badri et al. (2017) proposes a multi-product and multi-period model for operational and strategic decision making and posit that managers focus their attention on controlling the value drivers. Devalkar and Krishnan (2019) again using a theoretical model demonstrate that working capital financing costs have an impact on adoption of specific trade credit policies by firms which in turn can impact supply chain efficiency. Alexandridis et al. (2018) highlight the fundamentally capital-intensive nature of the logistic and transportation industry. They also highlight the widespread variability in revenues, operating cash-flows, and asset values, contingent on volatile business cycles and global macroeconomic scenarios, which together contribute to a stimulating business and financing environment for logistics and transportation companies. Tsionas et al. (2012), Drobetz et al. (2019) explore the impact of concentrated ownership on firm performance in the shipping industry and report a strong positive association between them. Drobetz et al. (2021) further study the consequence of the presence of institutional investors on the valuation of shipping firms and find that the presence of institutional investors, augment the market value of firms, thereby confirming that "institutional ownership is a universal corporate governance mechanism". He et al. (2023) construct a Stackelberg game model to investigate the financing preferences of buyer and supplier firms in a transnational supply chain under variable tax symmetry environment.

Abdou et al. (2012) employ a variable impact neural-network analysis to investigate the role of pay-out policy, on share prices of

[6] They cite an example in their above-mentioned article: "Deloitte found that UK Plcs have £60bn tied up in unproductive working capital".

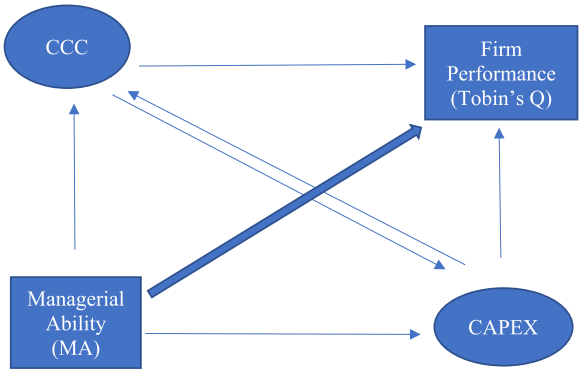

Fig. 1.

transportation providers and allied service companies in a cross-country setup. They report that for Europe, US, and Canada a firm's growth opportunities are negatively related to their dividend yields, as they typically fulfill expectations of pressures on pay-out policies. They posit that this observation is in sync with the pecking order theory. Xiaoyong, and Xingjun (2012), investigate the potential factors that affect the level of cash dividend in Chinese transportation firms. They find that firms in this industry maintain a low debt ratio and a relatively higher level of cash dividends. Zhang and Yu (2016), explore capital structure and financing decisions of Chinese-listed logistics enterprises and highlight key differences between the financing decisions of Chinese logistics firms and traditional manufacturing enterprises. Drobetz et al. (2013) explores capital structure policies of internationally listed logistics firms. They test whether logistics companies actively pursue any target capital structure and investigate their speed of adjustment of the same after deviating from the target. Capobianco and Fernandes (2004) test the capital structure policies of the global airline industry and test the impact of leverage on their financial performance.

In summary, despite the rising importance of the logistics and transportation industry on the overall growth of any economy, corporate finance research, particularly issues concerning WCM and CAPEX investments in these firms has been sparse and inadequate. The current study tries and bridge this gap and address this important issue by simultaneously exploring in the light managerial ability.

3. Data and methodology

3.1. Sample selection and variable description

The data for all pertinent variables are collected from Compustat database except the data on MA. As already highlighted before, we collect the firm-year data of MA from Peter Demerjian's personal webpage.[7] Our sample begins with all available US-listed firms which belong to the logistics and transportation industry. For that, we use Fama and French (FF) industry classification code FF-41 in the Compustat database. In other words, we consider firms which has four digits SIC code ranging from 4000 to 4789. The detailed specification of the industry affiliation of sample firms is shown in Appendix 1. Our study period extends over 30 years ranging from 1988 to 2018. The cut-off year, in the beginning is chosen primarily keeping in mind the availability of data. Our initial sample consists of 4408 firm-year observations. In order to remove the outliers of CCC components, we first remove the firm-year observations where the CCC components i.e., days receivable outstanding (DSO), days inventory of supply (DIS), and days payable outstanding (DPO) as explained above, exceeds 365 days. Further, we also omit observations with missing values of the key variables used in our regression models as firm-level control variables. The final sample consists of 3811 firm-year observations of logistics and transportation firms. The sample selection process is described in Appendix 2. In order to circumvent the disagreeable influence of the outliers, we winsorize all the main variables at 1 percent level for both tails. We report the year-wise break up of our sample in Appendix 3. As depicted in the model above, the principal variables of interest in this study are as follows:

(i) efficiency in working-capital-management measured by cash conversion cycle (CCC): Following past literature (Jalal and Khaksari, 2020; Wang, 2019) we compute cash conversion cycle (CCC) for each firm as a proxy of working-capital efficiency. Cash Conversion Cycle (or sometimes called simply the Cash Cycle) is the time elapsed (measured in days) to convert its investments in inventory and receivables into cash. In other words, CCC for a firm is measured as the days elapsed between selling its inventory, cash collected from receivables and cash paid for its inputs to suppliers. The lower the CCC, the better a firm's WCM. Following recent literature, we compute CCC as

$$\text{CCC} = 365 \times \left(\frac{\text{Accounts Receivable}}{\text{Sales}} + \frac{\text{Inventories}}{\text{Cost of goods sold}} - \frac{\text{Accounts Payable}}{\text{Cost of goods sold}} \right)$$

[7] https://faculty.washington.edu/pdemerj/data.html).

(ii) **Managerial Ability (MA):** We use MA score developed by Demerjian et al. (2012), who used Data-Envelopment-Analysis (DEA) to assess managerial effectiveness in converting resource inputs to outputs. The authors use a two stage process: first, they use an optimization method to calculate firm efficiency, and second, they regress it on some firm specific variables which influence firm efficiency. The residual terms resulting from this regression is the MA score.

(iii) **CAPEX:** CAPEX measures the intensity of investments in tangible fixed asset of a firm in a given year. Managers need to strike a balance between irreversible investments (like CAPEX) from the relatively more flexible investments (like working capital). In this study, CAPEX is estimated as the capital expenditure (Compustat Annual Item 128) scaled by total asset (Compustat Annual Item 6) at the beginning of the year. This approach is in line with extant literature (Coles, Daniel and Naveen, 2014).

(iv) **CAPEX-NWC**: Net of CAPEX minus NWC (net working capital) scaled by total assets. To test the mutual influence of CCC and CAPEX we utilize this novel testing strategy by following (Banerjee and Dutta, 2022; Rajkovic, 2020). Since CCC is represented in the number of days and CAPEX in absolute dollar terms, we cannot compare these two constructs to check the mutual influence. In order to mitigate this problem, we consider Net Working Capital (NWC) in place of CCC. Following the past literature (Aktas et al., 2015; Kieschnick et al., 2013), NWC is computed as total receivable plus inventory minus total payable (This construct of working capital would be similar in principle with CCC but represented in dollar value terms).

(v) **TOBIN'S Q (Firm performance):** Tobin's-Q (Tobin, 1969), is the ratio of market value of a company's assets to their replacement cost. Simply put, Tobin's-Q captures hidden values in firms (primarily growth opportunities), left uncaptured by ordinary financial statement numbers. This measure of Tobin's Q has been previously used as measure of firm performance in the extant literature (Bebchuk et al., 2009; Uotila et al., 2009; Brown and Caylor, 2006).

(vi) Following the past literature (Aktas et al., 2015; Banerjee and Dutta, 2022; Gan, 2019; Kieschnick et al., 2013; Lee et al., 2018), we also include several firm-specific control variables in our models like log-sales, age, leverage, operating-cash-flow (OCF), net tangible assets (PPE), and cash holding (Cash) which influence the CCC and CAPEX. We also control for some additional macro and firm level parameters like financial constraint (SA-Index), financial distress (Altman-Z score), economic-policy-uncertainty (EPU) and geopolitical Risk (GPR) later on in our additional analyses section. The brief descriptions and estimation procedures of all these control variables are reported in Appendix 4.

The primary models used by us are in line with the conceptualized flow of linkage depicted in Fig. 1 above and are as follows:

$$CCC = \alpha + \beta_1 MA + \beta_2 LogSALES + \beta_3 LEV + \beta_4 OCF + \beta_5 PPE + \beta_6 AGE + \beta_7 CASH + Year\,FE + \varepsilon$$

$$CAPEX = \alpha + \beta_1 MA + \beta_2 LogSALES + \beta_3 LEV + \beta_4 OCF + \beta_5 PPE + \beta_6 AGE + \beta_7 CASH + Year\,FE + \varepsilon$$

$$CAPEX - NWC = \alpha + \beta_1 MA + \beta_2 LogSALES + \beta_3 LEV + \beta_4 OCF + \beta_5 PPE + \beta_6 AGE + \beta_7 CASH + Year\,FE + \varepsilon$$

$$TOBIN^{'}SQ = \alpha + \beta_1 CCC + \beta_2 LogSALES + \beta_3 LEV + \beta_4 OCF + \beta_5 PPE + \beta_6 AGE + \beta_7 CASH + Year\,FE + \varepsilon$$

$$TOBIN^{'}SQ = \alpha + \beta_1 CAPEX + \beta_2 LogSALES + \beta_3 LEV + \beta_4 OCF + \beta_5 PPE + \beta_6 AGE + \beta_7 CASH + Year\,FE + \varepsilon$$

$$TOBIN^{'}SQ = \alpha + \beta_1 CAPEX - NWC + \beta_2 LogSALES + \beta_3 LEV + \beta_4 OCF + \beta_5 PPE + \beta_6 AGE + \beta_7 CASH + Year\,FE +$$

Table 1
Summary statistics. The table reports the summary statistics of all variables used in this study. All variables (except MA-Score) are winsorized at the 1% and 99% level.

Variable	Obs	Mean	Std. Dev.	Min	0.25	Median	0.75	Max
CCC	3,811	20.65	48.61	−302.37	0.27	19.58	37.54	344.03
CAPEX	3,811	0.10	0.09	0.00	0.04	0.07	0.14	0.36
CAPEX-NWC	3,811	0.03	0.15	−0.41	−0.04	0.03	0.10	0.52
MA_SCORE	3,811	−0.04	0.12	−0.30	−0.11	−0.06	−0.01	0.66
Tobin's q	3,811	1.41	0.83	0.54	0.94	1.16	1.56	5.95
DSO	3,811	43.78	31.02	0.00	23.20	39.63	56.50	361.84
DPO	3,811	36.91	38.14	0.00	14.48	26.22	44.71	362.30
DIS	3,811	13.78	25.15	0.00	0.00	6.53	16.54	282.63
Log Sales	3,811	6.18	1.87	−0.53	4.98	6.04	7.44	11.18
Leverage	3,811	0.29	0.20	0.00	0.13	0.29	0.42	0.88
OCF	3,811	0.09	0.09	−0.39	0.05	0.09	0.14	0.30
PPE	3,811	0.59	0.26	0.00	0.43	0.66	0.80	0.91
Age	3,811	12.73	13.94	0.00	3.00	8.00	18.00	93.00
Cash	3,811	0.07	0.09	0.00	0.01	0.04	0.09	0.52

Table 2
Pair-wise correlation. This table shows cross-correlation coefficients among the key variables. *, ** and *** denote respectively statistical significance at 10%,5% and 1%.

	CCC	CAPX	CAPX-NWC	MA_SCORE	Tobin's q	DSO	DPO	DIS	Log Sales	Leverage	OCF	PPE	Age	Cash
CCC	1													
CAPX	−0.0433**	1												
CAPX-NWC	−0.415***	0.725***	1											
MA_SCORE	−0.102***	0.0761***	0.0389*	1										
Tobin's q	−0.137***	−0.0274	−0.0329*	0.213***	1									
DSO	0.496***	−0.121***	−0.330***	−0.0715***	−0.0262	1								
DPO	−0.535***	−0.0706***	0.131***	0.0309	0.0726***	0.282***	1							
DIS	0.509***	−0.0409*	−0.198***	−0.0626***	−0.122***	0.153***	0.134***	1						
Log Sales	−0.00760	−0.0628***	−0.0457**	0.0456**	−0.0262	−0.126***	−0.181***	−0.134***	1					
Leverage	−0.0254	0.0440**	0.189***	−0.0270	−0.175***	−0.0522**	−0.00432	0.00876	0.0293	1				
OCF	−0.0512**	0.216***	0.0897***	0.158***	0.109***	−0.158***	−0.142***	−0.119***	0.225***	−0.0886***	1			
PPE	−0.104***	0.337***	0.513***	−0.0977***	−0.323***	−0.205***	−0.0252	0.0130	0.0532**	0.376***	0.150***	1		
Age	0.123***	−0.0416*	−0.0453**	0.00868	−0.0680***	0.0904***	−0.0222	0.0925***	0.415***	−0.0725***	0.0668***	0.0845***	1	
Cash	−0.117***	−0.101***	−0.00629	0.0816***	0.336***	−0.0849***	0.0636***	−0.0241	−0.163***	−0.268***	−0.0335*	−0.415***	−0.121***	1

4. Results and inferences

4.1. Descriptive statistics

Table 1 presents the descriptive statistics of the variables of interest we use in our regression models. The table shows that the mean (median) cash conversion cycle for average transportation and logistics firms is around 20.5 days (19.5 days). The minimum (maximum) CCC is −302 days (344 days). The mean (median) average receivable period, average payable period, and average inventory period are 44 days (40 days), 37 days (26 days), and 14 days (6 days) respectively, for the overall sample firms. The mean (median) capital expenditure (CAPEX) is found to be 10% (7%) of the total assets. The mean and median CAPEX minus NWC is 3 percent of the total asset. The mean (median) MA-Score is computed as −0.04 (−0.06) respectively.

The sample firms remain relatively young (Age = 12.7 years), with relatively high leverage (Lev = 0.29). As logistics and transportation industry firms are capital intensive in nature, the average net tangible assets as compared to total assets are found to be relatively higher (PPE = 0.59). The mean cash flow of sample firms as a proportion of total asset (CFO = 0.09) and holds about 7% of cash and cash equivalent with concerning to total assets.

4.2. Correlations

Table 2 shows the pair-wise correlations amongst the variables of interest. We have some interesting observations here: First, in line with our hypothesis 1 above, we find that CCC is negatively associated with MA (correlation −0.102; $p < 0.01$). In other words, working-capital-management efficiency is positively associated with MA (as lower CCC implies enhanced working-capital-management efficiency). Second, MA and CAPEX are positively correlated (coefficient 0.076, $p < 0.01$). Third, MA and CAPEX minus NWC are positively correlated (coefficient 0.039, $p < 0.10$). Fourth, Tobin's Q and MA are positively correlated and statistically significant (correlation coefficient 0.213; $p < 0.01$). In summary, these correlations provide prima-facie evidence supporting the hypotheses presented above, and motivate us to probe further.

4.3. Relationship between CCC, CAPEX and MA

Table 3, presents the results of models (1), (2) and (3) above, where the association of MA is tested on WCM efficiency (reduced CCC), CAPEX and CAPEX-NWC. In model 1, we use ordinary-least-square (OLS) regression on full sample. We incorporate robust standard errors with adjustments for heteroscedasticity and clustered by firm. Column (1) presents the impact of MA on CCC in isolation, while column (2) presents the same in combination with control variables. Column (3) presents impact of MA on CAPEX in isolation, while column (4) presents the same in combination with other control variables. Column (5) presents impact of MA on CAPEX-NWC in isolation, while column (6) presents the same in combination with other control variables We include dummy variables to control for year-fixed-effect in all regression models.

We find MA is negatively related with CCC both in isolation (coefficient −41.97; $p < 0.01$) and in the presence of other control variables (coefficient −44.03; $p < 0.01$). This result implies that as MA increases, the WCM efficiency increases (in terms of reduced

Table 3

Relationship between CCC, CAPEX, CAPEX-NWC and MA. Table 3 presents the results from regression models examining the relationship between cash-conversion-cycle (CCC), capital-expenditure (CAPEX), capital-expenditure minus net working capital (CAPEX-NWC) and managerial-ability (MA-Score). Numbers within braces indicate robust t-statistics clustered at yearly basis.

VARIABLES	(1) CCC	(2) CCC	(3) CAPEX	(4) CAPEX	(5) CAPEX-NWC	(6) CAPEX-NWC
MA_SCORE	−41.975***	−44.028***	0.081***	0.095***	0.056**	0.115***
	(−4.649)	(−5.082)	(5.529)	(6.145)	(1.969)	(5.488)
Log Sales		−2.326***		−0.003***		−0.001
		(−4.114)		(−4.273)		(−0.701)
Leverage		3.200		−0.027***		0.016
		(0.718)		(−3.443)		(1.362)
OCF		0.450		0.143***		−0.010
		(0.048)		(8.249)		(−0.313)
PPE		−37.402***		0.134***		0.358***
		(−9.785)		(24.200)		(34.194)
Age		0.551***		−0.000**		−0.001***
		(8.576)		(−2.433)		(−3.992)
Cash		−97.043***		0.021		0.394***
		(−8.859)		(1.334)		(14.106)
Constant	25.778**	60.752***	0.159***	0.100***	0.067	−0.149***
	(2.150)	(4.966)	(5.247)	(4.237)	(1.412)	(−3.585)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,811	3,811	3,811	3,811	3,811	3,811
Adj. R-square	0.015	0.077	0.047	0.212	0.011	0.338

*, ** and *** denote respectively statistical significance at 10%, 5% and 1%.

CCC). We find strong positive relation of MA with CAPEX, both in isolation (coefficient of 0.081; $p < 0.01$), as well as in presence of control variables (coefficient of 0.095; $p < 0.01$). This result implies that as MA increases, the firm engages more into CAPEX. Further, we find strong positive relation of MA with CAPEX-NWC, both in isolation (coefficient of 0.056; $p < 0.05$), as well as in presence of control variables (coefficient of 0.115; $p < 0.01$). This result implies that as MA increases, the firm engages more in CAPEX and simultaneously reduces the investments in NWC. These findings lend support to our hypotheses 1, 4, and 7 respectively, and are also in sync with our proposed conceptual model (Fig. 1), wherein we propose that managers with more ability optimally use the financial resources. The efficiency is probably further augmented by economies of scale, as we find an association of CCC and CAPEX with firm Size (log Sales), leverage, PPE and Cash holdings. These results reinstate the premise of the upper echelon theory highlighting the criticality of behavioural traits and characteristics of managers such as their educational background or industry experience (captured by our measure of managerial ability in this study) can affect organizational outcomes.

4.4. Relationship between managerial Ability, working-capital management, capital expenditure and firm performance

This section examines the relationship between MA, CCC, CAPEX, and CAPEX-NWC with firm performance (Tobin's Q). *A priori*, the understanding is that an able manager would enhance the firm performance through efficient use of resources. Therefore, it is expected that effective use of working capital and higher investment in CAPEX in the capital-intensive logistic industry should enhance the firm performance.

Using Tobin's Q as a measure of firm performance, Table 4 presents the results of models 4, 5, and 6 above (columns 2, 3, and 4 respectively). The results of column 1 shows that managers of logistic firms with higher ability are associated with increased firm performance (coefficient 1.08; $p < 0.01$). We also find that efficient use of working capital or in other words, lower CCC enhances the market performance for logistic firms (coefficient −0.002; $p < 0.01$). Also, the larger investment in CAPEX increases the market performance for logistics firm (coefficient 0.482, $p < 0.01$). Finally, we check the mutual influence of WCM and CAPEX on firm performance. The result of column 4 suggests that the market performance of the firm increase when it simultaneously reduces the working capital and investment in CAPEX (coefficient 0.636; $p < 0.01$). These observations support our hypotheses 2, 5, and 8 respectively and provide prima facie evidence to further explore hypotheses 3, 6, and 9 more formally, which we do in the next section. Among the control variables we find operating cash flow (OCF) and Cash holdings positively augment the above relationship, while existing PPE and age dampens the relations. Once again, the critical influence of MA on firm outcomes and management of resources ratifies the postulates of the UE theory.

4.5. Testing the mediation effects:

In the preceding section, we show that efficient WCM and higher investment in CAPEX increase the market performance of logistic industry firms. We also show that better MA increases the firm performance. This section integrates these two aspects and explores how efficient WCM and higher investment in CAPEX mediates the association between MA and firm performance. This analysis helps to understand the importance of capital investment and efficient use of WCM in the logistics and transportation sector.

In our setting, first we show the direct association between MA and firm performance without the presence of any mediating variables. In the second step we show the indirect association or the path through which MA influences the firm performance, channelized through a mediating variable, which is CCC, CAPEX and/or CAPEX -NWC. The following are the equation models to recognize the direct and indirect relations of MA and firm performance.

(i) the relationship between MA and firm performance channeled through CAPEX

$$\text{TOBIN}^{'}\text{SQ} = \beta_0 + \beta_1 \text{CAPEX} + \beta_2 \text{MA} + \sum_{j=3}^{8} \alpha_j \text{Controls} + \varepsilon \tag{7}$$

$$\text{CAPEX} = \alpha_0 + \alpha_1 \text{MA} + \sum_{j=3}^{8} \alpha_j \text{Controls} + \text{YEAR\_FE} + \omega \tag{8}$$

(ii) The relationship between MA and firm performance channeled through CCC.

$$\text{TOBIN}^{'}\text{SQ} = \beta_0 + \beta_1 \text{CCC} + \beta_2 \text{MA} + \sum_{j=3}^{8} \alpha_j \text{Controls} + \varepsilon \cdots\cdots\cdots\cdots\cdots\cdots. \tag{9}$$

$$\text{CCC} = \alpha_0 + \alpha_1 \text{MA} + \sum_{j=3}^{8} \alpha_j \text{Controls} + \text{YEAR\_FE} + \omega \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (10).$$

(iii) The relationship between MA and firm performance channeled through CAPEX-NWC.

$$\text{TOBIN}^{'}\text{SQ} = \beta_0 + \beta_1 \text{CACPX} - \text{NWC} + \beta_2 \text{MA} + \sum_{j=3}^{8} \alpha_j \text{Controls} + \varepsilon \cdots\cdots \tag{11}$$

Table 4
Relationship between CCC, CAPEX, MA and Firm performance. Table 4 the results from regression models examining the relationship with firm performance (Tobin's q) and cash-conversion cycle (CCC), capital expenditure (CAPEX), capital-expenditure minus net working capital (CAPEX-NWC) managerial ability (MA-Score) respectively. Numbers within braces indicate robust t-statistics clustered at yearly basis.

	(1)	(2)	(3)	(4)
VARIABLES	Tobin's q	Tobin's q	Tobin's q	Tobin's q
CCC		−0.002***		
		(−7.181)		
CAPEX			0.482***	
			(3.163)	
CAPEX-NWC				0.636***
				(4.410)
MA_SCORE	1.080***			
	(9.119)			
Log Sales	0.003	−0.005	0.002	0.001
	(0.347)	(−0.547)	(0.227)	(0.087)
Leverage	−0.073	−0.053	−0.046	−0.071
	(−0.773)	(−0.560)	(−0.489)	(−0.741)
OCF	1.131***	1.385***	1.329***	1.394***
	(3.452)	(4.238)	(3.921)	(4.261)
PPE	−0.714***	−0.863***	−0.848***	−1.009***
	(−11.888)	(−13.502)	(−13.445)	(−11.883)
Age	−0.002***	−0.001	−0.002***	−0.002**
	(−2.800)	(−1.259)	(−2.722)	(−2.373)
Cash	2.074***	1.895***	2.104***	1.869***
	(8.604)	(7.951)	(8.596)	(7.351)
Constant	1.411***	1.497***	1.310***	1.456***
	(9.974)	(9.548)	(9.545)	(9.936)
Year FE	Yes	Yes	Yes	Yes
Observations	3,811	3,811	3,811	3,811
Adj. R-square	0.220	0.216	0.202	0.208

*, ** and *** denote respectively statistical significance at 10%, 5% and 1%.

$$\text{CAPEX} - \text{NWC} = \alpha_0 + \alpha_1 \text{MA} + \sum_{j=3}^{8} \alpha_j \text{Controls} + \text{YEAR\_FE} + \omega \quad \text{.....(12).}$$

Eq. (7) exhibits how the MA is associated with the firm performance proxied by TOBIN'S Q. The presence of MA in Eq. (7) captures the direct relation of MA with TOBIN'S Q. whereas Eq. (8) shows how MA is indirectly related with TOBIN'S Q through the CAPEX route. Similarly, Eq. (9) captures the direct impact of MA with TOBIN'S Q. while Equation (10) shows how MA is indirectly related with TOBIN'S Q through the CCC route. Finally, Eq. (11) captures the direct impact of MA with TOBIN'S Q. while Equation (12) shows how MA is indirectly related with TOBIN'S Q through the CAPEX-NWC. The controls for equations (7) through (12) remain the same used in Eqs. (1)–(6).

Table 5 (Panel A), demonstrates the mediating role of CAPEX, CCC, and CAPEX minus NWC in the relationship between MA and firm performance. Column (1), reveals a positive and significant relationship between CAPEX and firm performance (coefficient 3.159, $p < 0.01$), suggesting that higher investment in CAPEX leads to superior firm performance for transportation firms. Column (2) displays a significant and positive association between CAPEX and MA (coefficient 0.128, $p < 0.01$), indicating that more able managers tend to invest more in CAPEX. As shown in column (3) there is a negative and significant association between CCC and firm performance (coefficient −0.003, $p < 0.01$), indicating that higher efficiency in working capital management has a direct and positive impact on firm performance. Furthermore, column (4) exhibits a significant and negative relationship between MA and CCC (coefficient −16.71, $p < 0.01$), implying that firms with higher MA tend to manage their working capital more efficiently. In column (5), the study reveals a positive and significant association between CAPEX-NWC and firm performance (coefficient 7.025, $p < 0.01$), implying that higher investment in CAPEX and lower investment in NWC leads to better firm performance for transportation firms. Finally, column (6) displays a significant and positive relationship between CAPEX-NWC and MA (coefficient 0.152, $p < 0.01$), suggesting that more able managers invest more in CAPEX while simultaneously reducing their working capital investments.

Table 5 (Panel B) further examines the direct, indirect, and aggregate relationships between MA and firm performance, utilising a bootstrap method to measure standard errors. The results of section I indicate a significant positive association between MA and firm performance for higher investment in CAPEX, with an indirect effect (coefficient 0.1807, $p < 0.05$). The results of section II demonstrate a negative and significant indirect effect of MA and firm performance for efficient use of working capital or a reduction in CCC (coefficient −0.0665, $p < 0.05$). The results of section III reveal a positive and significant relationship between MA and firm performance for simultaneous higher investment in CAPEX and lower investment in working capital, with an indirect effect (coefficient 0.374, $p < 0.05$). These results highlight the significant mediating roles of both CAPEX and CCC in the relationship between MA and firm performance. Overall, the findings suggest that able managers can enhance firm performance by managing CAPEX and working capital investments effectively, which supports hypotheses 3, 6, and 9, respectively.

Table 5
Mediation analysis.

Panel A. Panel A presents direct and indirect connection (through CAPEX, CCC and CAPEX-NWC) of Tobin's q and the MA (refer Eqs. (7) and (8), Eqs. (9) and (10), and Eqs. (11) and (12) respectively in text). Numbers within braces indicate robust t-statistics.

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Tobin's q	CAPEX	Tobin's q	CCC	Tobin's q	CAPEX-NWC
CAPEX	3.159***					
	(5.142)					
CCC			−0.003***			
			(−2.994)			
CAPEX-NWC					7.025***	
					(25.061)	
MA_SCORE	1.845***	0.128***	2.017***	−16.706***	1.241***	0.152***
	(4.028)	(10.293)	(4.420)	(−3.182)	(2.855)	(5.844)
Log Sales	−0.018	−0.005***	−0.030	2.083***	0.011	−0.017***
	(−0.500)	(−3.254)	(−0.856)	(2.611)	(0.298)	(−5.913)
Leverage	−0.311	0.009	−0.367	−2.219	−0.455*	0.034*
	(−1.067)	(0.993)	(−1.262)	(−0.582)	(−1.664)	(1.874)
OCF	−2.858***	0.072***	−2.523***	−36.196***	−2.112***	−0.055*
	(−4.792)	(4.226)	(−4.257)	(− 4.92)	(−3.695)	(−1.667)
PPE	−1.448***	0.136***	−1.120***	−22.782***	−3.462***	0.269***
	(−5.559)	(14.746)	(−4.506)	(−4.734)	(12.995)	(14.188)
Age	−0.001	−0.000	−0.000	0.297***	0.002	−0.001
	(−0.298)	(−0.286)	(−0.074)	(2.981)	(0.408)	(−0.849)
Cash	0.912	0.004	0.699	−35.759***	−2.042***	0.270***
	(1.466)	(0.273)	(1.110)	(−4.515)	(−3.349)	(7.146)
Constant	2.082**	−0.294***	2.524***	−0.303***	3.201***	2.824***
	(2.383)	(−3.103)	(2.884)	(−3.180)	(3.937)	(2.984)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,811	3,811	3,811	3,811	3,811	3,811

Panel B. Panel B shows the joint effect using bootstrap method to estimate standard-errors.

	Coefficient	Bootstrap Std. Err.	Z	p-value
Section I - Capital Expenditure				
Indirect	0.1807	0.0891	2.03	0.043
Direct	1.3295	0.5426	2.45	0.014
Total (Direct + Indirect)	1.5102	0.7611	1.98	0.047
Section II - CCC				
Indirect	−0.0665	0.0294	−2.26	0.024
Direct	1.3065	0.7076	1.85	0.065
Total (Direct + Indirect)	1.2401	0.6982	1.97	0.048
Section III – CAPEX-NWC				
Indirect	0.3742	0.1795	2.08	0.042
Direct	1.8048	0.9117	1.98	0.049
Total (Direct + Indirect)	2.1790	1.0206	2.13	0.039

5. Additional analysis: exploring impact of other factors on CCC and CAPEX

Models 4, 5, and 6 above explore the impact of MA on CCC and CAPEX, wherein as mentioned we control for log-sales, leverage, operating-cash-flow (OCF), age, net tangible assets (PPE), and cash holding (Cash) along with year fixed-effects. In order to check the strength of the relationship, we further control for some macroeconomic and firm level parameters like financial constraint faced by a firm (SA-Index), financial distress (Altman-Z score), economic-policy-uncertainty (EPU) and geopolitical Risk (GPR) in our baseline regression.

5.1. Financial constraints (SA-Index)

A firm is considered financially constrained when it cannot raise debt or equity from the market due to its internal firm specific problems. This situation could in turn restrict the firm to finance its profitable investment projects. Firms with higher financial constraints should therefore value their working-capital more and try to manage it more efficiently, as this could be one of the potential sources of their internal cash flow (Gamba and Triantis, 2008; Almeida and Campello, 2010). In a similar vein, Kieschnick et al. (2013) contend that financial constraints and the possibility of bankruptcy exert a significant impact on the allocation of additional funds towards working capital. Capital investment schedule is smoothened by financially constrained firms thorough efficiently managing their working-capital (Ding et al, 2013). We use size and age to measure financial constraint as proposed by Hadlock and Pierce (2010).

5.2. Financial distress (Altman Z score)

Financial distress is a state in which an organization is incapable of fulfilling its short-term or long-term debt payment obligations. Firms that are financially distressed often experience reduced cash-generating potential and face greater challenges in obtaining credit. Consequently, financially distressed companies are expected to adopt a more cautious working capital management policy (Molina and Preve, 2009; Hill et al., 2010). In this study, we utilize the Altman-Z score model as a proxy for financial distress. This model was developed by Altman (1968) as a bankruptcy prediction model based on the analysis of a set of financial ratios.

5.3. Economic policy uncertainty (EPU)

Economic policy uncertainty arises from significant events such as change in political leadership, crutial policy adjustments, wars, riots etc. Instead of using individual significant events as dummy variables, some studies have proposed using comprehensive uncertainty indicators. Using text analysis of three sources, Baker et al. (2016) create the comprehensive Economic-Policy-Uncertainty score (EPU henceforth). The three sources are i) the reports of major economic policy uncertainty appeared in the ten leading newspapers, ii) the federal tax codes issued by the Congressional-Budget-Office (CBO) iii) Federal Reserve Bank of Philadelphia's Survey of Professional Forecasters. In recent times, a few studies report that CAPEX for firms can get 'depressed' in the face of EPU (Kang, et al., 2014; Wang, et al., 2014). A few others examine the relationship between EPU and corporate liquidity management and find that EPU and corporate cash holdings are positively related and adopt a more conservative WCM policy (Zhang and Wu, 2014; Xu, et al., 2016; Demir and Ersan 2017).

5.4. Global political Risk (GPR):

GPR is "the risk associated with wars, terrorist acts, and tensions between states affecting the normal and peaceful course of international relations," (Caldara and Iacoviello, 2022). It can have a strong association with firms' financial decisions, especially the logistics industry firms (Kotcharin and Maneenop, 2020). The reasons could be as follows: *First*, GPR is likely to introduce uncertainty in the business environment, leading to a decline in worldwide industrial production. Subsequently, logistic companies' cash flow and earnings may become more uncertain, leading them to delay their fixed investment related decision-making. *Second,* GPR can influence global capital markets - incidents involving terrorist activities can create problems for logistics firms to raise capital, since under such scenarios, capital providers' perceive enhanced risk in the business environment resulting in more volatile future company earnings. *Third*, GPR is expected to augment the operational costs of logistics and transportation companies. Because the fleet may need

Table 6
Relationship between CCC and MA after controlling for additional variables. Table 6 presents the regression results examining the relationship between CCC and Managerial ability (MA_Score) after controlling for four additional variables namely financial constraints (SA_Index), financial distress (Altman Z Score), News Based EPU and Geopolitical Risk. Numbers within braces indicate robust t-statistics clustered at yearly basis.

VARIABLES	(1) CCC	(2) CCC	(3) CCC	(4) CCC	(5) CCC
MA_SCORE	−44.251***	−28.145***	−44.028***	−44.028***	−27.897***
	(−5.146)	(−3.010)	(−5.082)	(−5.082)	(−2.985)
SA Index	−3.678***				−3.807***
	(−7.440)				(−7.627)
Altman Z Score		0.471**			0.467**
		(2.257)			(2.207)
News Based EPU			−0.186		0.202
			(−0.840)		(0.673)
Geopolitical Risk				−0.091	−0.056
				(−0.880)	(−0.388)
Log Sales	−4.972***	−3.562***	−2.326***	−2.326***	−6.173***
	(−6.574)	(−5.924)	(−4.114)	(−4.114)	(−7.613)
Leverage	6.574	13.965***	3.20	3.21	15.562***
	(1.484)	(2.837)	(0.718)	(0.718)	(3.126)
OCF	3.877	1.139	0.45	0.450	5.098
	(0.415)	(0.114)	(0.048)	(0.048)	(0.493)
PPE	−43.763***	−37.933***	−37.402***	−37.402***	−45.031***
	(−10.639)	(−9.524)	(−9.785)	(−9.785)	(−10.167)
Age	−0.539***	0.584***	0.551***	0.551***	−0.609***
	(−3.887)	(8.69)	(8.576)	(8.576)	(−4.632)
Cash	−100.034***	−98.869***	−97.043***	−97.043***	−101.958***
	(−9.114)	(−8.670)	(−8.859)	(−8.859)	(−8.748)
Constant	61.205***	63.809***	78.645**	66.091***	45.168
	(4.886)	(5.072)	(2.449)	(3.708)	(0.951)
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	3,811	3,433	3,811	3,811	3,433
Adj. R-square	0.088	0.079	0.077	0.077	0.089

*, ** and *** denote respectively statistical significance at 10%, 5% and 1%.

to take longer routes and cover additional distances to avoid disrupted routes, resulting in higher transportation costs. Thus, GPR can be related to corporate finance management of logistics firms, Even under normal conditions, extant literature (Ahrends et al., 2018) shows that, since the logistics sector is significantly more risk prone in nature due to such high GPR and international uncertainties, cash holdings of logistics companies are likely to be higher than those of companies in other industries. GPR may induce additional caution and force logistic firms to implement more conservative WCM strategy to generate the additional cash.

5.5. Impact of other firm specific and economic variables on the relationship between working-capital-management and managerial ability:

Table 6 show the results of additional analyses where we re-examine the relation between CCC and MA after controlling for additional firm level and economic variables like financial-constraint proxy (SA-Index), financial distress (Altman-Z score), economic-policy-uncertainty (EPU) and geopolitical Risk (GPR). We observe that financial constraints and CCC are negatively related (column 1, coefficient −3.678, $p < 0.01$). Column 2 shows that financial distress and CCC is positively related (coefficient 0.471, $p < 0.05$). However, there is no statistically significant connection between CCC, EPU and GPR. After controlling for all these four variables, we find that our main result remains unaltered (column 5).

5.6. Impact of other firm specific and economic variables on the relationship between CAPEX and MA

Table 7 show the results of additional analyses where we re-examine the relation between CAPEX and MA after controlling for additional firm level and economic variables like financial-constraint proxy (SA-Index), financial distress (Altman-Z score), EPU and GPR. In column 1, we find a positive and significant association between financial constraints and CAPEX (coefficient 0.004, $p < 0.01$). In columns 3 and 4, the results suggest a negative and association between news-based policy uncertainty and geopolitical risk with CAPEX (coefficient −0.001, $p < 0.01$). The statistical test suggests that there is no significant association between financial distress and CAPEX. In column 5, after controlling for all these four variables we find that our main result remains unaltered. i.e., able managers would invest more in CAPEX.

5.7. Impact of other firm specific and economic variables on the relationship between CAPEX-NWC and MA

Table 8 show the results of additional analyses where we re-examine the relation between CAPEX-NWC and MA after controlling for additional firm level and economic variables like financial-constraint proxy (SA-Index), financial distress (Altman-Z score), EPU and GPR. In column 1, we get a positive and significant association between financial constraints and CAPEX (coefficient 0.004, $p < 0.01$).

Table 7

Relationship between CAPEX and MA after controlling for additional variables. Table 7 reports the regression results examining the relationship between CAPEX and Managerial ability (MA_Score) after controlling for four additional variables namely financial constraints (SA_Index), financial distress (Altman Z Score), News Based EPU and Geopolitical Risk. Numbers within braces indicate robust t-statistics clustered at yearly basis. *, ** and *** denote respectively statistical significance at 10%, 5% and 1%.

	(1)	(2)	(3)	(4)	(5)
VARIABLES	CAPEX	CAPEX	CAPEX	CAPEX	CAPEX
MA_SCORE	0.095***	0.125***	0.095***	0.095***	0.122***
	(6.167)	(6.947)	(6.145)	(6.145)	(6.778)
SA Index	0.004***				0.004***
	(5.852)				(5.554)
Altman Z Score		−0.001			−0.001
		(−1.074)			(−1.147)
News Based EPU			−0.001***		−0.001**
			(−3.514)		(−2.262)
Geopolitical Risk				−0.001***	0.000
				(−3.145)	(0.776)
Log Sales	−0.001	−0.004***	−0.003***	−0.003***	−0.002
	(−0.660)	(−4.972)	(−4.273)	(−4.273)	(−1.491)
Leverage	−0.031***	−0.013	−0.027***	−0.027***	−0.014
	(−3.839)	(−1.314)	(−3.443)	(−3.443)	(−1.396)
OCF	0.139***	0.176***	0.143***	0.143***	0.175***
	(8.086)	(9.347)	(8.249)	(8.249)	(9.245)
PPE	0.140***	0.137***	0.134***	0.134***	0.142***
	(24.414)	(23.221)	(24.200)	(24.200)	(23.006)
Age	0.001***	−0.000***	−0.000**	−0.000**	0.001***
	(5.354)	(−4.745)	(−2.433)	(−2.433)	(3.991)
Cash	0.024	0.028*	0.021	0.021	0.032**
	(1.538)	(1.770)	(1.334)	(1.334)	(2.017)
Constant	0.100***	0.100***	0.242***	0.143***	0.149**
	(4.314)	(4.249)	(3.841)	(4.054)	(2.069)
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	3,811	3,433	3,811	3,811	3,433
Adj. R-square	0.215	0.238	0.212	0.212	0.239

Column 2 shows that financial distress and CAPEX-NWC is negatively related (coefficient −0.004, $p < 0.01$). Columns 3 suggest a negative and significant relationship between news-based policy uncertainty with CAPEX-NWC (coefficient −0.001, $p < 0.01$). The statistical test suggests that there is no significant association between geopolitical risk and CAPEX-NWC. In column 5, after controlling for all these four variables we find that our main result remains unaltered. i.e., able managers would invest more in CAPEX and simultaneously reduce NWC.

In summary, our main findings of the interlinkages between MA and CCC or CAPEX remain robust even after controlling for country-level macro parameters and substantiate the fundamental models prescribed by us.

5.8. Alternative specifications of managerial ability

To test the robustness of our results we use three alternative proxies of managerial ability such as MA Rank, CEO tenure and CEO compensation[8].

5.8.1. MA rank as an alternative measure of MA

First, we change our proxy of managerial ability to MA Rank. MA Rank is a relative measure of MA score ranges from the scale of 1 to 10. Following Abernathy et al. (2018); Lee et al. (2018) we estimate MA rank. This ranking is estimated by comparing the managerial ability score of a particular firm in the transportation and logistics industry for a given year. The MA rank reduces any potential measurement errors that can be present in the MA-score. Table 9 shows the association between CCC, CPAEX and CAPEX-NWC and MA rank. We find a significantly negative association between CCC and MA rank. We find a positive and significant association between CAPEX, CAPEX-NWC and MA rank. These findings corroborate our main results.

5.8.2. CEO tenure as an alternative measure of MA

Next, we estimate the CEO tenure as an alternative proxy for MA following Gan (2019) Huang, and Sun (2017). CEO tenure is the length of a CEO's term is measured by the number of years they have held office. This is a single composite measure that considers several personal attributes of the CEO like educational background, career path, personal reputation etc. Table 10 shows the association between CCC, CPAEX and CAPEX-NWC and CEO tenure. We find a significantly negative association between CCC and CEO tenure. We find a positive and significant association between CAPEX, CAPEX-NWC and CEO tenure. These findings corroborate our main results.

5.8.3. CEO compensation as an alternative measure of MA

Finally, we use change in CEO compensation as an alternative proxy of MA. Following Mitra et al. (2019), Yung, and Chen (2018), we estimate change in CEO compensation by considering the year-on-year percentage change in CEO compensation. We consider CEO's salary plus bonus plus estimated value of stock option held by the CEOs. Like CEO tenure this measure also captures the personal characteristics of the CEO as well as the confidence level of the CEOs. Table 11 shows the association between CCC, CPAEX and CAPEX-NWC and CEO compensation. We find a significantly negative association between CCC and CEO compensation. We find a positive and significant association between CAPEX, CAPEX-NWC and CEO compensation. These findings corroborate our main results.

5.9. Relationship between individual components of CCC and MA:

To deeply understand this relationship, we re-estimate regression (1) by replacing the individual components of CCC in the place of CCC (DSO, DPO and DIS). This analysis will help us to understand the sources of efficiency in WCM and the mechanism of reducing the CCC by able managers. The results of Table 12, column 1 show that days receivable period (DSO) is negatively related to MA (coefficient −19.05, $p < 0.01$). This implies that managers with higher ability can negotiate better with their customers and collect receivables faster. The result of column 2 suggests that there is a significant positive relationship (coefficient 14.22, $p < 0.05$) between days receivable period (DPO) and MA. This implies that able managers can negotiate better with their suppliers and delay the payments. The result of column 3 shows that there is a significant negative relationship between days inventory period (DIS) and MA (coefficient −10.75, $p < 0.01$). This infers that more able managers put more efficient inventory management in place and can reduce the inventory holding period. In summary, this granular analysis at the component level of CCC help us to understand how better managers reduce the overall CCC of logistic firms by efficiently managing each of the CCC components.

5.10. Endogeneity

The above analysis depicts that MA is positively associated with investment in CAPEX and efficient WCM (CCC). The statistical significance and directional sign of the above estimates however may be biased, if firm level MA and one or more independent variables are correlated with the regression residual (Bascle, 2008). Primarily we use all firm-specific lagged control variables in the main regression to alleviate the endogeneity concern. The instrument variable (IV) approach could address this issue. However, this IV approach may be insufficient due to large standard error (Wooldridge, 2015). To further dispel the endogeneity issue, first, we apply

[8] We thank the reviewer to suggest these tests.

Table 8
Relationship between CAPEX-NWC and MA after controlling for additional variables. Table 8 reports the regression results examining the relationship between CAPEX-NWC and Managerial ability (MA_Score) after controlling for four additional variables namely financial constraints (SA_Index), financial distress (Altman Z Score), News Based EPU and Geopolitical Risk. Numbers within braces indicate robust t-statistics clustered at yearly basis. *, ** and *** denote respectively statistical significance at 10%, 5% and 1%.

VARIABLES	(1) CAPEX-NWC	(2) CAPEX-NWC	(3) CAPEX-NWC	(4) CAPEX-NWC	(5) CAPEX-NWC
MA_SCORE	0.116***	0.156***	0.116***	0.116***	0.126***
	(5.511)	(6.268)	(5.499)	(5.499)	(6.996)
SA Index	0.004***				0.004***
	(3.402)				(5.661)
Altman Z Score		−0.004***			−0.001
		(−3.601)			(−1.092)
News Based EPU			−0.001*		−0.003*
			(−1.763)		(−1.934)
Geopolitical Risk				−0.001	0.001
				(−1.563)	(1.160)
Log Sales	0.002	−0.001	−0.001	−0.001	−0.002
	(0.979)	(−0.614)	(−0.747)	(−0.747)	(−1.484)
Leverage	0.013	0.005	0.016	0.016	−0.014
	(1.044)	(0.342)	(1.367)	(1.367)	(−1.504)
OCF	−0.015	0.076**	−0.011	−0.011	0.172***
	(−0.437)	(1.982)	(−0.330)	(−0.330)	(9.194)
PPE	0.365***	0.360***	0.359***	0.359***	0.144***
	(32.626)	(31.070)	(34.062)	(34.062)	(23.453)
Age	0.001**	−0.001***	−0.001***	−0.001***	0.001***
	(2.109)	(−4.558)	(−3.991)	(−3.991)	(4.127)
Cash	0.397***	0.420***	0.394***	0.394***	0.033**
	(14.123)	(15.453)	(14.044)	(14.044)	(2.057)
Constant	−0.150***	−0.145***	−0.041	−0.117*	0.332***
	(−3.610)	(−3.576)	(−0.372)	(−1.904)	(2.678)
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	3,811	3,433	3,811	3,811	3,433
Adj. R-square	0.338	0.368	0.337	0.337	0.242

Table 9
Relationship between CCC, CAPEX, CAPEX-NWC, and MA rank. Table 9 presents the results from regression models examining the relationship between cash-conversion-cycle (CCC), capital-expenditure (CAPEX), capital-expenditure minus net working capital (CAPEX-NWC), and Rank of MA in a given year (Rank_MA). Numbers within braces indicate robust t-statistics clustered at yearly basis.

VARIABLES	(1) CCC	(2) CCC	(3) CAPEX	(4) CAPEX	(5) CAPEX-NWC	(6) CAPEX-NWC
Rank_MA	−12.472***	−16.962***	0.041***	0.079***	−0.006	0.061***
	(−4.065)	(−5.716)	(7.919)	(6.846)	(−0.645)	(7.704)
Log Sales		−2.398***		−0.006***		−0.001
		(−4.224)		(−4.218)		(−0.476)
Leverage		1.953		−0.031**		0.020*
		(0.436)		(−2.440)		(1.704)
OCF		−0.931		0.058		−0.017
		(−0.099)		(0.986)		(−0.510)
PPE		−39.051***		0.164***		0.367***
		(−10.271)		(18.942)		(34.658)
Age		0.562***		−0.000*		−0.001***
		(8.696)		(−1.822)		(−4.222)
Cash		−98.022***		0.066		0.396***
		(−8.849)		(0.888)		(14.115)
Constant	36.357***	75.942***	0.128***	0.055*	0.067	−0.202***
	(3.037)	(6.160)	(4.306)	(1.893)	(1.375)	(−4.950)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,811	3,811	3,811	3,811	3,811	3,811
Adj. R-square	0.011	0.075	0.053	0.112	0.013	0.341

*, ** and *** denote respectively statistical significance at 10%, 5% and 1%.

seemingly simple but very effective firm fixed-effect and random-effect regression models. Firm fixed effect models mitigate the concerns caused by unobservable factors which are time-invariant. These time-invariant, unobservable factors for each cross-sectional unit are controlled by distinct dummy variables. We also control for serial autocorrelation of error terms. These are assumed to be stationary and autoregressive of order one and partially takes care of omitted variable bias. However, these time-invariant unobservable factors are captured as disturbances in the random-effects model, since the assumption that their correlations with the

Table 10

Relationship between CCC, CAPEX, CAPEX-NWC, and CEO tenure. Table 10 presents the results from regression models examining the relationship between cash-conversion-cycle (CCC), capital-expenditure (CAPEX), capital-expenditure minus net working capital (CAPEX-NWC), and CEO tenure (Tenure) as a proxy of managerial ability, indicated by the number of years a CEO is in the position. Numbers within braces indicate robust t-statistics clustered at yearly basis. *, ** and *** denote respectively statistical significance at 10%, 5% and 1%.

VARIABLES	(1) CCC	(2) CCC	(3) CAPEX	(4) CAPEX	(5) CAPEX-NWC	(6) CAPEX-NWC
Tenure	−0.658***	−0.802***	0.001***	0.001*	0.002***	0.001***
	(−5.669)	(−7.292)	(3.558)	(0.181)	(4.606)	(3.745)
Log Sales		−10.133***		−0.012***		0.000
		(−10.906)		(−8.734)		(0.140)
Leverage		−8.136		−0.003		0.026
		(−1.075)		(−0.220)		(1.222)
OCF		−13.584		0.355***		0.189***
		(−0.603)		(10.110)		(3.565)
PPE		−14.913**		0.127***		0.393***
		(−2.368)		(14.114)		(24.355)
Age		0.283***		−0.000**		−0.000
		(4.429)		(−2.348)		(−1.080)
Cash		−75.761***		−0.051**		0.312***
		(−5.173)		(−2.036)		(8.208)
Constant	34.378***	99.623***	0.224***	0.130***	0.121***	−0.177***
	(19.751)	(12.661)	(48.116)	(11.746)	(18.783)	(−9.493)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,012	1,012	1,012	1,012	1,012	1,012
Adj. R-square	0.034	0.203	0.053	0.350	0.032	0.499

Table 11

Relationship between CCC, CAPEX, CAPEX-NWC and CEO compensation. Table 11 presents the results from regression models examining the relationship between cash-conversion-cycle (CCC), capital-expenditure (CAPEX), capital-expenditure minus net working capital (CAPEX-NWC) and year-on-year percentage change in CEO compensation (CEO_Comp). Numbers within braces indicate robust t-statistics clustered at yearly basis. *, ** and *** denote respectively statistical significance at 10%, 5% and 1%.

VARIABLES	(1) CCC	(2) CAPEX	(3) CAPEX-NWC
CEO_Comp	−0.007*	0.002*	0.004***
	(−1.654)	(1.753)	(2.651)
Log Sales	−9.484***	−0.013***	−0.001
	(−8.772)	(−7.348)	(−0.286)
Leverage	2.904	−0.013	−0.005
	(0.336)	(−0.876)	(−0.219)
OCF	−4.921	0.403***	0.159***
	(−0.244)	(11.232)	(2.688)
PPE	−1.513	0.111***	0.326***
	(−0.157)	(9.747)	(17.242)
Age	0.269***	−0.000	−0.000
	(3.844)	(−0.209)	(−1.404)
Cash	−36.929**	−0.034	0.174***
	(−2.325)	(−1.044)	(3.371)
Constant	103.867***	0.096***	−0.200***
	(9.218)	(5.433)	(−6.583)
Year FE	Yes	Yes	Yes
Observations	1012	1012	1012
Adj. R-square	0.170	0.444	0.512

independent variables are zero. The random-effects estimator offers enhanced efficiency over the fixed-effects estimator, if this assumption is met. The results of Table 13, columns 1 and 2 show the relationship between CCC and MA using random effect and firm fixed effect models respectively, while columns 3 and 4 show the relationship between CAPEX and MA using random effect and firm fixed effect models respectively. Column 5 and 6 reports the relationship between CAPEX-NWC and MA using random effect and fixed effect models respectively. The results indicate that the sign of the relationship and statistical significance remain unchanged in both fixed effect and random effect models. These results substantiate our previous findings with respect to hypotheses 1, 4, and 7 respectively.

Additionally, we also use a system-GMM for our baseline regression to mitigate the concerns related to unobserved heterogeneity and omitted variable bias. Firm fixed effect models may not fully address the unobserved heterogeneity bias. Further, GMM models can take care of the weak instrument problems that arises from using lagged level of persistent independent variables as instruments for the

Table 12
Relationship between Managerial ability and CCC components. Table 12 presents the regression results examining the relationship between components of CCC and Managerial ability (MA Score). In model 1, 2 and 3 the regression of the components of CCC – days sales outstanding (DSO), and days payable outstanding (DPO) and days inventory of supply (DIS) respectively. Numbers within braces indicate robust t-statistics clustered at yearly basis.

VARIABLES	(1) DSO	(2) DPO	(3) DIS
MA_SCORE	−19.052***	14.224**	−10.752***
	(−3.518)	(2.014)	(−3.722)
Log Sales	−3.399***	−3.857***	−2.784***
	(−11.547)	(−8.793)	(−9.047)
Leverage	1.546	−0.769	0.885
	(0.481)	(−0.205)	(0.441)
OCF	−24.544***	−45.327***	−20.333***
	(−3.811)	(−5.659)	(−3.961)
PPE	−35.427***	2.027	0.053
	(−15.539)	(0.747)	(0.025)
Age	0.392***	0.158***	0.317***
	(6.891)	(2.677)	(10.749)
Cash	−71.521***	15.991*	−9.530**
	(−12.529)	(1.648)	(−2.112)
Constant	81.072***	59.791***	39.471***
	(11.229)	(7.334)	(5.107)
Year FE	Yes	Yes	Yes
Observations	3,811	3,811	3,811
Adj. R-square	0.143	0.059	0.062

*, ** and *** denote respectively statistical significance at 10%,5% and 1%.

Table 13
Test of endogeneity. Table 13 presents the regression results examining the relationship between cash conversion cycle (CCC), capital expenditure (CAPEX), capital-expenditure minus net working capital (CAPEX-NWC) and Managerial ability (MA_Score) using random effect, firm-fixed effect and system GMM. Numbers within braces indicate robust t-statistics clustered at yearly basis. *, ** and *** denote respectively statistical significance at 10%, 5% and 1%.

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(8)
	RE	FE	RE	FE	RE	FE	GMM	GMM	GMM
	CCC	CCC	CAPEX	CAPEX	CAPEX-NWC	CAPEX-NWC	CCC	CAPEX	CAPEX-NWC
MA_SCORE	−17.019**	−11.575*	0.126***	0.140***	0.125***	0.123***	−4.153	0.108***	0.082***
	(−1.999)	(−1.724)	(4.772)	(7.705)	(3.696)	(5.159)	(−0.729)	(7.295)	(4.461)
Log Sales	2.075	2.121	−0.004**	−0.010***	−0.015***	−0.023***	3.617*	0.021***	0.022***
	(0.951)	(1.158)	(−2.554)	(−3.368)	(−3.719)	(−4.974)	(1.889)	(4.158)	(3.615)
Leverage	−2.127	−3.788	0.006	0.033***	0.050**	0.071***	−2.110	0.068***	0.113***
	(−0.377)	(−0.771)	(0.453)	(2.754)	(2.508)	(4.171)	(−0.484)	(5.964)	(8.009)
OCF	−35.882***	−41.659***	0.072***	0.079***	0.082**	0.139***	−52.531***	0.081***	0.195***
	(−2.974)	(−4.535)	(3.404)	(3.237)	(1.991)	(3.361)	(−7.022)	(4.155)	(7.968)
PPE	−22.661**	−25.963***	0.137***	0.131***	0.270***	0.230***	−24.290***	0.209***	0.281***
	(−2.277)	(−3.393)	(13.077)	(7.547)	(11.947)	(8.770)	(−3.369)	(11.209)	(11.984)
Age	0.299*	0.261**	−0.000	0.000	−0.000	0.000	0.178	−0.002*	−0.002
	(1.731)	(2.302)	(−0.300)	(0.958)	(−0.716)	(0.622)	(0.490)	(−1.658)	(−1.412)
Cash	−36.364**	−26.433**	0.007	−0.022	0.193***	0.101***	−24.471***	−0.081***	0.129***
	(−2.480)	(−2.544)	(0.309)	(−0.952)	(4.326)	(2.817)	(−2.798)	(−3.549)	(4.815)
Constant	24.690*	32.661**	0.091***	0.107***	−0.038	0.011	63.744***	0.080***	0.125***
	(1.751)	(2.478)	(3.860)	(3.715)	(−0.802)	(0.204)	(5.871)	(2.601)	(2.201)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,811	3,811	3,811	3,811	3,811	3,811	2953	2953	2953
Adj. R-square	0.041	0.728	0.198	0.513	0.341	0.680	–	–	–
AR (1)							−24.65	−25.95	−24.90
							(0.000)	(0.000)	(0.000)
AR (2)							0.93	1.33	1.02
							(0.351)	(0.183)	(0.309)
Sargan Overid							3088.28	2751.18	3102.05
							(0.000)	(0.000)	(0.000)

regression in differences (Blundell and Bond 1998) and mitigate the identification problem – past changes in the endogenous variables (MA) are correlated with current period CCC, CAPEX and CAPEX-NWC its components only through their correlations. We estimate system GMM by using Roodman's (2009) "xtabond2" module in Stata.

Column 7, 8, and 9 of Table 13 reports the results of system GMM model. The results show that relationship between CCC, CAPEX,

and CAPEX-NWC and MA remain robust after controlling for endogeneity issues. The directional relationship also remained unaltered with respect to our baseline regression results. We find that the directional association between CCC and MA is unchanged but do not find the statistical significance in GMM estimation. The reasons for this observation could be the prerequisite of large panels with more observations for system GMM approach to be precise (Blundell and Bond,1998; Flannery and Hankins, 2013). Table 13, Columns 7, 8, and 9 also report the diagnostic test results for serial correlation and Sargan test of overidentification restrictions. If the error terms are serially correlated, we expect first-order serial correlation to be significant but the second-order correlation in the first-difference residual to be insignificant. Our results confirm that AR(1) is significant but AR(2) is insignificant. In summary, these robustness tests more or less substantiate the principal findings from our main analyses.

6. Managerial insights

The findings of this study have important managerial implications in general and for logistics and transportation sector in particular. Since the logistics and transportation industry is highly fragmented and firms in this sector operates in a highly competitive environment, judicious investment mix and optimum use of funds enhances superior firm performance According to the Upper echelon (UE) theory, the characteristics, beliefs, and actions of top-level executives have a substantial impact on a firm's decision-making and results (Hambrick and Mason, 1984). The UE theory is widely recognized as the primary framework for comprehending managerial ability (Anggraini and Sholihin, 2023), which is a central focus of our paper. In this paper we empirically examine the UE theory in the context of logistics and transportation industry and investigate the role of managers in the context of optimum resource utilization decisions.

Our findings suggest that managers with higher levels of ability tend to increase their capital expenditure (CAPEX) in order to improve capacity, efficiency, and service quality through investments in new technology, equipment, and facilities. These investments address key challenges faced by logistics and transportation firms. The logistics and transportation industry is currently experiencing an era of intense competition and significant transformation (Yang et al., 2022; Zhang et al., 2021). Supply chain management (SCM), in particular, faces pressing challenges including the need for quick turnaround times and delivery (Dai et al., 2015), transparent provenance (Dutta et al., 2020), stringent security and safety requirements (Marucheck et al., 2011), high degrees of transparency (Hastig and Sodhi, 2020), and efficient management of product lifecycle (Corallo et al., 2020). In response to this increasing complexity and dynamism, firms are introducing operational innovations that involve the formation and distribution of new methods and substantial modification in how they provide products and services. These innovations need significant CAPEX and offer strategic, operational and commercial benefits (Oke and Kach, 2012), allowing firms to overcome the aforementioned difficulties and improve performance. Capital investments in new technologies, such as blockchain, RFID, satellite-based GPS navigation systems, smart logistics, and AI-enabled devices, can promote more advanced capabilities and help logistics companies leverage better risk and returns, leading to increased productivity, fewer errors, and reduction of costs (Fu et al., 2021). To deal with these challenges and ensure competitiveness and survival, logistics and transportation companies must adopt a strategic approach to CAPEX by investing in technology and infrastructure, thereby improving their chances of survival and maintaining a competitive edge in a rapidly evolving industry. However, the requirement for necessary finance remains a significant obstacle in this regard. Securing sufficient funds for high CAPEX may not always be feasible through external sources alone. Hence, capable managers strive to allocate a portion of these investments by efficiently managing working capital and unlock funds that are tied up in working capital.

The current study emphasizes the significance of managerial roles in the logistics and transportation sector, leading to the attainment of optimal financing strategies, optimal investment strategies, balanced operational decisions, and superior firm performance. The study demonstrates that able managers by designing optimal investment strategies and engaging in efficient WCM, can partially mitigate the challenges of obtaining external finance and improve overall firm performance. The study thus offers valuable insights for managers striving to enhance their firm's performance and fortify their survival prospects in a dynamic and fiercely competitive logistics and transportation industry.

7. Conclusion

Prior studies based on the Upper Echelon theory (Hambrick and Mason, 1984) have demonstrated the significant impact of managerial ability on different facets of firm performance like corporate investment decisions (Gan, 2019), firm disclosure (García-Sánchez and Martínez-Ferrero, 2019), reporting quality (Abernathy et al., 2018; Demerjian et al., 2020), firm performance (Yuan et al., 2019; Fernando et al., 2020), and dividend policy (Sarwar et al., 2020). However, to the best of our knowledge, the interlinkage between managerial ability (MA), capital expenditure (CAPEX), efficient working-capital management (WCM), and firm performance has not been examined. This paper investigates the same, for a sample of transportation and logistics firms from the US between 1988 and 2018 and provide some novel insights. Our findings suggest that higher MA results in efficient WCM, higher CAPEX and greater firm performance, with a demonstrated role of efficient WCM in the process. We posit that managers with greater ability focus on maximizing firm performance, which prompts them to engage in higher CAPEX. Given the challenges and costs of raising external funds, these managers frequently seek to generate internal funds by enhancing WCM efficiency. This leads managers to implement better WCM practices to release locked-up funds to facilitate higher investments in CAPEX. Overall, the study demonstrates that able managers try to strike a balance between WCM and CAPEX and in combination enhance the firm performance. Our findings remain robust even after using alternative proxies for MA, controlling for various firm-specific variables and macroeconomic parameters, as well as potential endogeneity concerns.

The paper significantly contributes to the existing literature in several ways. It explores the impact of managerial ability and

providing new insights into the relationship between MA, CAPEX, WCM efficiency, and firm performance. The findings have practical implications for the logistics industry, emphasizing the importance of effective WCM and strategic CAPEX decisions, and advancing our understanding of managerial ability in financial decision-making. While previous studies have primarily focused on the association between MA and firm's long-term goals such as capital budgeting and capital structure, this paper takes a novel approach by examining the impact of MA on WCM and its interlinkage with CAPEX. The study sheds light on the role of managers on the holistic financial aspects, including relatively neglected area of WCM. These insights provide valuable guidance for managers in general and the logistics industry in particular, enabling them to make informed decisions regarding WCM and CAPEX, ultimately improving firm performance. The paper also makes empirical contributions by considering the moderating effects of external factors such as financial constraints, proximity to financial distress, macroeconomic uncertainty, and geopolitical risk, thereby providing a comprehensive analysis for a better understanding of the unique impact of MA on WCM and CAPEX.

In summary, this study offers an extensive examination of the interlinkages between MA, CAPEX, WCM efficiency, and firm performance specifically for logistics industry firms. We hope these findings, augment the existing literature on MA, CAPEX, WCM and logistics and operations management. Although our data is extensive in terms of volume, we acknowledge its limitation as it pertains solely to a single country i.e., the US. While, this may raise concerns about the generalizability of our findings in other countries, it presents an opportunity for further research to explore the topic in a multi-country setting under diverse conditions and contexts.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix 1. . Sample firms based on 4-digit SIC code

Description of Industry	SIC
Railroads, line-haul operating	4000–4013
Local & suburban transit & interurban highway passenger transportation	4100–4100
Trucking & courier services, except air	4210–4219
Water transport	4400–4499
Air transportation	4500–4599
Pipelines, excluding natural gas	4600–4699
Transportation-services	4700–4700
Arrangement of transportation of freight and cargo	4730–4739

Appendix 2. . Sample selection process

Total observations in the industry during the period	4408
Less: if any CCC component is more than 365 days	340
Less: Missing Value of Capex	28
Less: Missing Value of MA Score	47
Less: Missing Value of OCF	36
Less: Missing Value of Age	1
Less: Missing Value of Cash	37
Less: Missing value of Tobin's Q	108
Final Sample	3811

Appendix 3. . Year-wise distribution of firm-year observations

Year	Observations	Percentage
1988	12	0.31
1989	87	2.28
1990	93	2.44
1991	97	2.55
1992	105	2.76
1993	113	2.97
1994	125	3.28
1995	129	3.38
1996	142	3.73
1997	148	3.88
1998	153	4.01
1999	139	3.65

(*continued on next page*)

(*continued*)

Year	Observations	Percentage
2000	131	3.44
2001	127	3.33
2002	123	3.23
2003	128	3.36
2004	132	3.46
2005	140	3.67
2006	136	3.57
2007	136	3.57
2008	133	3.49
2009	130	3.41
2010	126	3.31
2011	120	3.15
2012	120	3.15
2013	123	3.23
2014	130	3.41
2015	133	3.49
2016	133	3.49
2017	131	3.44
2018	136	3.57
Total	**3,811**	**100**

Appendix 4. . Variable Description

Variables	Measurement
CCC	Cash Conversion Cycle $=DRO + DIO - DPO$
DPO	Payable period $=\frac{AccountsPayable}{Costofgoodssold} \times 365$
DSO	Receivable period $=\frac{AccountsReceivable}{Sales} \times 365$
DIS	Inventory period $=\frac{Inventory}{Costofgoodssold} \times 365$
Tobin's Q	Indicator of firm performance $=\frac{TotalAssets + Marketvalueofequity - Bookvalueofequity}{TotalAssets} \times 365$
CAPEX	Capital Expenditure $=\frac{CapitalExpenditure}{TotalAssets}$
CAPEX-NWC	Difference between capital Expenditure and net working capital (NWC) $NWC = Receivables + Inventory - payables (CAPEX - NWC) = \frac{(CAPEX - NWC)}{TotalAssets}$
Log Sales	Proxy of firm size $= Log(Sales)$.
Leverage	Capital Structure $=\frac{Longtermdebt + Shorttermdebt}{TotalAssets}$
OCF	Operating cash flow $=\frac{Incomebeforeextraordinaryitems + Depreciation}{TotalAssets}$
Age	Firm Age $= (Numberofyearssincethefirmenteredinto CRSPdatabase)$.
PPE	Net tangible fixed assets $= \frac{PropertyPlantandEquipment}{TotalAssets}$.
Cash	Cash balance $=\frac{Cash}{TotalAssets}$
SA_Index	Indicator of financial constraints [(Proposed by Hadlock and Pierce (2010).)], $([-0.737 \times \text{Log(Total asset)}] + [0.043 \times \text{Log(Total asset)2}] - (0.040 \times \text{Age}))$
Altman_z_ Score	Indicator of financial distress. $\left(0.012 \times (\frac{WorkingCapital}{TotalAssets}) + 0.014 \times (\frac{RetainedEarnings}{TotalAssets}) + 0.033 \times (\frac{EBIT}{TotalAssets}) + 0.006 \times (\frac{Marketvalueofequity}{Bookvalueoftotalliabilities}) + 0.999 \times (\frac{Netsales}{TotalAssets})\right)$
MA Score	Indicator of Managerial Ability. (We use managerial ability score developed by Demerjian et al. (2012).). ($We collect this data from Peter Demerjian's personal webpage (https://faculty.washington.edu/pdemerj/data.html)$).
EPU	Economic policy uncertainty. (We collect the data from https://fred.stlouisfed.org/series/USEPUINDXM.)
Geopolitical Risk (GPR)	Measured by Caldara and Iacoviello, (2018) (We collect this data from https://www.policyuncertainty.com/gpr.html .).

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