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Article

Behavior of small and medium shipping enterprises' working capital management: moderating role of firm-specific characteristics in times of crises and geopolitical risk

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Behavior of small and medium shipping enterprises' working capital management: moderating role of firm-specific characteristics in times of crises and geopolitical risk

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ABSTRACT

This study examined the relationship between working capital management and the profitability of small and medium enterprises (SMEs) in the shipping industry, particularly during crises and geopolitical uncertainty, as well as the moderating effects of firm-specific characteristics and macroeconomic factors. We used firm-level data from Thailand's shipping SMEs from 2001 to 2021 and a dynamic panel Generalized Method of Moments (GMM) approach. We found a nonlinear and negative relationship between working capital and profitability for all of the study's samples. Shipping SMEs tended to adopt aggressive working capital policies during the global financial crisis, whereas they were likely to use conservative policies during the 2016–2017 shipping market turmoil, according to the separate analysis. The 2016–2017 shipping market turmoil negatively impacted firms' profitability, albeit mitigated by sales growth. Our findings indicated that the impact of working capital management on profitability was more pronounced during the global financial crisis compared to the shipping industry turbulence observed in 2016–2017. We also discovered that, in the presence of China's geopolitical risk, firms were likely to enhance their working capital efficiency and mitigate an adverse impact on firm performance with their financial leverage and firm size. Additionally, financially constrained firms exhibited an inverted U-shaped relationship between working capital and profitability. To maximize firms' profitability, management should pay attention to their working capital management and attempt to maintain the optimum level of working capital. Moreover, management should consider working capital as an essential source of financing, especially for financially constrained firms. The findings shed light on the working capital management decisions made by shipping SMEs in the emerging market.

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1. Introduction

The focus of our study is the shipping industry in Thailand, which has received less attention in previous research despite its significance as a service sector in a developing economy. The shipping industry is essential for global distribution and facilitates the relocation of industrial production to emerging countries (Drobetz et al., 2013). As a result, these nations are able to participate in regional trade and global value chains (UNCTAD, 2023). Nevertheless, the shipping industry is very susceptible to unforeseen occurrences such as worldwide economic fluctuations, fluctuating freight prices, financial crises, political upheavals and outbreaks of diseases (Yin et al., 2023). A single supply chain supplier's bankruptcy might have a cascading effect on the supply network as a whole (Grosse-Ruyken et al., 2011). Therefore, having reliable and financially sound partners—like shipping companies—is essential for effective supply chain management.

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Most Thai shipping enterprises are small- and medium-sized (SMEs), although many of them are family-owned and significantly reliant on long-term debt (Kotcharin & Maneenop, 2017). This demonstrates commitment and may help them secure long-term financing due to their family's reputation. Shipping SMEs make financial decisions similar to those of larger maritime companies, including capital structure. As a result, companies rely heavily on capital inputs and have high debt. Unique business characteristics are comparable to those of large listed companies. For instance, the tangibility ratio of nonlisted Thai shipping SMEs is 59% (Kotcharin & Maneenop, 2017), while that of globally listed shipping companies is 63% (Drobetz et al., 2013). Nonlisted shipping companies, conversely, differ in size, profits and growth from globally listed shipping companies.

In Thailand, commercial bank lending is SMEs' main external funding (OECD, 2024). As the economy improved, SMEs borrowed more for working capital. SMEs borrowing conditions tightened. SMEs cannot borrow from commercial banks without credit history, collateral or reliable financial records (OECD, 2024; Punyasavatsut et al., 2011). Shipping companies' cash flows depend on global commerce and economic conditions (Drobetz et al., 2016). For instance, the U.S. dollar–Thai Baht exchange rate affects Thailand's small- and medium-sized maritime companies' cash flows (Kotcharin & Maneenop, 2018). These companies require better internal financial management. Working capital management (WCM) is more important for SMEs than large firms, according to Afrifa and Padachi (2016) and Baños-Caballero et al. (2010). SMEs with limited funds may overlook WCM, losing their business opportunities (Zeidan & Shapir, 2017). Companies can also suffer from excess working capital. To thrive, shipping SMEs must emphasize WCM.

Previous WCM research falls into three groups. The first group studies the relationship between WCM and profitability (e.g. Umar & Al-Faryan, 2024; Vo & Ngo, 2023). The second group focuses on the determinants of WCM (e.g. Nyeadi et al., 2018), while the last group examines business-specific conditions or macroeconomic issues that affect WCM and their prospects (e.g. Hussain et al., 2024; Mahmood et al., 2024). To begin with, empirical studies on the relationship between WCM and firms' profitability yield conflicting results. Several prior studies show a negative relationship (e.g. Farhan et al., 2021; Garg & Singh, 2023; Hussain et al., 2024; Kayani et al., 2023; Soukhakian & Khodakarami, 2019; Vo & Ngo, 2023). Other studies reveal a positive relationship (e.g. Dash et al., 2023; Deari et al., 2022; Gill et al., 2010; Pant et al., 2023), a nonsignificant relationship (e.g. Hatane et al., 2023; Rey-Ares et al., 2021) or a nonlinear relationship (e.g. Chambers & Cifter, 2022; Mahmood et al., 2024). Some of them show a U-shaped pattern between working capital level and firms' profitability (e.g. Chambers & Cifter, 2022; Mahmood et al., 2019), whereas others reveal an inverted U-shaped pattern (e.g. Afrifa et al., 2014; Ahangar, 2021; Baños-Caballero et al., 2012; Dash et al., 2023; Mahmood et al., 2024). Singh and Kumar (2014) discovered that firm size influences WCM and profitability through a meta-analysis of 126 research papers. Mahmood et al. (2019) found that company size and leverage have significantly impacted the U-shaped relationship between WCM and profitability. Previous studies have shown inconclusive findings about the particular relationships and factors that have impacted WCM and corporate profitability (Jaworski & Czerwonka, 2022).

Other factors, such as macroeconomic levels and financial crises, also affect WCM (e.g. Hussain et al., 2024; Mahmood et al., 2024). Hussain et al. (2024) reported that the currency rate moderates the relationship between the cash conversion cycle and the ROA of Pakistani manufacturing companies. Additionally, according to the study of Jaworski and Czerwonka (2022), country- and industry-specific factors affect the WCM-profitability relationship. In contrast, Singh et al. (2017) found that there was no moderating effect of economic development on the relationship between working capital and firm performance in a meta-analysis. Similarly, Soukhakian and Khodakarami (2019) discovered that macroeconomic factors (i.e. inflation and GDP) have no moderating effects on the relationship between WCM and profitability. In a recent study by Vlismas (2024), the author argued that research on the internal and external factors influencing the WCM-profitability relationship requires urgent attention. This gap in the literature highlights the need for comprehensive studies that consider both firm-level factors and macroeconomic variables to provide a holistic understanding of WCM's impact on profitability.

Moreover, WCM research has mostly focused on large organizations (e.g. Aktas et al., 2015; Boisjoly et al., 2020; Deloof, 2003). As compared to SMEs, large firms are likely to have better management of their working capital (Afrifa et al., 2022). Due to their access to long-term external financing, large firms can invest more in their current assets, properly control their level of current liabilities and manage to have excess cash for their daily operations. Nevertheless, a limited number of firms, particularly those

with smaller sizes, have the ability to secure external funding. Specifically, SMEs tend to face constraints on their long-term borrowings because of the limited amount of their fixed assets as collateral (Duarte et al., 2017; Punyasavatsut et al., 2011). In addition, SMEs are more vulnerable to crises, which may lead to an increase in their liquidity risk or result in bankruptcy (Zimon et al., 2024). As a result, various behaviors of WCM for SMEs are worth exploring. Nonetheless, there is little empirical evidence on WCM and the profitability of SMEs (Afrifa & Padachi, 2016). The difficulty in data collection for SMEs may be the reason (Carbó-Valverde et al., 2016).

Pratap (2023) carried out a comprehensive analysis of WCM literature, spanning from 1960 to 2021. The study found that the majority of research on WCM focuses on developed countries, such as the US, UK and EU. Therefore, we need empirical studies that use samples from emerging economies for comparison. Furthermore, studies on WCM often collect and analyze organizations from a variety of industries, overlooking the fact that WCM is dependent on business types (Grosse-Ruyken et al., 2011) and that working capital levels might vary dramatically between industries (Dash et al., 2023; Rey-Ares et al., 2021). Recent studies attempt to fill up the research gap by focusing on a specific industry, namely the pharmaceutical industry (Farhan et al., 2021), hospitality and tourism (Chambers & Cifter, 2022), construction (Zimon et al., 2024) and halal food and beverage industries (Umar & Al-Faryan, 2024). However, most of the prior studies concentrated on manufacturing sectors (Pratap, 2023). Therefore, it would be beneficial to conduct studies on the service sectors, especially in developing countries, due to the unique characteristics of both the industry and the country. We are interested in WCM and profitability for SMEs in shipping services because they possess a unique nature. In particular, they operate in uncertain situations, face significant risk and have high financial and operating leverage (Ahrends et al., 2018).

During the financial crisis, shipping businesses have faced constraints on external financing due to fewer asset-based financing options and strict banking restrictions. Even prominent and publicly traded shipping companies nevertheless have substantial financial limitations when it comes to financing their growth opportunities (Ahrends et al., 2018). Securing capital in the shipping sector is one of the primary obstacles due to high risks and low profitability. During times of uncertainty, banks are likely to adopt more cautious lending strategies to lessen their bad loans, resulting in stricter regulation (Drobetz et al., 2016; Ivantsov, 2024). Kotcharin and Maneenop (2018) demonstrate that Thai SMEs in the shipping industry actively pursue external funding options in response to fluctuations in China's economic policy uncertainties. Therefore, we argue that shipping SMEs must effectively monitor their levels of working capital to generate internal cash flow and earn profits by reducing finance costs, particularly during periods of heightened uncertainty.

This study addresses the following research questions after the aforementioned discussion:

RQ1: How does WCM affect Thai shipping SMEs' profitability?

RQ2: How do Thai shipping SMEs manage their working capital during crises?

RQ3: How do firm-specific factors shape Thai shipping SMEs' WCM and profitability?

RQ4: How do macroeconomic factors, especially China's geopolitical risk, influence Thai shipping SMEs' WCM and profitability?

RQ5: How do financial constraints and unconstrained financial conditions influence Thai shipping SMEs' WCM and profitability?

Our findings contribute to the literature in several ways. First, to our knowledge, this is the first empirical study in the field of shipping business research to assess the nonlinear relationship between working capital and profitability in an emerging country. Second, the global financial crisis had a greater impact on the WCM-profitability relationship than the 2016–2017 shipping market turmoil. Third, while Pant et al. (2023) reported a linear or positive relationship between WCM and profitability, we discovered no relationship between WCM and profitability, a negative relationship, an inverted U-shaped relationship or a U-shaped relationship. Fourth, we answered the question of why earlier studies show different WCM and profitability trajectories. In other words, we have identified the potential presence of moderating factors, such as sales growth, liquidity and crises that influence the results. Fifth, this study investigated the influence of country-specific and industry-specific factors on WCM and profitability. Previous research (e.g. Mahmood et al., 2024) reported that macroeconomic factors have a role in shaping the

WCM–profitability relationship. Finally, our findings empower government institutions to implement favorable policies to enhance working capital performance during crises and geopolitical uncertainties.

The remaining portion of the paper follows this structure: [Section 2](#) reviews the literature and presents the development of research hypotheses. [Section 3](#) shows the data and sample, the selection of variables and the research model. [Section 4](#) presents the results with discussions. [Section 5](#) concludes the study and provides implications for the findings.

2. Theoretical background and hypotheses development

2.1. Theoretical background

The pecking order theory, as proposed by Myers and Majluf (1984) and Myers (1984), addresses the relationship between WCM and firm profitability. Firms tend to use internal cash due to the information asymmetry between them and their external capital providers, and if they need additional funds, they prefer debt financing over equity financing. In particular, for SMEs, which are normally family-owned businesses (Duh, 2012), firms' managers are predominantly concerned about losing their control to external parties. They tend to use internal cash or retained earnings and bank loans for their working capital investment, daily operations and to sustain sales growth.

SMEs face financial constraints on loans and equity capital because of their information asymmetry and the absence of transparency (Hoang et al., 2019). The low quality of their financial reporting may result in high monitoring expenses for capital providers. As a result, efficient management of working capital through the cash conversion cycle is among the alternatives to lower finance costs and provide sufficient cash for day-to-day operations (Ahangar, 2021; Baños-Caballero et al., 2014). Liquidity increases when fastening the cash collection days from customers or postponing the payments to suppliers. Increased liquidity and lowered finance costs can eventually boost a firm's sales and profits (Deloof, 2003). In addition, firms with sufficient internal cash may consider augmenting their investment in working capital as a means to enhance their overall performance (Afrifa, 2016). Nevertheless, ineffective WCM can increase the financial burden of external debts for firms, resulting in lowered firm performance. Kieschnick et al. (2013) support this by suggesting that excessive investments in working capital necessitate supplementary external funding.

In addition, we described how WCM influences profitability from an operational standpoint. Working capital shows robust operational efficiency. Finance managers focus on working capital and credit collection to maintain a net liquid balance for smooth business operations (Tiwari et al., 2023). Firms also utilize trade credit to enhance cost efficiency and provide predictability to suppliers and consumers (Yazdanfar & Öhman, 2016). Using trade credit helps attract customers and boost sales, resulting in increased scale efficiencies. Thus, high-performance firms with diminished conversion cycles have shorter payment periods due to their adeptness in managing operational capital effectively, which enables them to conduct operations with decreased financial needs. These companies are not dependent on delaying payments to suppliers. Instead, they opt to make prompt payments to reap the advantages of early payment, which help reduce procurement costs and sustain a satisfactory level of profitability (Kumar et al., 2024).

The literature also suggests that firms with more uncertainty in demand are highly likely to provide trade credit compared to firms with more steady demand (Martínez-Sola et al., 2014). It aligns with the reasoning from a commercial standpoint. Extending trade credit has a tendency to increase sales and profitability for companies (Dary & James, 2019). Companies mostly utilize trade credit to enhance their market shares and cultivate enduring relationships with clients. Conversely, trade credit investment is costly. Companies expect to incur extra administrative expenses when providing trade credit. Moreover, they are more vulnerable to the risks associated with delayed payments or failure to make payments. If the costs of investing in trade credit outweigh the benefits, it is inevitable that profitability will decline. Therefore, SMEs with low market power are more inclined to offer their trade credit to boost their sales and profits and enhance their reputation (Martínez-Sola et al., 2014).

From the theoretical perspective, WCM can be classified into two policies: aggressive and conservative policies (Hill et al., 2010; Juan García-Teruel & Martínez-Solano, 2007). Aggressive working capital policies

are derived from a firm's net operating working capital and offer financing for long-term assets. In other words, in aggressive strategies, firms tend to minimize their investment in working capital and use excess funds for long-term assets and business expansion (Demiraj et al., 2022). An aggressive policy may be suitable for SMEs' financial conditions. Hill et al. (2010) and Zeidan and Shapir (2017) argued that financially constrained firms tend to use aggressive working capital policies. Nevertheless, employing aggressive policies entails the costs of decreased sales and elevated liquidity risk. Meanwhile, firms apply conservative working capital policies by using available cash flow or expanding their lines of trade credit. Firms that are able to secure funding from external sources or those that have no trouble earning cash from inside are more inclined to use conservative policies (Hill et al., 2010; Zeidan & Shapir, 2017). Extended trade credit enables firms to either boost their sales by meeting rising customer demand or enhance customers' relationships, resulting in improved firm performance. Excessively cautious policies, conversely, might result in firms missing out on chances to invest in valuable long-term assets or lucrative projects. Additionally, firms with a high level of working capital may be exposed to credit risks, especially when they must borrow money from external sources with high interest rates (Baños-Caballero et al., 2014).

2.2. Hypotheses development

2.2.1. WCM and profitability

A company's liquidity is the focus of WCM, yet conventional liquidity measurements like the current ratio offer little insight (Cagle et al., 2013; Ebben & Johnson, 2011). The current ratio is used to measure a firm's liquidity by taking into account all current assets and liabilities at a specific moment in time. It ignores financial resources' time component (Cagle et al., 2013). The current ratio, as a static measure of liquidity, does not reflect the cash collection days and the cash payment days. In contrast, the cash conversion cycle (CCC) is considered an effective approach for assessing a firm's liquidity (Briones et al., 2022; Moss & Stine, 1993). The CCC reflects how many days the firm can sell inventories, collect cash from customers and pay bills to its suppliers.

In addition, CCC, as a dynamic measure of the firm's liquidity, helps consider how trade credit offerings to customers affect sales revenue, how the level of inventories adversely influences holding and maintenance costs and how deferring payments to suppliers may provide financial leverage for the firm. Therefore, some argue that CCC influences sales revenue, thereby impacting the firm's profitability (Chambers & Cifter, 2022; Sawarni et al., 2022; Umar & Al-Faryan, 2024). Moreover, CCC explains WCM by synchronizing fund inflow and outflow and managing fund timing to satisfy the firm's liquidity demands (Richards & Laughlin, 1980). The CCC can measure WCM efficiency and productivity (Deloof, 2003). Also, CCC helps measure a firm's ability to pay short-term bills and debts, which is vital to its financial stability (Sah et al., 2022), especially for SMEs. Therefore, we believe that CCC is a suitable indicator of profitability for SMEs. Cagle et al. (2013) suggested using both CCC and the current ratio to assess a company's liquidity. The CCC represents liquidity status dynamically, whereas the current ratio represents it statically. The reasoning mentioned suggests that we can empirically examine the relationship between WCM and firm performance using the current ratio, one of the control variables, in our regression model. Previous studies on the WCM-profitability relationship have employed the current ratio as a control variable in their models (e.g. Afrifa et al., 2014; Akgün & Karataş, 2020; Altaf & Ahmad, 2019; Hassan et al., 2023).

Demiraj et al., 2022; Enqvist et al. (2014), Rey-Ares et al. (2021) and Umar and Al-Faryan (2024) measured efficient working capital management using CCC. Operating efficiency improves with a shorter CCC (Enqvist et al., 2014). Implementing an aggressive working capital policy can affect sales, firm profitability and supplier administrative costs (Deloof, 2003). However, a longer CCC indicates more working capital investment (Singh & Kumar, 2014). With such cautious policies, insufficient working capital conversion into cash can put firms at operational risk (Demiraj et al., 2022). Firms investing extensively in working capital may have poor financial performance due to the greater costs of external financing (Aktas et al., 2015; Baños-Caballero et al., 2014; Deloof, 2003). When choosing working capital levels, management should weigh liquidity and profitability.

It is important to note that businesses operate in dynamic environments; therefore, what constitutes an optimal quantity of working capital for one company (country) may not be suitable for another. The

results of the current investigations are inconclusive. Several studies, such as Dash et al. (2023), Deari et al. (2022) and Pant et al. (2023), have found a positive relationship between working capital and firm profitability. Specifically, Hatane et al. (2023) conducted a study on the relationship between working capital and profitability of Indonesian listed enterprises, which indicated that working capital has a little impact on return on capital employed (ROCE). Nevertheless, effective management of working capital has a substantial and positive influence on economic value added (EVA). In contrast, several prior studies, such as Hassan et al. (2023), Soda et al. (2022), Umar and Al-Faryan (2024), Vo and Ngo (2023) and Yeboah and Kjaerland (2024), have reported a negative relationship between working capital and firm profitability. Based on the pecking order theory and the financial conditions of Thai shipping SMEs operating in a volatile market with limited external funding, we projected that these SMEs would strive to reduce their CCC to achieve a decent level of profitability. Therefore, we proposed that:

H1a: *The cash conversion cycle (CCC) is negatively related to firm profitability.*

Recent literature suggests that the relationship between WCM and firm performance is nonmonotonic (Dash et al., 2023; Deari et al., 2022; Rey-Ares et al., 2021; Singhania & Mehta, 2017). In particular, the relationship between CCC and firms' profitability has an inverted U shape (e.g. Afrifa et al., 2014; Ahangar, 2021; Baños-Caballero et al., 2012; Dash et al., 2023; Mahmood et al., 2024). The concave relationship between CCC and profitability demonstrates the existence of the optimum level of working capital, which is crucial for corporate success (Deari et al., 2022). The complexity of the relationship and its impact on financial decision-making deserve additional research.

Utilizing short-term loans for working capital has positive and negative effects, depending on the percentage used (Altaf & Ahmad, 2019). Financing a small percentage of working capital with short-term loans may improve business performance because the benefits outweigh the costs. In contrast, using more loans to finance working capital may result in greater financial costs and negatively affect corporate performance (Baños-Caballero et al., 2016). Therefore, we argued that working capital financing may have an inverted U-shape relationship with corporate performance. Similarly, Baños-Caballero et al. (2014) suggested that the positive and negative signs of working capital result from trade-off decisions to reach the optimal working capital level. When firms increase their investment in working capital to reach a certain beyond-optimum level, they should lower their investment to avoid the costs associated with excess working capital. This highlights the importance of regularly evaluating and adjusting working capital levels to maximize firms' efficiency and profitability. Therefore, we proposed that:

H1b: *The square of the cash conversion cycle (CCC²) is negatively related to firm profitability.*

2.2.2. Other testable hypotheses

Tsuruta (2019) explains that the level of working capital rises during the global financial crisis for several reasons, including a rapid drop in business sales, clients' postponing payments during the recession and lower trade payables. Also, most firms finance working capital using their existing funds. Extra working capital may impair firms' financial performance because it necessitates costly borrowings. Thus, during and after crises, firms should adjust their working capital to maintain their corporate performance. Ahmad et al. (2022), for instance, conducted a comparative analysis of WCM and profitability of Asian nations, specifically Malaysia, Thailand and Pakistan, throughout the global financial crisis and the COVID-19 crisis. The CCC and ROA have a positive relationship, according to their combined samples. In terms of the impact on ROA, the COVID-19 crisis has a greater impact than the 2008 financial crisis. In contrast, according to Zimon and Tarighi (2021), the COVID-19 crisis did not alter WCM practices. In addition, Akgün and Karataş (2020) reported that the 2008 global financial crisis negatively affected the working capital and profitability of businesses.

In this study, three major crises, namely the aftermath of the global financial crisis (D1) (Ahmad et al., 2022; Casey & O'Toole, 2014; Mahmood et al., 2024; Notteboom et al., 2021), the shipping market turmoil (D2) (Song et al., 2019) and the COVID-19 crisis (D3) (Ahmad et al., 2022) are world-important crises affecting shipping businesses. For example, Mahmood et al. (2024) divided the data pertaining to the global recession (2008–2010) to assess the relevance of the WCM-profitability relationship. During the

forementioned recession, companies experienced difficulties obtaining and repaying short-term loans. They demonstrate a direct and negative relationship between WCM and profitability. Additionally, Song et al. (2019) argue that several events, including the bankruptcy of Hanjin Shipping, marked the period of 2016–2017, causing turbulence in the shipping market. During the period of 2016–2017, shipping companies worldwide faced low demand and industry overcapacity. Such turbulent market phenomena could potentially affect firm profitability and signal to the firm's management to adjust their WCM policies. Based on the literature, we proposed the following:

H2a: *In times of crisis, the relationship between CCC and profitability is significantly negative.*

H2b: *In times of crisis, the relationship between CCC² and profitability is significantly negative.*

Akgün and Karataş (2020) and Deari et al. (2022) have demonstrated that the interaction between working capital management and crises has a positive impact on ROA. It implies that firms invest more in working capital during crises. During the global financial crisis, working capital financing and performance differed based on business financial flexibility and solvency (Baños-Caballero et al., 2016). The authors add that Spanish SMEs with substantial short-term loans had a lower return on equity, regardless of debt financing and liquidity policies during the financial crisis. In contrast to pre-crisis, SMEs with the lowest percentage of working capital financed with short-term bank loans are the most profitable. Therefore, we proposed that:

H3a: *The crises significantly moderate the relationship between CCC and firm profitability.*

H3b: *The crises significantly moderate the relationship between CCC² and firm profitability.*

Researchers have established the roles of firm size (Baños-Caballero et al., 2016), financial leverage (Mahmood et al., 2019) and cash flow (Laghari & Chengang, 2019) in the working capital-profitability relationship. Specifically, larger firms tend to gain more profitability than smaller firms when they invest in trade credit (Martínez-Sola et al., 2014). Because our sample consisted of SMEs, sales growth would be an important factor that firms can use to drive business growth. Martínez-Sola et al. (2014) noted that sales growth helps increase firms' profits, which is a good indicator of firms' investment opportunities. Therefore, we expect a relationship between working capital, such as CCC and firms' profitability due to sales growth. The impact of CCC on profitability may vary depending on individual firms' sales growth levels. Nonetheless, researchers reported that the growth of revenues has no impact on CCC (Baños-Caballero et al., 2010), whereas some studies found a negative relationship between sales growth and working capital requirements (Jadiyappa & Shette, 2024). In addition, sales growth strongly and positively correlates with profitability (e.g. Afrifa, 2016; Hoang et al., 2019; Sah et al., 2022; Sawarni et al., 2022). Therefore, we proposed the following:

H4a: *Firm-specific characteristics significantly moderate the relationship between CCC and firm profitability.*

H4b: *Firm-specific characteristics significantly moderate the relationship between CCC² and firm profitability.*

Geopolitical risk has a significant impact on the operating expenses and revenues of maritime companies (Khan et al., 2021). Due to the increasing geopolitical risk, listed shipping companies have increased their cash reserves as a preventive measure (Kotcharin & Maneenop, 2020b). Financial constraints, in particular, cause shipping companies to maintain a larger cash reserve than those without such constraints. When shipping companies have difficulties obtaining external financing, they may use cautious working capital practices rather than aggressive ones. Similarly, when there is a rise in geopolitical uncertainty, shipping companies reduce their leverage in response to the increased cost of borrowing (Kotcharin & Maneenop, 2020a). We presume that an escalation in geopolitical risk increases SMEs' difficulties in obtaining their funds externally. SMEs, therefore, need to make adjustments to their WCM policies to survive and earn reasonable profitability.

Baños-Caballero et al. (2014) highlight the importance of working capital as a means of financing for companies when they face financial limitations. Companies with limited financial resources should reduce

their investment in working capital, whereas companies with ample resources can increase their investment (Baños-Caballero et al., 2014; Laghari & Chengang, 2019). To put it simply, firms with financial flexibility may allocate more funds towards working capital. Limiting access to external funding due to excessive spending has a negative impact on a company's WCM and profitability (Dash et al., 2023). Investing a large amount of working capital increases finance costs and raises the risk of firms' insolvency (Laghari & Chengang, 2019). The pecking order theory and cash conversion method suggest that firms should maintain a shortened cash conversion cycle to boost their performance and value. Therefore, firms should adopt efficient WCM strategies to enhance their financial performance (Umar & Al-Faryan, 2024). Dash et al. (2023) and Laghari and Chengang (2019) provide support for the inverted U-shaped link between WCM and firms' success. The financial limitations of firms can impact their capacity to effectively oversee working capital, which in turn may have a negative effect on their profitability. According to Baños-Caballero et al. (2014), companies that have limited financial resources tend to have lower levels of optimal working capital. Hoang et al. (2019) suggested that financially constrained SMEs value more efficient WCM than financially unconstrained ones. Therefore, based on the literature, we proposed the following:

H5a: *China's geopolitical risk significantly moderates the relationship between CCC and firm profitability.*

H5b: *China's geopolitical risk significantly moderates the relationship between CCC² and firm profitability.*

H5c: *The relationship between CCC and profitability of firms with greater financial constraints differs from that of firms with less financial constraints.*

H5d: *The relationship between CCC² and profitability of firms with greater financial constraints differs from that of firms with less financial constraints.*

3. Methodology

3.1. Data and sample

We sourced financial data from Business Online Public Company Limited (BOL), a licensed financial data provider that includes a comprehensive database of most companies registered with the Thai Ministry of Commerce. Previous studies on topics pertinent to Thailand have also utilized this particular data source (e.g. Bertrand et al., 2008; Bunkanwanicha & Wiwattanakantang, 2006; Charumilind et al., 2006; Kotcharin & Maneenop, 2018; Sirirattanaphonkun & Pattarathammas, 2012). We used a web-based business database that contained financial data for companies categorized under the TSIC code 50121 (sea and coastal freight water transport). Additionally, we acquired macroeconomic data from the Bank of Thailand.

We collected the data of Thailand's shipping companies from 2001 to 2021. At the start of the collection process, we extracted 205 companies with 3,512 firm-year observations. We deleted: (i) observations with anomalies or containing empty data and (ii) observations with zero value for variables used in the research model (e.g. total sales, cost of goods sold, inventories, total assets and accounts payable) and ended with 1,684 firm-year observations (128 companies). Furthermore, we removed observations without data for consecutive years to capture changes for some model variables, such as sales growth. We also removed outliers from our sample. Our sample consisted of firms with a total asset value of at least 100 million baht. Such a cut-off value for the total assets was appropriate for our study's purpose, focusing on shipping SMEs. In the end, our final sample consisted of 978 firm-year observations with 96 companies.

3.2. Variables

The dependent variable was the ROA, which represents a firm's overall profitability. The ROA indicates the ratio of earnings before interest and taxes to total assets. For the independent variables, we measured WCM through the number of days with respect to accounts receivable, inventory and accounts payable. The CCC was calculated as the number of days of accounts receivable plus the number of days of inventory minus the number of days of accounts payable. The CCC days were calculated as follows:

$$\text{CCC} = (\text{Number of Days of Accounts Receivable} + \text{Number of Days of Inventory}) - (\text{Number of Days of Accounts Payable})$$

We calculated the components of CCC days as follows:

$$\text{Number of Days of Accounts Receivable} = \left(\frac{\text{Accounts receivable}}{\text{Sales}} \right) \times 365$$

$$\text{Number of Days of Inventory} = \left(\frac{\text{Inventory}}{\text{Cost of goods sold}} \right) \times 365$$

$$\text{Number of Days of Accounts Payable} = \left(\frac{\text{Accounts payable}}{\text{Cost of goods sold}} \right) \times 365$$

We used the following firm-specific characteristics relating to firm profitability as control variables (e.g. Chambers & Cifter, 2022; Enqvist et al., 2014; Rey-Ares et al., 2021).

3.2.1. SIZE

Firm size is measured by the natural logarithm of total assets. Theoretically, firms with large asset sizes generate better profitability compared with smaller firms owing to economies of scale or ship size economies (Wu & Lin, 2015).

3.2.2. LEV

Financial leverage is measured by total debt divided by total assets. Juan García-Teruel and Martínez-Solano (2007) and Lyngstadaas and Berg (2016) used SMEs to confirm that leverage has a negative relationship with profitability. Therefore, higher leverage is likely to lead to lower firm performance. Because the shipping business is highly leveraged, financial leverage would be directly and negatively related to profitability.

3.2.3. CR

Current ratio, a measure of firm liquidity, is calculated by dividing current assets by current liabilities. According to Cagle et al. (2013), the CCC along with the current ratio (CR) should be used to measure corporate liquidity. The CCC reflects a dynamic measure of liquidity and provides a better prediction for future cash flows of firms, while the CR, as a static measure, captures the measurement of liquidity at a specific time. The correlation matrix (refer to Table 2) shows that the relationship between the CCC and the CR is 0.017 and statistically insignificant. Hence, to prevent the potential bias of missing variables on the liquidity–profitability relationship, we decided to have the CR as one of the control variables in our regression model. Our decision is consistent with that of many recent studies on the WCM–profitability relationship (e.g. Akgün & Karataş, 2021; Altaf & Ahmad, 2019; Dash et al., 2023; Hassan et al., 2023; Kayani et al., 2023; Vlismas, 2024). These studies include the CR as one of the control variables in their regression model. However, there are mixed results on the relationship between the CR and corporate profitability. Altaf and Ahmad (2019), Akbar et al. (2021) and Kumar et al. (2024) report a negative relationship between the CR and profitability. It implies that firms bear a high cost of liquidity, resulting in lower profitability. In contrast, Enqvist et al. (2014), Akgün and Karataş (2021), Dash et al. (2023), Hassan et al. (2023), Kayani et al. (2023) and Vlismas (2024) point out that firms' liquidity supports a better performance. For this study, we expect a positive relationship between the CR and profitability of SMEs. Hoang et al. (2019), who studied nonfinancial listed SMEs from nine Asian countries, suggest that the availability of liquidity helps small- and medium-sized enterprises control their operations. This leads to a favorable link between the current ratio and firms' profitability.

3.2.4. GROWTH

Sales growth is calculated as the percentage change in sales from period $t - 1$ to t . Several studies document that sales growth directly relates to higher profitability (Baños-Caballero et al., 2012; Lyngstadaas & Berg, 2016).

Additionally, we used several macroeconomic variables as control variables. Prior studies (e.g. El-Masry et al., 2010; Kim & Lee, 2019; Kotcharin & Maneenop, 2020a) have widely used annual GDP growth, changes in oil prices and changes in exchange rates. These variables influence firm profitability (Kim & Lee, 2019).

3.2.5. GDP

Gross domestic product growth is the annual change in Thailand's GDP rates. GDP growth positively impacts on ROA (Hassan et al., 2023; Juan García-Teruel & Martínez-Solano, 2007; Lyngstadaas & Berg, 2016; Mahmood et al., 2024).

3.2.6. WTI

Change in West Texas Intermediate oil prices is the annual change in the WTI oil price. Generally, changes in oil prices tend to be negatively related to the performance of shipping firms; however, El-Masry et al. (2010) found a positive impact on the returns of shipping stocks when they used oil prices as the world economy indicator and a long phase of economic prosperity as their sample period.

3.2.7. FX

Change in foreign exchange rates is the annual change in Thai Baht against the U.S. dollar. Hussain et al. (2024) conducted a study on the impact of currency rates on the profitability of industrial companies listed on the Pakistan Stock Exchange. According to their research, the decrease in exchange rate impacts the firm's net exports, which in turn has an impact on the overall performance of the firm. It is also argued that exchange rates affect shipping firms' stock returns (El-Masry et al., 2010). However, these studies reported conflicting results. A negative relationship between changes in exchange rates and shipping stock returns indicates an appreciation of the U.S. dollar against a country's currency. In contrast, when the change in exchange rates is positively related to shipping stock returns, U.S. dollars tend to appreciate the country's currency. Therefore, fluctuations between the domestic currency and the U.S. dollar can relate to shipping firms' performance either positively or negatively.

3.2.8. GPR_China

China's geopolitical risk is the natural logarithm of China's geopolitical risk index. Geopolitical risk positively affects shipping firms' cash reserves (Kotcharin & Maneenop, 2020b). This implies that shipping firms may apply conservative working capital policies in response to the rise of geopolitical risk. Khan et al. (2021) argued that in the presence of China's geopolitical risk (i.e. the trade war between China and the United States), global trade is harmed, resulting in a decline in the earnings of shipping companies.

Moreover, we added three crisis dummy variables representing the periods of the global financial crisis ($D1$), the 2016–2017 shipping market turmoil ($D2$) and the COVID-19 crisis ($D3$). The following reasons support the selected periods as proxies for times of crisis: First, the global financial crisis has been widely explored in the literature (Ahmad et al., 2022; Akgün & Karataş, 2020; Mahmood et al., 2024). In addition, researchers have documented that the global financial crisis continues to affect the performance of SMEs across the world from 2009 to 2011 (Casey & O'Toole, 2014). Second, the period of 2016–2017 was included in the study to represent another crisis as a result of the spillover effect of Hanjin Shipping's bankruptcy and the turbulence of the shipping market with low freight rates and vessel overcapacity (Song et al., 2019). Finally, the COVID-19 pandemic during 2020–2021 affected most businesses, including transportation businesses. Ahmad et al. (2022) showed that the impact of COVID-19 on WCM and corporate performance was greater than during the 2008 financial crisis. Zimon et al. (2024) conducted a study on the impact of the quality management system on WCM in the Polish construction

industry during the COVID-19 period from 2020 to 2021. Their findings reported that SMEs in the Polish construction industry do not achieve optimal efficiency in WCM. A crisis dummy variable is 1 if the firm-year observation was from the period of those mentioned years, and 0 otherwise. [Appendix A \(Table A1\)](#) presents the definitions of the variables and data sources.

In addition, we utilized the SA index, a commonly employed measure in previous research (e.g. Banerjee & Deb, 2023), to identify firms that are experiencing financial constraints. The SA index is calculated from $[-0.737 \times \text{Log}(\text{Total assets})] + [0.043 \times \text{Log}(\text{Total assets})^2] - (0.040 \times \text{Firm age})$. If the value is higher, it means that the firm tends to be more financially constrained. Banerjee and Deb (2023) suggested that financially constrained firms value more efficient WCM than financially unconstrained ones.

3.3. Research model

We tested our hypotheses using unbalanced panel data and obtained the estimates using the following equations, specifically [Eqs. \(1\)–\(16\)](#). In particular, to estimate H1a and H1b, we proposed [Eqs. \(1\)–\(6\)](#):

$$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 FSV_{it} + \mu_{it} \quad (1)$$

$$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it}^2 + \beta_3 FSV_{it} + \mu_{it} \quad (2)$$

$$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 CCC_{it}^2 + \beta_4 FSV_{it} + \mu_{it} \quad (3)$$

$$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 FSV_{it} + \beta_4 MCV_t + \beta_5 GPR_China_t + \mu_{it} \quad (4)$$

$$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it}^2 + \beta_3 FSV_{it} + \beta_4 MCV_t + \beta_5 GPR_China_t + \mu_{it} \quad (5)$$

$$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 CCC_{it}^2 + \beta_4 FSV_{it} + \beta_5 MCV_t + \beta_6 GPR_China_t + \mu_{it} \quad (6)$$

To estimate H2a and H2b, we proposed [Eq. \(7\)](#):

$$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 CCC_{it}^2 + \beta_4 FSV_{it} + \beta_5 MCV_t + \beta_6 GPR_China_t + \beta_7 D1_t + \beta_8 D2_t + \beta_9 D3_t + \mu_{it} \quad (7)$$

To estimate H3a and H3b, we proposed [Eqs. \(8\)–\(10\)](#):

$$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 CCC_{it} \times D1_t + \beta_4 CCC_{it}^2 + \beta_5 CCC_{it}^2 \times D1_t + \beta_6 D1_t + \beta_7 FSV_{it} + \beta_8 FSV_{it} \times D1_t + \beta_9 MCV_t + \beta_{10} GPR_China_t + \mu_{it} \quad (8)$$

$$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 CCC_{it} \times D2_t + \beta_4 CCC_{it}^2 + \beta_5 CCC_{it}^2 \times D2_t + \beta_6 D2_t + \beta_7 FSV_{it} + \beta_8 FSV_{it} \times D2_t + \beta_9 MCV_t + \beta_{10} GPR_China_t + \mu_{it} \quad (9)$$

$$ROA_{it} = \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 CCC_{it} \times D3_t + \beta_4 CCC_{it}^2 + \beta_5 CCC_{it}^2 \times D3_t + \beta_6 D3_t + \beta_7 FSV_{it} + \beta_8 FSV_{it} \times D3_t + \beta_9 MCV_t + \beta_{10} GPR_China_t + \mu_{it} \quad (10)$$

To estimate H4a and H4b, we proposed Eqs. (11)–(14):

$$\begin{aligned} ROA_{it} = & \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 CCC_{it} \times SIZE_{it} + \beta_4 CCC_{it}^2 + \beta_5 CCC_{it}^2 \times SIZE_{it} \\ & + \beta_6 SIZE_{it} + \beta_7 LEV_{it} + \beta_8 LEV_{it} \times SIZE_{it} + \beta_9 CR_{it} + \beta_{10} CR_{it} \times SIZE_{it} \\ & + \beta_{11} GROWTH_{it} + \beta_{12} GROWTH_{it} \times SIZE_{it} + \beta_{13} MCV_t + \beta_{14} GPR_China_t + \mu_{it} \end{aligned} \quad (11)$$

$$\begin{aligned} ROA_{it} = & \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 CCC_{it} \times LEV_{it} + \beta_4 CCC_{it}^2 + \beta_5 CCC_{it}^2 \times LEV_{it} \\ & + \beta_6 SIZE_{it} + \beta_7 SIZE_{it} \times LEV_{it} + \beta_8 LEV_{it} + \beta_9 CR_{it} + \beta_{10} CR_{it} \times LEV_{it} \\ & + \beta_{11} GROWTH_{it} + \beta_{12} GROWTH_{it} \times LEV_{it} + \beta_{13} MCV_t + \beta_{14} GPR_China_t + \mu_{it} \end{aligned} \quad (12)$$

$$\begin{aligned} ROA_{it} = & \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 CCC_{it} \times GROWTH_{it} + \beta_4 CCC_{it}^2 + \beta_5 CCC_{it}^2 \times GROWTH_{it} \\ & + \beta_6 SIZE_{it} + \beta_7 SIZE_{it} \times GROWTH_{it} + \beta_8 LEV_{it} + \beta_9 LEV_{it} \times GROWTH_{it} + \beta_{10} CR_{it} \\ & + \beta_{11} CR_{it} \times GROWTH_{it} + \beta_{12} GROWTH_{it} + \beta_{13} MCV_t + \beta_{14} GPR_China_t + \mu_{it} \end{aligned} \quad (13)$$

$$\begin{aligned} ROA_{it} = & \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 CCC_{it} \times CR_{it} + \beta_4 CCC_{it}^2 + \beta_5 CCC_{it}^2 \times CR_{it} + \beta_6 SIZE_{it} \\ & + \beta_7 SIZE_{it} \times CR_{it} + \beta_8 LEV_{it} + \beta_9 LEV_{it} \times CR_{it} + \beta_{10} CR_{it} + \beta_{11} GROWTH_{it} \\ & + \beta_{12} GROWTH_{it} \times CR_{it} + \beta_{13} MCV_t + \beta_{14} GPR_China_t + \mu_{it} \end{aligned} \quad (14)$$

To estimate H5a – H5d, we proposed Eqs. (15) and (16):

$$\begin{aligned} ROA_{it} = & \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 CCC_{it} \times GPR_China_t + \beta_4 CCC_{it}^2 \\ & + \beta_5 CCC_{it}^2 \times GPR_China_t + \beta_6 GPR_China_t + \beta_7 FSV_{it} \\ & + \beta_8 FSV_{it} \times GPR_China_t + \beta_9 MCV_t + \mu_{it} \end{aligned} \quad (15)$$

$$\begin{aligned} ROA_{it} = & \beta_0 + \beta_1 ROA_{it-1} + \beta_2 CCC_{it} + \beta_3 CCC_{it}^2 + \beta_4 FSV_{it} + \beta_5 MCV_t \\ & + \beta_6 GPR_China_t + \mu_{it} \end{aligned} \quad (16)$$

where ROA is return on total assets; β_0 is the constant; CCC is the cash conversion cycle; CCC^2 is the square of the cash conversion cycle; firm-specific variables (FSV) are firm size (SIZE), financial leverage (LEV), firm liquidity (CR) and sales growth (GROWTH); macroeconomic variables (MCV) are gross domestic product growth (GDP), changes in the West Texas Intermediate oil prices (WTI) and changes in foreign exchange rates (FX); GPR_China is China's geopolitical risk; D1 is a dummy variable equal to 1 for the crisis years 2009–2011 and 0 otherwise; D2 is a dummy variable equal to 1 for the crisis years 2016–2017 and 0 otherwise; D3 is a dummy variable equal to 1 for the crisis years 2020–2021 and 0 otherwise; and μ is an error term.

Corporate finance literature argues that endogeneity is the most significant issue (Ahmad et al., 2022). Prior research on working capital and firm performance, utilizing the Generalized Method of Moments (GMM) estimator, has identified issues related to the connection between independent and dependent variables (Rey-Ares et al., 2021). The explanatory variables may potentially correlate with various firms with heterogeneous characteristics (e.g. size, liquidity). Thus, it might create a dynamic relationship. The nature of independent variables may also lead to reverse causality. If certain regression variables are endogenous, conventional least squares and panel fixed effects will yield conflicting findings because the models have suffered from the endogeneity problem.

In our research, Durbin–Wu–Hausman statistics identify endogeneity. The econometric literature recommends using the dynamic panel GMM to address the endogeneity problem. The GMM estimator handles serial correlation, endogeneity and unobserved heterogeneity (Arellano & Bond, 1991; Roodman, 2009). We chose GMM over other estimating approaches (e.g. Instrumental Variable (IV)) because it works on more models, including those with complex instrument structure and error distribution. Heterogeneity makes GMM more efficient than the IV instrumental variable estimator. The IV estimate lacks moment

conditions and residual difference structure, so it may not be able to estimate model parameters (Baltagi, 2013). Arellano and Bond (1991) suggested that GMM predicts small-time data better. Given model parameters and data, moment conditions define economic connections between variables. Momentary conditions must provide valuable parametric data. The GMM estimator needs instrumental variables uncorrelated with the error term but related to the model's independent variable. We followed the work of Ullah et al. (2018), which suggested two-step system GMM and panel data endogeneity bias detection. Arellano and Bond (1991) used lagged dependent variable values to manage dynamic endogeneity. The two-step GMM method needed stationary data (Chambers & Cifter, 2022). Before using the two-step GMM system, we examined stationary characteristics with ADF-Fisher and PP-Fisher panel unit root tests. We conducted the estimation of all panel series at a significance level of 1% and Appendix B (Tables B1 and B2) provides the results of the stationary data.

The relationship between WCM and corporate profitability is highly likely to be more complex than linear, necessitating a quadratic relationship. This study uses the same method as earlier ones (e.g. Altaf & Ahmad, 2019; Baños-Caballero et al., 2012; Chambers & Cifter, 2022; Rey-Ares et al., 2021; Singhania & Mehta, 2017) to compare the risk-return of various strategies without taking into account endogeneity and heterogeneity. According to corporate finance literature, the most significant problems in financial literature are the validity and quality of financial connection inferences. Therefore, we need a dynamic technique like GMM to evaluate the regression of corporate performance on WCM (Altaf & Ahmad, 2019; Singhania & Mehta, 2017).

Recent research on WCM and profitability studies uses GMM for their estimation, including Ahangar (2021), Ahmad et al. (2022), Hussain et al. (2024), Rey-Ares et al. (2021), Tiwari et al. (2023) and Vo and Ngo (2023). This technique employs the Hansen J statistic for both first-order (AR(1)) and second-order (AR(2)) autocorrelation to assess the validity of the instruments (Arellano & Bond, 1991). To test for serial correlation of the first- and second-order error terms, if the p -value is less than 0.05, we reject the null hypothesis for the first-order serial correlation. In contrast, if the p -value is greater than 0.05, we confirm that there is no second-order serial correlation. The Hansen's p -values are insignificant at the 5% level, showing that the instruments are valid and correctly specified.

4. Results

4.1. Descriptive analysis

Figure 1 displays the trends in ROA, CCC and CCC² over the sample period 2001–2021, using the mean values of all the shipping SMEs in the sample. When firms used aggressive working capital policies, ROAs tended to increase, in line with previous studies (e.g. Deloof, 2003). This is observed through a negative relationship between ROA and CCC. During the shipping boom period in 2003–2007, ROAs were above average and CCC tended to be longer. However, ROAs dramatically dropped following the global financial crisis. Consequently, the number of CCC days has increased since 2009. After 2013, ROAs increased, but never reached above average before jumping again during the COVID-19 crisis. The CCC² was non-linear, indicating that the CCC changed over time. For example, ROA tended to decline in the aftermath

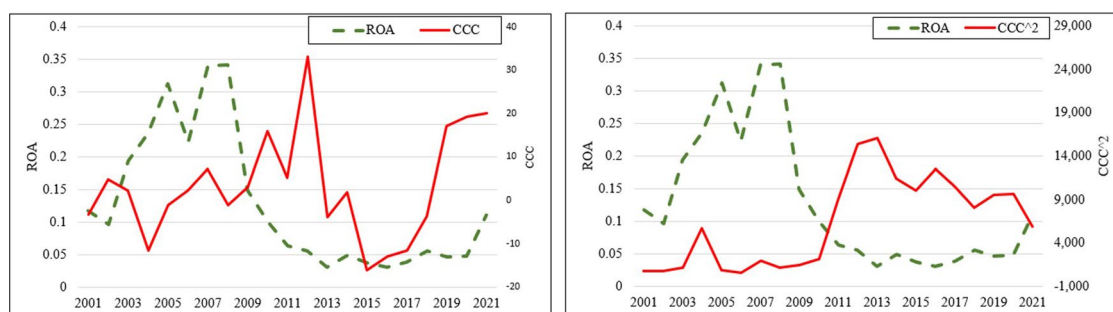


Figure 1. ROA versus CCC and CCC².

Table 1. Statistical description of variables.

Variables	Mean	Median	Std.Dev	Min	Max
ROA	0.119	0.060	0.255	−0.400	2.156
CCC	3.512	0.776	84.851	−378.172	339.790
CCC ²	7,204.737	549.493	22,289.252	0	143,014.043
SIZE	19.767	19.096	0.887	18.382	22.223
LEV	0.339	0.077	0.275	0.000	1.840
CR	1.895	0.916	2.849	0.012	19.719
GROWTH	0.137	0.027	0.569	−0.892	6.941
GDP	0.031	0.015	0.031	−0.062	0.075
WTI	64.616	45.776	22.524	20.239	100.050
FX	−0.011	−0.039	0.045	−0.089	0.108
GPR_China	−0.720	−0.934	0.270	−1.239	−0.193

Table 2. Correlation matrix.

Variables	ROA	CCC	CCC ²	SIZE	LEV	CR	GROWTH	GDP	WTI	FX	GPR_China
ROA	1.000										
CCC	0.010	1.000									
CCC ²	−0.068**	−0.567***	1.000								
SIZE	−0.175***	0.067**	0.012	1.000							
LEV	−0.297***	−0.087***	0.080**	0.191***	1.000						
CR	0.041	0.017	−0.011	−0.042	−0.082**	1.000					
GROWTH	0.062*	0.028	0.051	−0.004	0.030	−0.011	1.000				
GDP	0.085***	−0.015	−0.001	−0.071**	−0.008	−0.036	0.048	1.000			
WTI	−0.018	0.061*	0.008	0.006	0.019	0.005	0.078**	0.108***	1.000		
FX	−0.155***	−0.015	0.034	0.100***	0.137***	0.048	0.013	−0.349***	−0.337***	1.000	
GPR_China	−0.205***	0.028	0.044	0.161***	0.123***	−0.023	−0.028	−0.174***	−0.024	−0.133***	1.000

Note: *, ** and *** Significant at 10, 5 and 1 percent levels, respectively.

of the global financial crisis, whereas CCC² jumped up following the crisis years. The relationship between ROA and CCC² was further examined using panel data regression.

Table 1 shows the descriptive statistics of shipping SMEs. The logarithm of total assets was 19.767. The leverage ratio of shipping SMEs was 0.339, similar to the amount reported in Drobetz et al. (2013) and Kotcharin and Maneenop (2020b). The current ratio of shipping SMEs was approximately 1.895, slightly lower than that of listed shipping firms (Yeo, 2016). The mean sales growth was 13.70%. On average, the ROA of Thai shipping SMEs was 11.90% and Drobetz et al. (2013) reported that the profitability of globally listed shipping firms is 11.30%. The mean CCC was 3.512 days. This is similar to the results in Baños-Caballero et al. (2012). The CCC days of the transportation sector tend to reflect aggressive working capital policies.

Table 2 shows the correlations between the variables. ROA was significantly and negatively correlated with CCC², SIZE, LEV, FX and GPR_China, whereas it was significantly and positively correlated with GROWTH and GDP. The CCC was significantly negatively correlated with CCC², SIZE and LEV. The CCC² had a significant positive correlation with LEV. Overall, the coefficient values of the correlations between the variables were less than 0.80, indicating the absence of any multicollinearity problem (Field, 2005).

4.2. Multivariate analysis

4.2.1. The results of the GMM estimation of the models and discussions

Table 3 presents the results of the baseline regression of the relationship between WCM and profitability. In regression model (1), CCC had no statistically significant impact on ROA, whereas in model (2), CCC² had a negative relationship with ROA. The baseline result does not support H1a, but supports H1b. In model (3), CCC² remained significant and negative. All firm-specific variables were significant and their signs were as expected and consistent with prior studies (e.g. Martínez-Sola et al., 2014; Mun & Jang, 2015).

Adding macroeconomic variables to model (4), we found that GDP was significant and its sign was positive for ROA. This was consistent with the results of Grau and Reig (2018), Hassan et al. (2023) and Mahmood et al. (2024) who found that GDP determines a firm's profitability. While, FX and GPR_China

Table 3. Baseline result.

Variables	(1)	(2)	(3)	(4)	(5)	(6)
Independent variables						
LROA	0.517*** (8.906)	0.505*** (9.962)	0.512*** (8.777)	0.517*** (8.906)	0.505*** (9.966)	0.512*** (8.777)
CCC	-0.001 (-0.525)		-0.001 (-1.182)	-0.001 (-0.525)		-0.001 (-1.182)
CCC ²		-0.001** (-2.167)	-0.001*** (-2.592)		-0.001** (-2.165)	-0.001*** (-2.592)
Control variables						
Firm characteristics						
SIZE	-0.019* (-1.700)	-0.022** (-2.378)	-0.018* (-1.690)	-0.019* (-1.700)	-0.022** (-2.371)	-0.018* (-1.690)
LEV	-0.145*** (-4.158)	-0.173*** (-3.541)	-0.148*** (-3.751)	-0.145*** (-4.158)	-0.173*** (-3.540)	-0.148*** (-3.751)
CR	0.001* (1.819)	0.001** (2.036)	0.001* (1.839)	0.001* (1.819)	0.001** (2.042)	0.001* (1.839)
GROWTH	0.009*** (3.137)	0.009*** (4.134)	0.009*** (2.985)	0.009*** (3.137)	0.009*** (4.136)	0.009*** (2.985)
Macroeconomic variables						
GDP				0.011** (1.974)	0.012** (2.245)	0.010* (1.940)
WTI				0.012 (0.733)	0.017 (1.184)	0.010 (0.606)
FX				-0.022* (-1.696)	-0.026** (-2.252)	-0.022* (-1.645)
GPR_China				-0.132** (-2.289)	-0.151*** (-3.099)	-0.132** (-2.348)
Constant	0.446** (2.088)	0.520*** (2.904)	0.444** (2.098)	0.350** (2.004)	0.407*** (2.800)	0.347** (2.002)
Year effect (Y/N)	Yes	Yes	Yes	Yes	Yes	Yes
Observations	652	652	652	652	652	652
Number of firm	96	96	96	96	96	96
AR(1) test	-3.100	-3.120	-3.080	-3.100	-3.120	-3.080
AR(1) <i>p</i> -val	0.002	0.002	0.002	0.002	0.002	0.002
AR(2) test	-0.450	0.020	-0.500	-0.450	0.020	-0.500
AR(2) <i>p</i> -val	0.652	0.985	0.617	0.652	0.984	0.617
Hansen <i>J</i> statistic	39.995	54.920	38.935	39.995	54.936	38.936
Hansen <i>J</i> <i>p</i> -val	0.258	0.933	0.297	0.258	0.933	0.297

Source: Authors' estimation. Note: Sargan test provides the *p*-value for validating the null hypothesis that all over-identifying restrictions are valid. The AR (1) and AR (2) are used to determine the *p*-value for validating first-order autocorrelation and second-order autocorrelation, which is necessary for GMM approach. The instruments utilized in GMM consist of the lagged regression of the ROA at period $t - 1$. *t*-statistics are in parentheses. *, **, *** Significant at 10, 5 and 1 percent levels, respectively. Lagged return on total assets (LROA), The cash conversion cycle (CCC), The square of the cash conversion cycle (CCC²), Firm size (SIZE), Financial leverage (LEV), Firm liquidity (CR), Sales growth (GROWTH), Gross domestic product growth (GDP), Change in West Texas Intermediate oil prices (WTI), Change in foreign exchange rates-Thai Baht against the U.S. dollar (FX), China's geopolitical risk (GPR_China), The global financial crisis (D1), The shipping market turmoil (D2), The COVID-19 crisis (D3).

were negatively related to ROA. In models (5) and (6), CCC² was significantly and negatively related to ROA. In addition, among all variables in the models, the coefficients of LEV and GPR_China were large and had a significant and negative impact on ROA.

Our primary discovery diverged from the findings of Pant et al. (2023), who observed that an increase in working capital had a favorable and substantial effect on firm performance. Their findings implied that firms should invest more in their working capital to increase profitability. In contrast, our results revealed no relationship between CCC and ROA, consistent with Hatane et al. (2023) and Rey-Ares et al. (2021), which asserted that working capital alone has no statistically significant relationship with profitability, but rather depends on firm-specific characteristics. Moreover, we found a negative relationship between CCC² and ROA in models (5) and (6) when firm-specific and macroeconomic factors were included. It indicates that WCM also depends on macroeconomic factors and several studies (Aktas et al., 2015; Deloof, 2003) have overlooked how such factors, especially GPR_China, affect firms' profitability.

The negative CCC²-ROA relationship is in line with Chambers and Cifter (2022) and Mun and Jang (2015), which studied the relationship between working capital and profitability in the service sector. An interpretation is that WCM and profitability have an inverted U-shaped relationship, supporting the presence of the optimum level of WCM among firms (Aktas et al., 2015; Baños-Caballero et al., 2012; Mahmood et al., 2024). Overall, management should manage firms' working capital and attempt to reach an

optimal level, resulting in profit maximization. Moreover, we found that firm liquidity, measured by CR, positively affected ROA, confirming the findings of Enqvist et al. (2014) and Hassan et al. (2023).

Similarly, sales growth (GROWTH) was positively related to ROA, supporting the findings of Chambers and Cifter (2022) and Kumar et al. (2022). Among the firm-specific factors, GROWTH had the strongest positive impact on ROA. Thus, the management of firms with high liquidity and sales growth should concentrate on optimizing working capital to maximize firm profitability. SIZE and LEV were negatively related to ROA. This is in line with Martínez-Sola et al. (2014), which argued that SIZE reflects financial constraints or creditworthiness for SMEs. Also, firms with higher financial leverage experience decreased profitability due to the larger amount of their borrowing costs.

4.2.2. *The impacts of crises and discussions*

Table 4 presents the impacts of the global financial crisis ($D1$), the 2016–2017 shipping market turmoil ($D2$) and the COVID-19 crisis ($D3$) on WCM and profitability. The CCC and CCC² were significantly and negatively related to ROA. Interestingly, the magnitude of the impact on ROA for $D1$ was the largest, followed by $D2$, whereas $D3$ was insignificant and positive. Crises had a significant and negative impact on ROA, consistent with Akgün and Karataş (2020), Chambers and Cifter (2022) and Enqvist et al. (2014). During the times of crises, WTI was significant and positive with ROA. This interprets that shipping SMEs are able to pass oil charges to their customers, allowing them to gain profitability. CR and GROWTH remained significantly and positively related to ROA during the crises. Thus, CR and GROWTH could mitigate the adverse impact of crises on ROA.

In addition, Table 4 shows the moderating roles of $D1$ and $D2$ in the working capital-profitability relationship. However, $D3$ was not used to test the moderating effect because it was insignificantly related to ROA. Interestingly, CCC* $D1$ and CCC²* $D1$ were significant and negative with ROA. An inverted U-shaped relationship between CCC² and ROA existed during the period of $D1$. In contrast, CCC* $D2$ and CCC²* $D2$ were significant and positive for ROA. The U-shaped relationship between CCC² and ROA emerged during the period of $D2$. This indicates that shipping SMEs tend to adjust their working capital management policies depending on the nature of crises. More specifically, shipping SMEs may face difficulty in obtaining loans in the aftermath of the global financial crisis; therefore, they tend to implement aggressive working capital policies to improve profitability. In contrast, shipping SMEs are likely to adopt conservative policies during the 2016–2017 shipping market turbulence to maximize firm performance. The $D2$ crisis reflected the downturn of the shipping market with overcapacity and low shipping demand, which made shipping SMEs grant more trade credit to build up good relationships with their customers or even stimulate their sales and profitability. If shipping SMEs do not heavily invest in their working capital, they may lose their clients to competitors. This finding is consistent with Kestens et al. (2012) in that more investment in working capital helps firms mitigate the adverse impact of financial crises on firm performance. Moreover, the result shows that GROWTH mitigates the adverse impact of crises on profitability. This certainly indicates that management should emphasize on conservative working capital policies to increase sales growth when facing shipping market turbulence.

4.2.3. *The moderating effects of firm-specific characteristics and discussions*

Table 5 reports the moderating effects of firm size. The CCC and CCC² were significant and positive with ROA. This asserts that larger shipping SMEs are generous to their customers by extending trade credit, resulting in increased sales and profitability. However, the moderating role of firm size on the working capital–ROA relationship is significant and negative. It shows that larger firms must properly invest in working capital and attempt to maintain an optimal level of their working capital. Overly invested working capital may cause a decline in firm performance. Moreover, larger firms with high liquidity can boost their sales and profitability.

In addition, Table 5 displays that only CCC was significant and negative with ROA under the moderating role of financial leverage. It indicates that shipping SMEs use aggressive working capital policies. Firms with more debt, high liquidity and sales growth appear to be more profitable. Therefore, the accessibility of debt financing is important for shipping SMEs. However, the moderating effect of LEV on the SIZE–ROA relationship is significant and negative. It shows that even though larger firms have the ability to access debt financing and heavily invest in their working capital to boost sales, they should attempt

Table 4. Crisis impact.

Variables	Crisis	Variables	D1	Variables	D2
Independent variables					
LROA	0.534*** (11.132)	LROA	0.554*** (11.157)	LROA	0.529*** (10.079)
CCC	-0.001* (-1.816)	CCC	-0.001* (-1.699)	CCC	-0.001* (-1.755)
CCC ²	-0.001*** (-2.822)	CCC ²	-0.001*** (-3.104)	CCC ²	-0.001*** (-2.624)
Control variables					
Firm characteristics					
SIZE	-0.018* (-1.946)	SIZE	-0.014 (-1.458)	SIZE	-0.021* (-1.676)
LEV	-0.166*** (-3.902)	LEV	-0.140*** (-3.610)	LEV	-0.190*** (-3.410)
CR	0.001** (2.305)	CR	0.001 (0.072)	CR	0.001** (2.248)
GROWTH	0.009*** (3.639)	GROWTH	0.009** (2.188)	GROWTH	0.008*** (3.143)
Macroeconomic variables					
GDP	-0.233 (-0.736)	GDP	-0.143 (-0.529)	GDP	0.081 (0.315)
WTI	0.042* (1.851)	WTI	0.031 (1.388)	WTI	0.009 (0.363)
FX	-0.400 (-1.372)	FX	-0.298 (-1.137)	FX	-0.343 (-1.198)
GPR_China	-0.101*** (-2.650)	GPR_China	-0.120*** (-2.976)	GPR_China	-0.076** (-2.030)
D1	-0.100*** (-3.271)	D1	-0.042 (-0.496)	D2	-0.276 (-0.649)
D2	-0.039** (-2.287)	CCC*D1	-0.001* (-1.645)	CCC*D2	0.001* (1.763)
D3	0.004 (0.144)	CCC ² *D1	-0.001* (-1.691)	CCC ² *D2	0.001** (2.270)
		SIZE*D1	0.002 (0.447)	SIZE*D2	0.011 (0.501)
		LEV*D1	-0.242** (-2.553)	LEV*D2	0.071 (1.102)
		CR*D1	-0.001 (-0.012)	CR*D2	-0.001*** (-4.993)
		GROWTH*D1	0.001 (0.094)	GROWTH *D2	0.051* (1.946)
Constant	0.417** (2.276)	Constant	0.302* (1.645)	Constant	0.470* (1.913)
Year effect (Y/N)	Yes	Year Effect (Y/N)	Yes	Year Effect (Y/N)	Yes
Observations	652	Observations	652	Observations	630
Number of firm	96	Number of Firm	96	Number of Firm	96
AR(1) test	-3.220	AR(1) test	-3.190	AR(1) test	-3.110
AR(1) <i>p</i> -val	0.001	AR(1) <i>p</i> -val	0.001	AR(1) <i>p</i> -val	0.002
AR(2) test	-0.500	AR(2) test	-0.970	AR(2) test	-0.640
AR(2) <i>p</i> -val	0.618	AR(2) <i>p</i> -val	0.332	AR(2) <i>p</i> -val	0.520
Hansen <i>J</i> statistic	59.965	Hansen <i>J</i> statistic	59.789	Hansen <i>J</i> statistic	61.881
Hansen <i>J p</i> -val	0.912	Hansen <i>J p</i> -val	0.847	Hansen <i>J p</i> -val	0.716

Source: Authors' estimation. Note: Sargan test provides the *p*-value for validating the null hypothesis that all over-identifying restrictions are valid. The AR(1) and AR(2) are used to determine the *p*-value for validating first-order autocorrelation and second-order autocorrelation, which is necessary for GMM approach. The instruments utilized in GMM consist of the lagged regression of the ROA at period $t - 1$. *t*-statistics are in parentheses. *, **, *** Significant at 10, 5 and 1 percent levels, respectively. Lagged return on total assets (LROA), The cash conversion cycle (CCC), The square of the cash conversion cycle (CCC²), Firm size (SIZE), Financial leverage (LEV), Firm liquidity (CR), Sales growth (GROWTH), Gross domestic product growth (GDP), Change in West Texas Intermediate oil prices (WTI), Change in foreign exchange rates-Thai Baht against the US dollar (FX), China's geopolitical risk (GPR_China), The global financial crisis (D1), The shipping market turmoil (D2), The COVID-19 crisis (D3).

to maintain the optimal level of working capital. If they keep investing in working capital to reach a certain beyond-optimum level, their firm's performance can be negatively affected.

Table 6 reports the results of the moderating role of GROWTH. Only CCC² was significant and negative for ROA. This shows that firms with high sales growth and liquidity should improve working capital efficiency to maximize profitability. Interestingly, when firms increase their sales growth and have high financial leverage, their profitability significantly decreases. Therefore, management should not overlook working capital efficiency, even if firms can take on more debt to increase their sales and profitability.

Table 6 also shows that CCC² was significantly and negatively related to ROA under the moderating role of CR. The interaction between CCC and CR was significant and negative with ROA, indicating the

Table 5. The moderating role of firm size (SIZE) and financial leverage (LEV).

Variables	SIZE	Variables	LEV
Independent variables			
L.ROA	−0.004 (−0.259)	L.ROA	0.529*** (7.726)
CCC	0.004** (1.969)	CCC	−0.001** (−2.220)
CCC ²	0.001* (1.645)	CCC ²	−0.001 (−0.601)
Control variables			
Firm characteristics			
SIZE	0.006*** (3.302)	SIZE	−0.015 (−1.425)
LEV	0.001 (0.385)	LEV	0.116* (1.739)
CR	−0.008*** (−6.223)	CR	0.001* (1.645)
GROWTH	0.105*** (3.090)	GROWTH	0.010*** (2.922)
Macroeconomic variables			
GDP	0.008** (2.395)	GDP	0.012** (2.140)
WTI	0.007 (0.492)	WTI	0.015 (0.922)
FX	−0.011 (−1.487)	FX	−0.021* (−1.700)
GPR_China	−0.038 (−1.406)	GPR_China	−0.115** (−2.304)
CCC*SIZE	−0.001** (−1.997)	CCC*LEV	0.001 (0.695)
CCC ² *SIZE	−0.001* (−1.663)	CCC ² *LEV	−0.001 (−0.125)
LEV*SIZE	−0.010*** (−3.594)	SIZE*LEV	−0.013*** (−3.234)
CR*SIZE	0.001*** (6.434)	CR*LEV	−0.005 (−0.429)
GROWTH*SIZE	−0.005*** (−2.817)	GROWTH*LEV	−0.007 (−1.094)
Constant	0.005* (1.645)	Constant	0.303* (1.775)
Year effect (Y/N)	Yes	Year Effect (Y/N)	Yes
Observations	652	Observations	652
Number of firm	96	Number of Firm	96
AR(1) test	−2.370	AR(1) test	−3.030
AR(1) <i>p</i> -val	0.018	AR(1) <i>p</i> -val	0.002
AR(2) test	−1.270	AR(2) test	−0.330
AR(2) <i>p</i> -val	0.204	AR(2) <i>p</i> -val	0.741
Hansen <i>J</i> statistic	25.141	Hansen <i>J</i> statistic	47.562
Hansen <i>J</i> <i>p</i> -val	1.000	Hansen <i>J</i> <i>p</i> -val	0.991

Source: Authors' estimation. Note: Sargan test provides the *p*-value for validating the null hypothesis that all over-identifying restrictions are valid. The AR(1) and AR(2) are used to determine the *p*-value for validating first-order autocorrelation and second-order autocorrelation, which is necessary for GMM approach. The instruments utilized in GMM consist of the lagged regression of the ROA at period $t - 1$. *t*-statistics are in parentheses. ***, ** Significant at 10, 5 and 1 percent levels, respectively. Lagged return on total assets (L.ROA), The cash conversion cycle (CCC), The square of the cash conversion cycle (CCC²), Firm size (SIZE), Financial leverage (LEV), Firm liquidity (CR), Sales growth (GROWTH), Gross domestic product growth (GDP), Change in West Texas Intermediate oil prices (WTI), Change in foreign exchange rates-Thai Baht against the US dollar (FX), China's geopolitical risk (GPR_China), The global financial crisis (D1), The shipping market turmoil (D2), The COVID-19 crisis (D3).

length of working capital and high liquidity may cause poor performance. While, the interaction between CCC² and CR was significantly and positively related to ROA, displaying the U-shaped working capital–profitability relationship, which is in line with Baños-Caballero et al. (2012). To maximize their sales and profitability, shipping SMEs with financial flexibility tended to grant more trade credit to their customers. The result also shows that firms with high GROWTH and CR tend to generate better profitability.

4.2.4. The moderating role of GPR_China and the subgroup analysis for firms' financial constraints

Table 7 reveals a significant and negative relationship between the CCC-ROA and the CCC²-ROA under the moderating role of GPR_China. GPR_China, itself, strongly and negatively affected firms' profitability,

Table 6. The moderating role of sales growth (GROWTH) and firm liquidity (CR).

Variables	GROWTH	Variables	CR
Independent variables			
L.ROA	0.490*** (5.972)	L.ROA	0.570*** (8.611)
CCC	-0.001 (-0.856)	CCC	-0.001 (-0.325)
CCC ²	-0.001** (-2.103)	CCC ²	-0.001** (-2.093)
Control variables			
Firm characteristics			
SIZE	0.003** (2.525)	SIZE	0.003*** (2.688)
LEV	-0.110*** (-3.271)	LEV	-0.108*** (-3.037)
CR	0.001** (2.282)	CR	0.003 (0.694)
GROWTH	0.011 (1.503)	GROWTH	0.004 (1.310)
Macroeconomic variables			
GDP	0.005 (1.408)	GDP	0.007* (1.923)
WTI	-0.002 (-0.154)	WTI	0.004 (0.341)
FX	-0.001 (-0.183)	FX	-0.006 (-0.760)
GPR_China	-0.038* (-1.911)	GPR_China	-0.036** (-2.124)
CCC*GROWTH	-0.001* (-1.699)	CCC*CR	-0.001*** (-2.869)
CCC ² *GROWTH	-0.001* (-1.826)	CCC ² *CR	0.001*** (2.664)
LEV*GROWTH	-0.051** (-2.393)	SIZE*CR	-0.001 (-0.508)
CR*GROWTH	-0.001* (-1.906)	LEV*CR	-0.013 (-1.539)
SIZE*GROWTH	0.002* (1.866)	GROWTH*CR	0.001** (2.345)
Constant	-0.007 (-0.963)	Constant	-0.005 (-0.985)
Year effect (Y/N)	Yes	Year Effect (Y/N)	Yes
Observations	652	Observations	652
Number of firm	96	Number of Firm	96
AR(1) test	-3.040	AR(1) test	-3.140
AR(1) <i>p</i> -val	0.002	AR(1) <i>p</i> -val	0.002
AR(2) test	0.390	AR(2) test	-0.660
AR(2) <i>p</i> -val	0.699	AR(2) <i>p</i> -val	0.507
Hansen <i>J</i> statistic	36.731	Hansen <i>J</i> statistic	34.682
Hansen <i>J</i> <i>p</i> -val	0.435	Hansen <i>J</i> <i>p</i> -val	0.483

Source: Authors' estimation. Note: Sargan test provides the *p*-value for validating the null hypothesis that all over-identifying restrictions are valid. The AR(1) and AR(2) are used to determine the *p*-value for validating first-order autocorrelation and second-order autocorrelation, which is necessary for GMM approach. The instruments utilized in GMM consist of the lagged regression of the ROA at period $t - 1$. *t*-statistics are in parentheses. *, **, *** Significant at 10, 5 and 1 percent levels, respectively. Lagged return on total assets (L.ROA), The cash conversion cycle (CCC), The square of the cash conversion cycle (CCC²), Firm size (SIZE), Financial leverage (LEV), Firm liquidity (CR), Sales growth (GROWTH), Gross domestic product growth (GDP), Change in West Texas Intermediate oil prices (WTI), Change in foreign exchange rates-Thai Baht against the US dollar (FX), China's geopolitical risk (GPR_China), The global financial crisis (D1), The shipping market turmoil (D2), The COVID-19 crisis (D3).

asserting that the rise of GPR_China causes increased business risk and poor performance for shipping SMEs. In the presence of GPR_China, firms of large size appear to be more profitable. A possible explanation is that these firms can use their assets as collateral for bank loans. Collateral values also reflect firms' debt capacity (Drobetz et al., 2013). In addition, in the presence of GPR_China, firms with high debt are more profitable as compared to others. That means firms that have the ability to access debt financing externally can boost their sales, eventually increasing their profitability. Overall, the interaction between working capital and GPR_China was not statistically significant with ROA.

Table 7 also presents the subgroup analysis for firms' financial constraints. The relationship between working capital and ROA varies depending on the level of financial constraints. Firms with financial

Table 7. The moderating role of GPR_China and subgroup analysis for firms' financial constraints.

Variables	GPR_China	Variables	Cons.	Variables	Uncons.
Independent variables					
L.ROA	0.532*** (11.104)	L.ROA	0.310*** (3.362)	L.ROA	0.354*** (2.863)
CCC	-0.001* (-1.634)	CCC	-0.001* (-1.691)	CCC	-0.001 (-1.119)
CCC ²	-0.001** (-2.048)	CCC ²	-0.001*** (-3.572)	CCC ²	0.001 (0.347)
Control variables					
Firm characteristics					
SIZE	-0.023** (-2.280)	SIZE	-0.018 (-0.924)	SIZE	0.017*** (2.725)
LEV	-0.199*** (-4.532)	LEV	-0.226*** (-3.546)	LEV	-0.467*** (-3.253)
CR	-0.001 (-0.328)	CR	-0.001 (-1.341)	CR	0.001 (0.489)
GROWTH	0.007*** (2.971)	GROWTH	0.006 (0.892)	GROWTH	-0.020 (-0.650)
Macroeconomic variables					
GDP	0.256 (1.073)	GDP	0.016** (2.231)	GDP	0.039*** (2.783)
WTI	-0.002 (-0.082)	WTI	0.015 (1.202)	WTI	-0.065 (-1.083)
FX	-0.118 (-0.499)	FX	-0.025* (-1.860)	FX	0.022 (0.462)
GPR_China	-0.943** (-2.091)	GPR_China	-0.172* (-1.743)	GPR_China	0.050 (0.781)
CCC*GPR_China	-0.001 (-0.935)				
CCC ² *GPR_China	-0.001 (-0.229)				
SIZE*GPR_China	0.043* (1.869)				
LEV*GPR_China	0.158* (1.645)				
CR*GPR_China	0.003 (0.524)				
GROWTH*GPR_China	-0.004 (-0.320)				
Constant	0.570*** (2.765)	Constant	0.368 (1.154)	Constant	-0.039* (-1.645)
Year effect (Y/N)	Yes	Year Effect (Y/N)	Yes	Year Effect (Y/N)	Yes
Observations	652	Observations	457	Observations	98
Number of firm	96	Number of Firm	84	Number of Firm	49
AR(1) test	-3.130	AR(1) test	-2.480	AR(1) test	-2.100
AR(1) <i>p</i> -val	0.002	AR(1) <i>p</i> -val	0.013	AR(1) <i>p</i> -val	0.036
AR(2) test	-0.570	AR(2) test	-0.510	AR(2) test	-1.190
AR(2) <i>p</i> -val	0.567	AR(2) <i>p</i> -val	0.612	AR(2) <i>p</i> -val	0.234
Hansen <i>J</i> statistic	55.707	Hansen <i>J</i> statistic	38.087	Hansen <i>J</i> statistic	0.000
Hansen <i>J</i> <i>p</i> -val	0.944	Hansen <i>J</i> <i>p</i> -val	1.000	Hansen <i>J</i> <i>p</i> -val	1.000

Source: Authors' estimation. Note: Sargan test provides the *p*-value for validating the null hypothesis that all over-identifying restrictions are valid. The AR(1) and AR(2) are used to determine the *p*-value for validating first-order autocorrelation and second-order autocorrelation, which is necessary for GMM approach. The instruments utilized in GMM consist of the lagged regression of the ROA at period $t - 1$. *t*-statistics are in parentheses. *, **, *** Significant at 10, 5 and 1 percent levels, respectively. Lagged return on total assets (L.ROA), The cash conversion cycle (CCC), The square of the cash conversion cycle (CCC²), Firm size (SIZE), Financial leverage (LEV), Firm liquidity (CR), Sales growth (GROWTH), Gross domestic product growth (GDP), Change in West Texas Intermediate oil prices (WTI), Change in foreign exchange rates-Thai Baht against the US dollar (FX), China's geopolitical risk (GPR_China), The global financial crisis (D1), The shipping market turmoil (D2), The COVID-19 crisis (D3).

constraints appear to use aggressive working capital policies. This is in line with Banerjee and Deb (2023). Moreover, an inverted U-shaped relationship between CCC² and ROA emerged under the model of financial constraints. The finding suggests that greater financially constrained firms should maintain their optimal level of working capital to maximize firm performance. This is because working capital is an essential internal source of funds for financially constrained firms.

5. Conclusions and implications of findings

5.1. Summary

The current study aims to validate existing knowledge of WCM and corporate profitability in the context of an emerging country's distinctive shipping service business. We also clarify the moderating effects on

the U-shaped or inverted U-shaped relationship between WCM and profitability. We indicate the main findings as follows:

First, we discovered no significant relationship between CCC and ROA, supporting earlier findings (Rey-Ares et al., 2021). Deari et al. (2022), Pant et al. (2023), Sharma and Kumar (2011) and Tiwari et al. (2023) revealed that the relationship between CCC² and ROA was positive. On the contrary, we found that such a relationship was significantly negative, which is in line with Chambers and Cifter (2022), Hoang et al. (2019), Mahmood et al. (2024) and Vlismas (2024). The inverted U-shaped relationship between CCC² and ROA showed that shipping SMEs can maximize their profits by optimizing their level of working capital. Our results are also in line with Boisjoly et al. (2020) in the sense that transportation businesses adopt aggressive working capital policies. Additionally, the results support the assertion under the pecking order theory. Shipping SMEs can use internal funds through WCM before external financing, which has high finance costs, to increase their sales and profits. More specifically, shipping firms tend to perform better if they shorten their CCC by offering their customers incentives to pay invoices early or delaying the payments to their suppliers.

Second, we found that the financial crisis has a negative impact on ROA. The finding aligns with that of Akgün and Karataş (2020) and Ahmad et al. (2022), which reported similar adverse impacts on ROA. In addition, our results showed that during crises, sales growth helped mitigate the adverse impact on firms' profitability. This implies that the management of shipping SMEs, which normally face financial constraints, especially during crises, needs to promote working capital efficiency to maintain their day-to-day operations and increase their sales growth and profitability. This result also supports the pecking order theory. Moreover, during the global financial crisis, an inverted U-shaped relationship between WCM and profitability emerged, while the 2016–2017 shipping market turmoil revealed a U-shaped relationship between WCM and profitability. This confirms that to survive during crises, the management of shipping SMEs adjusts their working capital policies based on the nature of crises.

Third, we discovered a significant and negative influence of firm size and sales growth on the relationship between the CCC–ROA and the CCC²–ROA. This implies that, when large shipping SMEs have adequate funds, they are inclined to provide more trade credit to their clients to boost their sales. However, overly invested working capital can inevitably result in the decline of firms' profitability. Firms' managers should attempt to maintain the optimal level of working capital. Additionally, our research revealed a strong and negative relationship between CCC and ROA when considering financial leverage. Highly leveraged shipping SMEs with a large scale of working capital investment have a lower ROA due to expensive external financing costs. This suggests that management should consider the cost-benefit approach when they largely finance their working capital with debts. Alternatively, referring to the assertion of the pecking order theory, shipping SMEs can promote working capital efficiency through CCC, resulting in increased performance.

Fourth, we found that GPR_China has a substantial and negative impact on the profitability of shipping SMEs. Also, the results showed that larger firms or firms with high leverage performed better when facing China's geopolitical risk. Despite economic uncertainties, larger companies with significant financial leverage were more profitable. Larger firms have a greater ability to apply for loans due to the availability of collateral (Drobetz et al., 2013). Finally, our results suggest that financially constrained firms tend to enhance their working capital efficiency as compared to financially unconstrained ones, consistent with the findings of Banerjee and Deb (2023) and Laghari and Chengang (2019). For SMEs, which are particularly sensitive to the availability of cash, maximizing firm performance requires efficient WCM and a focus on optimizing working capital levels. Thai shipping SMEs prioritize working capital investment over expensive external funding because of high geopolitical risk and financial constraints. As a result, firms with low levels of working capital investment can obtain reasonable profitability.

5.2. Discussions

The absence of a substantial linear relationship between the CCC and profitability suggests that Thai shipping SMEs have faced challenges in managing their cash conversion cycle. These challenges may arise from several factors, such as power dynamics in negotiations between firms and their customers or suppliers. Alternatively, it may imply that the relationship between the CCC and profitability is concave

rather than linear. We agree with Baños-Caballero et al. (2012) that a nonlinear relationship between working capital and corporate performance involves maximizing profitability through a trade-off between costs and benefits. Therefore, managers or owners of shipping SMEs must attempt to maintain the optimum level of working capital by considering firms' financial conditions.

Additionally, this study explores the relationship between WCM and corporate performance, focusing on the impact of financial constraints on working capital investment. Working capital investment depends on factors, such as the availability of internal finance, access to capital markets and the costs of external financing (Fazzari et al., 1988; Laghari & Chengang, 2019). Our study reveals an inverted U-shaped relationship between WCM and corporate performance, particularly for financially constrained firms, showing that the optimal level of working capital is lower for financially constrained firms. Moreover, aggressive working capital management is positively related to higher corporate values, which aligns with others, such as Laghari and Chengang (2019), who use firms listed on the Shanghai Stock Exchange and the Shenzhen Stock Exchange. Typically, smaller firms face various frictions, resulting in varying costs for external financing. To overcome financial constraints, firms must consider the cost-benefit trade-off. Furthermore, our result is consistent with Dash et al. (2023), who use listed Indian manufacturing companies and suggest that an optimal level of working capital is critical for profit maximization. They also argue that aggressive working capital policies lead to the lowest optimal cash conversion cycle.

The findings on moderating effect of crises broaden our understanding of the disparate WCM strategies managers used in various crises. Shipping SMEs employ cautious WCM during a period of shipping volatility and implement aggressive WCM strategies during a global financial crisis, according to our research. In contrast, Mahmood et al. (2024), who studied Chinese manufacturing companies across nine industries, document conservative policy during the 2008–2010 recession, whereas our finding is consistent with those of Ahmad et al. (2022), who used a sample of developing nations, including Thailand, in terms of aggressive WCM adopted during the global financial crisis. This implies that the WCM strategies used during the global financial crisis may not be applicable to other sectors in other countries. We explain the disparate and comparable results as the outcome of various macroeconomic circumstances. According to Jaworski and Czerwonka (2022) and Singh et al. (2017), there are variations in CCC based on certain external circumstances. Alternatively, another possible explanation for the variations or similarities in the results could be that WCM relies on institutional characteristics that define a certain economy, particularly in emerging economies.

5.3. *Implications and limitations*

Our study, which focuses on WCM and firm performance for Thai shipping SMEs, is one of the initial thorough investigations in this field. It has significant importance for academics, practitioners and policymakers in several aspects. In terms of theoretical contributions, first, we establish a nonlinear relationship between WCM and profitability, which depends on firm-specific and macroeconomic factors. Second, according to the pecking-order theory, high- or low-profitable firms should use aggressive working capital policies to enhance sales growth and profitability. Management should come up with their internal funds by promoting working capital efficiency and relying less on external financing. In particular, by shortening their CCC, Thai shipping SMEs can earn profits. Finally, the existing body of empirical evidence regarding the effects of various factors (e.g. firm characteristics, crises, political turmoil and financial constraints) on working capital and profitability in the particular service sector of a developing country is notably scarce. In terms of the country context, this study demonstrates that there is a non-monotonic relationship between working capital and firm performance. Such a relationship is not always positive or negative, which is in line with Singhania and Mehta (2017).

This study has substantial practical and managerial implications for business owners and practitioners in the shipping sector, enabling them to oversee their working capital efficiently and enhance firm performance properly. This study examines the influence of unique corporate characteristics, crises, China's geopolitical risk and financial constraints on WCM and the profitability of shipping SMEs in an emerging country. The findings indicate that maintaining the optimal level of working capital is very critical for attaining the highest level of firm performance. Managers or business owners have to establish appropriate strategies to uphold the optimum working capital level, but they also need to take into

consideration aspects such as their asset size, leverage level, potential crises, geopolitical risks and financial constraints. More precisely, this study reports that for different periods of crisis, shipping SMEs apply various working capital levels to maintain their operations and earn profits. Additionally, the rise in geopolitical risk in China has a negative impact on firm performance. Interestingly, the results show that firms with a larger size or high leverage are more profitable. This suggests that management needs to assess the magnitude of the risk and if they have the opportunity to expand business through debt financing, it is likely to generate more profits. Nonetheless, for financially constrained SMEs, an increase in their firm size should come from the efficiency of their working capital. Furthermore, it is imperative for government agencies to promote the implementation of efficient working capital approaches and streamline the process of obtaining external financing for maritime SMEs, particularly during periods of crisis and the rise in geopolitical instability. Ultimately, the government should provide financial aid to SMEs in the maritime sector, therefore, improving their ability to adjust to any financial challenges.

While our study has provided important empirical insights into WCM in maritime transportation, it is critical to acknowledge the limitations of our research. At first, we utilized samples exclusively from one country. In future studies, it is critical to include data from other countries to provide a comparative examination of the results. In addition, our macroeconomic variables may not be appropriate for generalization. We attribute this to its dependence on country-specific components and their utilization within a specific industry. Due to differences in institutional contexts, future research may use international firms and incorporate global macroeconomic variables.

Only a limited number of studies have specifically examined the management of working capital in developing nations (Laghari & Chengang, 2019). Additionally, prior studies have not covered the samples in the transport sector (e.g. Mahmood et al., 2024). Despite the uniqueness of our target sample, which hinders its generalizability, it can enhance previous research using samples from the logistics and transport sectors (e.g. Banerjee & Deb, 2023). Moreover, we concur with Sawarni et al. (2022), who evidence the nonuniform direction of all the statistically significant relationships across the manufacturing, trading and service sectors. It is clear that managers should consider the nature of business while formulating their WCM strategy. Given the significant differences in the operation and management styles of companies across countries, it is important to carefully assess the degree of similarity between these companies and the sample firms before applying the findings of this research to companies in other economies (Sawarni et al., 2022). In addition, because maritime business is primarily an international business (Drobetz et al., 2013), it is more susceptible to external factors, such as international political and economic uncertainty, than companies that primarily operate in domestic markets. Subsequent investigations should include a larger set of samples from multiple countries and future research may look at how global transportation firms behave on WCM in other contexts. This is because the WCM strategies employed by shipping SMEs in developing nations may not be applicable to other shipping SMEs or even large transportation firms in developed economies.

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Availability of data

The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Authors' contributions

The authors confirm contribution to the paper as follows. Study initiation: Suntichai Kotcharin, Kulaya Jantadej. Study conception and design: Suntichai Kotcharin, Kulaya Jantadej. Data analysis and interpretation: Suntichai Kotcharin, Kulaya Jantadej. Draft manuscript: Suntichai Kotcharin, Kulaya Jantadej. Manuscript preparation: Suntichai Kotcharin, Kulaya Jantadej. All authors have reviewed the results and approved the final version of the manuscripts. Furthermore, all authors are accountable for all aspects of the work.

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Appendix A.

Table A1. Summary of variable calculations and definitions.

Variables	Acronym	Measurement	Source of data
Return on total assets	ROA	Earnings before interest and taxes divided by total assets	Business online (BOL)
The cash conversion cycle	CCC	$[(\text{accounts receivable} / \text{sales}) \times 365] + [(\text{inventory} / \text{cost of goods sold}) \times 365] - [(\text{accounts payable} / \text{cost of goods sold}) \times 365]$	Business online (BOL)
The square of the cash conversion cycle	CCC ²	Cash conversion cycle multiplied by cash conversion cycle	Business online (BOL)
Firm size	SIZE	The natural logarithm of total assets	Business online (BOL)
Financial leverage	LEV	Total debt divided by total assets	Business online (BOL)
Firm liquidity	CR	Current assets divided by current liabilities	Business online (BOL)
Sales growth	GROWTH	The percentage change in sales over the period $t-1$ to t	Business online (BOL)
Gross domestic product growth	GDP	The annual change in Thailand's GDP rates	Bank of Thailand
Change in West Texas Intermediate oil prices	WTI	The annual change in the WTI oil prices	Datastream
Change in foreign exchange rates	FX	The annual change in Thai Baht against the US dollar	Bank of Thailand
China's geopolitical risk	GPR_China	The natural logarithm of China's geopolitical risk index	Matteoiacoviello.com
The global financial crisis	D1	Equal to 1 if the observation is from 2009, 2010 and 2011; zero otherwise	Casey and O'Toole (2014), Authors
The shipping market turmoil	D2	Equal to 1 if the observation is from 2016 and 2017; zero otherwise	Song et al. (2019), Authors
The COVID-19 crisis	D3	Equal to 1 if the observation is from 2020 and 2021; zero otherwise	Authors

Appendix B.

Table B1. ADF-Fisher type panel unit root test.

Variables	Without trend	<i>p</i> -values	With trends	<i>p</i> -values
ROA	209.944	0.005	201.622	0.014
CCC	324.716	0.000	380.474	0.000
CCC²	381.596	0.000	488.775	0.000
SIZE	319.612	0.000	260.214	0.000
LEV	151.415	0.674	118.373	0.994
CR	205.501	0.009	140.378	0.866
GROWTH	568.246	0.000	396.260	0.000
GDP	229.326	0.000	128.266	0.969
WTI	320.597	0.000	129.032	0.966
FX	443.593	0.000	270.566	0.000
GPR_China	334.110	0.000	261.442	0.000

Source: Authors' calculation. Note: the *p*-values are significant at the 1%, 5% and 10% levels, respectively.

Table B2. PP-Fisher type panel unit root test.

Variables	Without trend	<i>p</i> -values	With trends	<i>p</i> -values
ROA	454.361	0.000	335.851	0.000
CCC	521.471	0.000	640.070	0.000
CCC²	776.711	0.000	749.679	0.000
SIZE	321.749	0.000	279.757	0.000
LEV	244.194	0.000	417.145	0.000
CR	722.175	0.000	604.666	0.000
GROWTH	2163.864	0.000	1630.706	0.000
GDP	812.137	0.000	760.918	0.000
WTI	520.479	0.000	592.330	0.000
FX	533.960	0.000	479.144	0.000
GPR_China	458.863	0.000	534.408	0.000

Source: Authors' calculation. Note: the *p*-values are significant at the 1%, 5% and 10% levels, respectively.