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The Effect of Working Capital Management on Cost Stickiness Considering the Mediating Role of Financial Constraints

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Abstract

This study examined the effect of working capital management (WCM) policies on cost stickiness, providing the first direct empirical quantification of whether and how financial constraints mediate this relationship in a major emerging market. Building on established trade-off, agency, and adjustment-cost theories, we hypothesize that aggressive WCM primarily reduces cost stickiness for efficiency, but that financial constraints partially offset this gain. Using 1,848 firm-year observations from 132 Tehran Stock Exchange (TSE)–listed firms (2010–2023), we estimated multiple regression and a covariance-based SEM. More aggressive WCM is associated with lower cost stickiness. Critically, the mediation analysis indicates partial mediation; aggressive WCM is linked to higher financial constraints, and these constraints, in turn, amplify cost stickiness, thereby quantifying the trade-off between direct efficiency gains and indirect financial rigidities. Our findings establish an empirical foundation for advising managers to adopt aggressive WCM strategies only when coupled with strategies to mitigate financial constraint risk. Policymakers, particularly in SME contexts, should design targeted liquidity provision mechanisms to unlock the full cost-flexibility potential of WCM.

Keywords:
Cost Stickiness, Financial Constraints, Working Capital Management

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1. Introduction

In corporate finance, WCM, or strategic management of a firm's short-term liabilities and assets, has grown to become a fundamental area of operational performance, liquidity, and value generation (Gitman, 1974; Deari et al., 2024). Effective WCM enables firms to meet short-term obligations by improving cash flow and profitability, primarily through reductions in the Cash Conversion Cycle (CCC) (Huynh et al., 2025). While historically viewed as a routine money-generating activity, WCM is nowadays a managerial option at the mercy of the risk-taking nature of the manager, industry rivalry, and the overall macro-financial environment (Filbeck and Krueger, 2005; Prasad et al., 2019).

Concurrently, a growing cost accounting literature has examined asymmetric cost behavior, particularly cost stickiness, the mechanism through which costs decrease less when activity declines than they increase when activity rises by the same margin (Anderson et al., 2003). These asymmetries challenge conventional proportional cost adjustment-based models and have significant managerial choice implications, earnings forecasting, and firm resilience (Banker and Byzalov, 2014; Deneckere and Kovenock, 1996; Ballas et al., 2022). Despite the large amount of research conducted on WCM and asymmetric cost behavior independently, relatively little is known regarding the interplay between WCM and asymmetric cost behavior.

Causes of cost stickiness are attributed to discretionary economic decisions resulting from resource flexibility for change costs of resources such as capacity, labor, and infrastructure (Anderson and Lanen, 2007). Theoretical models of cost stickiness (Anderson et al., 2003) focus on the fact that managers typically avoid cutting costs in a depression due to expected future recoveries or fear of frictions imparted by cost adjustment (Restuti et al., 2022). Simultaneously, WCM approaches ranging from aggressive (low cost usage, liquidity-constrained) to conservative (high liquidity, risk-sensitive) set up a company's ability and desire to modify its cost structure (Hung and Su Dinh, 2022). Prior studies (e.g., Berg et al., 2024) have shown that cost stickiness is less pronounced in aggressive WCM firms due to greater cost sensitivity to promote efficiency. Conversely, conservative WCM practices can solidify cost stickiness by strategic resource holding back (Mirón Sanguino et al., 2024). Since WCM decisions involve short-term resource allocation and liquidity control, they directly affect how quickly a firm can adjust its operating costs when activity levels change.

The relationship gets complex in the case of financially constrained firms. For financially constrained firms with limited access to external capital, particularly small companies, cost adjustments would occur faster, irrespective of risk management purposes, because such firms do not possess the ability to buffer economic shocks (Hadlock and Pierce, 2010).

Thus, the definition using financial constraints yields implications about direct influence on costs behavior and mediation mechanism, contending that these are mechanisms intervening between WCM strategies' effect and asymmetric cost behavior (a central yet unexplored process) (Ibrahim et al., 2022). This has received more attention in recent years, but no studies have tested the mediating effect of financial constraints on asymmetric cost behavior in terms of WCM strategies. Most empirical studies have considered the effects of WCM and financial constraint individually and sometimes side by side, but never in terms of how they might interact or condition one another (Jabbouri et al., 2024). This, indeed, is a very critical omission because aggressive WCM, aimed at cost reduction, may expose an enterprise to financial constraints, thus limiting cost reactions. Conversely, conservative WCM shields a firm from such constraints but, at the same time, may impose cost rigidity (Ujah et al., 2020). Without an understanding of how financial limitations mediate this interaction, managerial and policy implications stemming from existing literature may be suboptimal or even inaccurate.

This study bridges this gap by investigating whether financial limitations account for the interaction between WCM strategies and cost stickiness (Chen and Ma, 2021), which also considers

whether aggressive WCM policies impact cost asymmetry indirectly through financing constraints (Jabbouri et al., 2024). Managerial cost behavior causal mechanisms are tested through a mediation analysis framework (Baron and Kenny, 1986; Hayes and Scharkow, 2013). To this effect, the study aims to determine how and why WCM affects cost adjustments under financial frictions, gaining insight into firm behavior under regimes of uncertainty.

Accordingly, this study seeks to answer the following research question: To what extent do financial constraints mediate the relationship between WCM strategies and cost stickiness? By addressing this question, the study contributes to the literature in several important ways. Specifically, it offers three distinct contributions:

First, it establishes an empirical foundation for the strategic WCM trade-off by quantifying, for the first time in an emerging market context, focusing on firms listed in the Tehran Stock Exchange, the precise extent to which constraint-induced rigidity offsets WCM efficiency gains.

Second, it theoretically reconciles the conflicting effects of aggressive WCM by demonstrating the mechanism through which the same policy simultaneously drives the efficiency channel and the vulnerability channel, thereby enriching the application of Adjustment Cost Theory.

Third, this research provides specific managerial guidance, advising firms to adopt WCM efficiency initiatives only in conjunction with financing strategies aimed at mitigating liquidity risk. This also lays the groundwork for policy-targeted interventions to support small and medium-sized enterprises (SMEs) facing financial constraints.

2. Literature review

2.1. Theoretical basis

The present study is based on three theoretical frameworks: the liquidity-profitability trade-off theory in WCM, the adjustment cost theory in cost behavior, and the agency theory. Liquidity-profitability trade-off theory: This theory states that firms face a fundamental conflict between maintaining liquidity and achieving profitability (Deloof, 2003; Baños-Caballero et al., 2014). In aggressive WCM policies, the level of investment in current assets (such as inventory and accounts receivable) is minimized while reliance on current liabilities (such as accounts payable) increases (Agegnew, 2019). Adopting such a strategy boosts free cash flow at the expense of liquidity risk associated with greater usage of external financing channels, which also worsens financial frictions (Atanasova and Willeboordse, 2025). Aggressive working capital policies improve efficiency and profitability ultimately, but from a trade-off perspective, they also inherently increase liquidity risk and dependence on external finance, increasing the firm's vulnerability to financial constraints. This provides the theoretical underpinnings for why it is important to explore financial constraints as a mediating mechanism.

By keeping a large amount of current assets, conservative policies might reduce profitability (Singh et al., 2017), but they can ensure more liquidity. The major theory explaining the cost stickiness is based on the fact that there are adjustment costs. When sales fall, managers are reluctant to take down resources such as skilled labor or key supplier relationships too quickly, for the repositioning costs (e.g. of hiring and training) in the future can be high (Anderson et al., 2003; Banker and Chen, 2006). Simultaneously, agency theory presents a complementary explanation and posits that managers might be motivated to hoard resources beyond the optimal level for self-serving reasons, e.g. establishing empires (empire building) or augmenting job security. Such behavior can create cost stickiness even when it does not enhance shareholder value (Chen et al., 2012; Jensen and Meckling, 1976), a characteristic that we continue in our model.

When facing financial constraints, managers may have a limited capacity to make strategic

resource adjustments: costs of adjustment become more binding and agency considerations play an influence in terms of choosing whether to retain or release resources, potentially heightening cost stickiness even during periods of revenue declines.

2.2. The link between WCM and cost stickiness

The strategic approach to WCM directly affects a company's cost structure (Vlismas, 2024). According to the principles of the trade-off theory, the selection of a WCM strategy is not merely operational; rather, it reflects a fundamental balance between efficiency and financial vulnerability, which subsequently shapes managerial cost decisions. Firms adopting aggressive WCM policies are philosophically and operationally oriented toward efficiency. Managers in such firms typically possess strong capabilities in eliminating excess inventory, accelerating receivables collection, and managing short-term liabilities, which naturally extend to operating cost management (Frankel et al., 2017; Aktas et al., 2015).

Further, the causal link between WCM (particularly the cash conversion cycle) and cost stickiness can be explained through the adjustment cost theory, which posits that constrained liquidity increases the marginal cost of adjusting operational resources and influences managers' choices between reducing costs and preserving capacity (Jose et al., 1996; He et al., 2020). An efficiency-oriented managerial mindset, therefore, reduces the likelihood of accumulating slack resources and increases managers' willingness to accept adjustment costs to align the cost structure with declining revenues.

Empirical evidence supports these mechanisms in which firms with shorter cash conversion cycles, an indicator of aggressive WCM, tend to exhibit lower levels of cost stickiness (Berg et al., 2024). Combining insights from the trade-off theory, the adjustment cost theory, and the agency theory, we can articulate the theoretical rationale for linking aggressive WCM, financial constraints, and cost stickiness.

Aggressive WCM, typically reflected in a shorter cash conversion cycle (CCC), a lower net trade cycle (NTC), and a reduced working-capital-to-total-assets ratio (WCTA), modifies the firm's operating resource base by reducing cash tied up in inventory and receivables while increasing reliance on spontaneous financing through accounts payable (Baños-Caballero et al., 2014; Aktas et al., 2015). From the perspective of adjustment cost theory, reducing investment in working capital limits slack resources and prevents the buildup of idle capacity. Consequently, when sales decline, managers face fewer excess inputs and encounter lower adjustment costs associated with labor shedding, capacity downsizing, or supplier renegotiation (Anderson et al., 2003).

Under this resource-lean structure, the marginal cost of adjusting operating resources is lower, thereby weakening the conditions that typically generate asymmetric cost behavior. Therefore, in line with predictions of the aforementioned theories, firms following aggressive WCM policies are expected to exhibit less cost stickiness.

Combining these perspectives, it is argued that aggressive WCM, by reducing cash and inventory holdings (liquidity-profitability trade-off), reduces adjustment costs when resources are downsized (adjustment cost theory), while managerial agency considerations can also affect the excess of resources held (agency theory). These mechanisms collectively reduce cost stickiness and form the basis of hypothesis H1.

The first hypothesis, ensuing from these findings, is the following:

H1: Firms with more aggressive working capital management experience less cost stickiness.

2.3. The mediating role of financial constraints

Aggressive WCM operationalized by a shorter CCC, a lower NTC, and a lower WCT reduces the firm's holdings of cash, inventories and receivables, while increasing reliance on spontaneous and

short-term liabilities (accounts payable) (Chow and Fung, 2000; Bottazzi et al, 2014). Empirically and theoretically, these three WCM proxies capture complementary aspects of the same policy choice. CCC and NTC reflect the timing of cash flows (days inventory and receivables relative to payables), whereas WCTA captures the intensity of current-asset investment relative to firm scale (Deloof, 2003; Baños-Caballero et al., 2014). By compressing internal liquid buffers and elevating dependence on external or supplier financing, aggressive WCM increases a firm's exposure to funding shortfalls and therefore the degree of financial constraint (Path A).

When financial constraints bind, firms face limited access to external funds needed to absorb the one-time, fixed costs of re-scaling operations (severance payments, contract termination costs, plant retooling, supplier renegotiation). Under the adjustment-cost theory, these fixed costs determine whether managers can economically implement immediate, large-scale adjustments; when internal and external liquidity are scarce, managers are unable to bear those upfront costs and therefore postpone or ration adjustments. The net consequence is that costs remain relatively inflexible in the face of declining sales, i.e., financial constraints amplify cost stickiness (Path B), because constrained firms cannot pay the fixed adjustment costs required to reduce committed inputs (Hadlock and Pierce, 2010).

Hence, full consideration of financial constraints would involve two relationships that need to be tested; aggressive WCM lowers liquidity and increases the constraint (Path A), whereas financial constraints limit managers' motivation to downsize in the face of declining sales (Path B), thereby strengthening cost stickiness.

Thus, the second hypothesis of this research reads as follows:

H2: Financial constraints mediate the relationship between aggressive working capital management and cost stickiness.

In summary, aggressive WCM (independent variable) affects cost stickiness (dependent variable) both directly and indirectly through financial constraints (mediator), forming the conceptual framework of this study in Figure 1.

3. Methodology

3.1. Sample selection

To achieve the objectives of this study, all firms listed on the TSE were considered as the population, with the sample selected systematically according to the following exclusion criteria:

1. Listed on the TSE from 2010 to 2023.
2. Fiscal years ending on Esfand 29 (March 19).
3. Perform as manufacturing companies, dropping off firms dealing with finance, including the banks, insurance companies, and investment firms.
4. Remaining listed on the TSE through 2023 with continuous operations.
5. Experiencing no transaction halts longer than six months.

Based on the above criteria, the final sample consisted of 132 manufacturing firms, yielding a total of 1,848 firm-year observations between 2010 and 2023. The Consumer Price Index (CPI), which tracks overall price fluctuations over time consistently, was used to deflate data for adjusting inflationary measures. Thus, the two measures of WCM can be consistent across sectors. In addition, we performed winsorization at the 1st and 99th percentiles to mitigate extreme values. Hypotheses were tested via multiple regression models and structural equation modeling (SEM) conducted in Stata software.

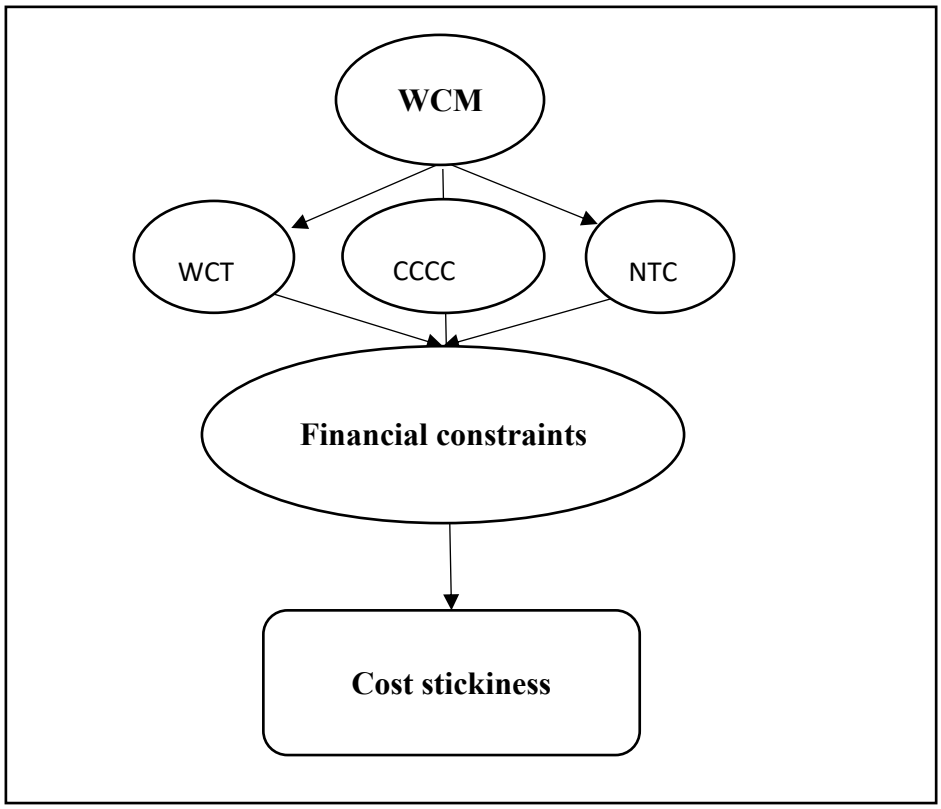

Figure 1. The conceptual framework

3.2. Research design

Model 1: Direct Effect of WCM on cost stickiness

In this study, an attempt was made to incorporate the model presented by Anderson et al. (2003) and, with reference to the study by Berg et al. (2024), to examine the effect of working capital management on asymmetric cost behavior in companies, which was the target of the first hypothesis. This model can be represented as follows:

$$\Delta \ln COST_{i,t} = \beta_0 + \beta_1 \Delta \ln SALES_{i,t} + \beta_2 D_{i,t} \times \Delta \ln SALES_{i,t} + \beta_3 D_{i,t} \times \Delta \ln SALES_{i,t} \times WCM_{i,t} + \beta_4 WCM_{i,t} + \beta_5 FCF_{i,t} + \beta_6 EMINT_{i,t} + \beta_7 SIZE_{i,t} + \beta_8 ROA_{i,t} + \beta_9 Cash\ holding_{i,t} + \beta_{10} \Delta GDP_{i,t} + \varepsilon_{i,t}$$

The regression equations are estimated three times by replacing WCM with CCC, NTC, and WCTA.

3.2.1 Variable definitions and measurement (Model 1)

3.2.1.1. Dependent variable

Change in Logarithmic Operating Costs (ΔlnCOST): This variable, known as the logarithmic change in operating costs, measures the change in a firm's operating costs from the previous year to the current year. This indicator was first used in the cost stickiness model by Anderson et al. (2003) and is used in most studies related to asymmetric cost behavior (Anderson et al, 2003).

$$\Delta \ln C\ OST = \ln C\ OST_{i,t} - \ln C\ OST_{i,t-1}$$

3.2.1.2. Independent variable

Working capital management (WCM): In order to conduct an analysis on the first hypothesis, the three main dimensions of WCM, namely, WCTA, CCC, and NTC, are examined. Based on the background of studies, CCC, as a common indicator used in WCM studies (Liu et al., 2024), focuses on the time and liquidity cycle, and WCTA, as a proxy for the liquidity health of the company, provides a comprehensive view of the current financial structure, and NTC, which is a relative measure of working capital, is useful for studying sales and comparability (Berg et al., 2024).
WCM: calculated using three metrics: WCTA, CCC, and NTC.

Working capital to total assets ratio (WCTA): WCTA is a widely used liquidity indicator that measures the proportion of a firm's total assets financed through net working capital, which illustrates the health of a firm in the short run. Whether it can settle its immediate debts using the available resources or not, this indicates that a decrease in WCTA means aggressive WCM. As described in the equation below (Berg et al., 2024).

$$\mathrm{WCTA}_{\mathrm{i,t}} = \frac{\text{Current assets}_{i,\mathrm{t}} - \text{Current liabilities}_{i,t}}{\text{Total assets}_{i,\mathrm{t}}}$$

Cash Conversion Cycle (CCC): The CCC is one of the most commonly applied measures of WCM efficiency, which indicates the number of days it takes for a business to turn its investments in inventory and receivables into cash, minus the amount of time it gets credit from suppliers. The shorter the better, as it reflects more aggressive WCM, determined using Equation (b) (Liu et al., 2024).

$$\mathrm{CCC} = \mathrm{INV} + \mathrm{ACR} - \mathrm{ACP}$$

Inventory Turnover: $\mathrm{INV} = \frac{\text{Inventories}}{\text{Cost of goods}} \times 365$

Accounts receivable Turnover: $\mathrm{ACR} = \frac{\text{Accounts receivable}}{\text{Sales}} \times 365$

Accounts Payable Turnover: $\mathrm{ACP} = \frac{\text{Accounts payable}}{\text{Purchases}} \times 365$

Net Trade Cycle (NTC): The NTC captures the net time that a firm's operating resources spend stuck in the business and is an alternative measure of WCM. In contrast to the traditional Cash Conversion Cycle, NTC allows normalizing working capital elements by sales and expresses the outcome in terms of days, which makes it particularly useful when comparing firms across types and sizes. A shorter NTC implies more aggressive WCM, which is calculated using the following equation (Berg et al., 2024):

$$\mathrm{NTC} = \frac{\text{Inventories} + \text{Accounts receivable} - \text{Accounts payable}}{\text{Sales}} \times 365$$

3.2.1.3. Control variables

Following Liu and Jin (2024) and Sun and Gong (2023):

Logarithmic Change in Sales Revenue (ΔlnSALES): This variable represents the logarithmic change in sales between two periods, which can be interpreted as an indicator for the percentage change in sales. For cost stickiness models, this variable is often the main dependent variable explaining cost changes, typically (Anderson et al., 2003).

$$\Delta\, ln\, S\, ALSE = ln\, S\, ALES_{i,t} - ln\, S\, ALES_{i,t-1}$$

Decrease Dummy (D): is an indicator of decreased sales, which can be taken equal to one and zero

in cases where the sales revenue of the current period is estimated as less when compared to that of the previous year and otherwise, respectively, revenue (Anderson et al, 2003).

Free cash flow (FCF): It is one of the important indicators in finance and accounting research that is considered in the framework of Agency Theory. According to this theory, managers may invest in low-value or low-return projects when they have free cash, and this can increase the conflict of interest between managers and owners. For this reason, many studies, including Chen et al. (2012), have used FCF as a key variable in analyzing managerial behavior (Chen et al., 2012).

$$FCF_{i,t} = \frac{Operating\ Cash\ FloW_{i,t} - Dividends_{i,t}}{Total\ Assets_{i,t}}$$

Employee intensity (EMINT) is measured by dividing the number of employees by sales. This indicator shows how many human resources the company has employed in relation to its sales volume and the intensity of labor utilization in the company's operational structure (Chen et al, 2012).

$$EMINT_{i,t} = \frac{Number\ Of\ Employees_{i,t}}{Total\ sales_{i,t}}$$

Firm size (SIZE): Firm size is calculated as the natural logarithm of total assets **(**Huynh et al., 2025).

Profitability (ROA): Profitability is measured as net income divided by total assets. ROA reflects operational performance and internal financing capacity (Huynh et al., 2025).

$$ROA_{i,t} = \frac{Net\ Income_{i,t}}{Total\ Assets_{i,t}}$$

Cash holding: Ratio of operating cash flow to total assets. This ratio measures the company's cash holdings based on cash flow from operations relative to total assets. This metric shows the company's operational liquidity (Habib and Hasan, 2019).

$$Cash\ Holding_{i,t} = \frac{operating\ cash\ floew_{i,t}}{Total\ Assets_{i,t}}$$

Changes in Gross Domestic Product (ΔGDP) are incorporated as a control variable to represent changes in Gross Domestic Product. This variable accounts for the effects of inflation and managerial expectations. (Banker and Byzalov, 2014).

$$\Delta GDP_{i,t} = \frac{GDP_t}{GDP_{t-1}} - 1$$

Model 2: Effect of WCM on financial constraints (Mediation)

The next model analyzes the mediating role of financial constraints with respect to the SA index (Hadlock and Pierce, 2010). The SA index is based on only exogenous variables (firm size and age) and is the least endogenously biased one compared to other indices (for example, KZ). The SA index was chosen based on the cost stickiness model and literature review background (Costa et al., 2021; Wang, 2022).

On the basis of prior empirical results, and in particular Huynh et al. (2025), the subsequent model has been applied to investigate the influence of working capital management on financial constraints.

$$SA_{i,t} = \beta_0 + \beta_1 WCM_{i,t} + \beta_2 Leverage_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 Cash\ holding_{i,t} + \beta_5 ROA_{i,t} + \beta_6 Salesgrowth_{i,t} + \beta_7 \Delta GDP_{i,t} + \varepsilon_{i,t}$$

The regression equations are estimated three times by replacing WCM with CCC, NTC, and WCTA.

3.2.2. Variable definitions and measurement (Model 2)

3.2.2.1. Dependent variable

Hadlock–Pierce Financial Constraints Index (SA): One of the most reliable and non-parametric indicators for measuring the degree of financial constraint of firms was developed by Hadlock and Pierce (2010). This indicator focuses on the fundamental characteristics of the firm, because the authors believed that financial variables such as cash flow or profitability may themselves be the result of financial constraint and introduce bias. This indicator uses only firm size and firm age, because these two variables are less susceptible to endogenous bias than changes in financial policies. A higher value of this index indicates greater financial constraints.

$$SA_{i,t} = -0.737SIZE_{i,t} + 0.043SIZE_{i,t}^{2} - 0.04AGE_{i,t}$$

3.2.2.2. Independent variable

WCM is measured using three separate indicators; therefore, the model is estimated three times, once with CCC, once with NTC, and once with WCTA as the working capital proxy (Berg et al, 2024).

3.2.2.3. Control variables

Leverage: It shows the extent to which a company relies on debt. The leverage ratio shows what portion of a company's assets is financed through debt. Several studies, including Banerjee et al. (2023), emphasize that increasing leverage can increase debt repayment risk and exacerbate the company's level of financial constraints. Leverage is measured as total debt divided by total assets (Banerjee et al, 2023).

$$Leverage_{i,t} = \frac{Total\ Debts_{i,t}}{Total\ Assets_{i,t}}$$

Firm Size (SIZE): measured by total assets, the natural logarithm. SIZE is a prevalent control variable in empirical studies of corporate finance and accounting because larger firms are universally less subject to financing frictions and better situated to obtain external capital (Huynh et al., 2025).

Cash holding: Operating cash flow to total assets ratio. This ratio calculates the cash the company holds based on cash from operations divided by total assets. This metric indicates the operational liquidity of the company. ((Habib and Hasan, 2019).

$$Cash\ Holding_{i,t} = \frac{operating\ cash\ floew_{i,t}}{Total\ Assets_{i,t}}$$

Profitability (ROA): Profitability is measured as net income divided by total assets. ROA indicates operating performance and internal financing ability (Huynh et al., 2025).

$$ROA_{i,t} = \frac{Net\ Income_{i,t}}{Total\ Assets_{i,t}}$$

Sales Growth: Sales growth is defined as the change in sales from year t−1 to year t scaled by year t−1 sales. Higher sales growth increases a firm's need for external financing and may intensify financial constraints, so this variable is a widely used proxy of growth-related financing pressure in corporate finance research (Anderson et al, 2003).

$$Sales\ Growth_{i,t} = \frac{SALES_{i,t} - SALES_{i,t-1}}{SALES_{i,t}}$$

Changes in Gross Domestic Product (ΔGDP) are incorporated as a control variable to represent changes in Gross Domestic Product. This variable accounts for the effects of inflation and managerial expectations. (Banker and Byzalov, 2014).

$$\Delta GDP_{i,t} = \frac{GDP_t}{GDP_{t-1}} - 1$$

3.2.3. Resulting structure

This specification clearly establishes that the dependent variable is financial constraints, the main independent variable is working capital management (measured through three alternative proxies), and all other variables function as standard control variables consistent with international empirical literature.

After examining the first model, which is the direct path of the relationship between WCM and cost stickiness according to the model of Chen et al. 2003 and Berg et al. 2024, the second model is examined by examining the indirect path that shows the relationship and type of effect of WCM on financial constraints, and confirmation of the two direct and indirect relationships is obtained. According to Baron and Kenny (1986), a mediating effect exists when the independent variable affects the mediator, and the mediator in turn affects the dependent variable. Then, to finally examine the SA of financial constraints in the model (1), we examine it with the structural equation mediation method and whether the indirect effect in the example is statistically significant, we can use bootstrapping or the Sobel Test (Sobel 1998). Bootstrapping is statistically more accurate and flexible, because it does not depend on the normality of the data, so the bootstrapping test has been used for high accuracy of the study.

4. Findings

4.1. Descriptive statistics

Table 1 shows the descriptive analysis of the variables used in this research.

Table 1. Descriptive statistics

Variable	Mean	Minimum	Maximum	Std.dev	Skewness	Kurtosis	N
ΔlnCOST	0.226	-3.160	4.090	0.365	0.376	23.810	1848
ΔlnSALES	0.227	-0.435	0.899	0.279	-0.016	2.680	1848
WCTA	0.171	-1.950	2.006	0.216	-0.220	3.470	1848
CCC	200.100	-2025	3101	190.900	-0.304	13.530	1848
NTC	233.500	-2376	2689	295.900	0.927	15.120	1848
SA	-1.660	-3.165	3.997	0.908	1.710	7.860	1848
FCF	0.024	-0.814	0.538	0.127	-0.775	7.025	1848
EMINT	0.005	1.900	0.008	0.000	3.740	26.540	1848
SIZE	14.480	10.030	21.570	1.611	0.665	4.050	1848
ROA	0.141	-0.400	0.681	0.144	0.677	3.890	1848
Cashholding	0.125	-0.460	0.726	0.140	0.539	4.140	1848
Leverage	0.355	0.003	0.953	0.220	0.380	2.140	1848
Salesgrowth	0.331	-0.739	3.770	0.452	1.87	10.700	1848
ΔGDP	- 0.480	-3.727	2.909	1.743	0.115	2.49	1848
D	0.192	0.000	1.000	0.000	1.550	3.420	1848

Table 1 presents the descriptive statistics of the variables used in this study. WCM is quantified using three proxies: WCTA, CCC, and NTC. The mean WCTA is 0.171 or approximately 17%, indicating that firms have good working capital and a good liquidity position. According to Eldomaty et al. (2023), a WCTA between 5% and 30% suggests appropriate working capital levels along with the adoption of aggressive WCM policies. The CCC median is 200 days, which means that firms take around 200 days to achieve the whole cycle from raw material cash outflows through to customer cash inflows. Likewise, the mean NTC is 233 days, which represents the sum of accounts payable

period, inventory holding period, and days' sales in accounts receivable. The mean value of the decrease in sales variable is 0.1926, indicating that the firm experienced a year-over-year sales reduction in about 19% of the observations.

4.2. Main results

Table 2 presents the results of the first model's estimation under hypothesis testing H1. The adjusted R2, Fisher statistics, and p-values ($p < 0.001$) all confirm the joint significance of the regression models. The Hausman test was significant in every one of the three estimates ($p < 0.001$), in support of employing the fixed effects model. Additionally, both the LR test for heteroscedasticity and the Wooldridge test for autocorrelation were significant, so fixed effects with robust standard errors and clustered standard errors were used in an attempt to solve these issues. The mean VIF scores were below 3 on all three estimates, and below 4 in all variables, indicating no indication of multicollinearity. All three WCM proxies, CCC, NTC, and WCTA, have their estimated coefficients positive and significant at 5% level. The sign is positive, suggesting that the higher values of these WCM measures are associated with a reduction in cost stickiness. Thus, hypothesis H1 holds. This result supports previous research, including Filbeck and Krueger (2005) and Berg et al. (2024), because they found effective working capital management also lowers cost inflexibility, such that cash can better adapt. This makes sense as a positive and significant value of coefficients for WCTA, NTC and CCC suggests that an increase in the working capital management indicators leads to decreasing cost stickiness. The positivity of the interaction coefficient ($D \times \Delta\ln Sales \times WCM$) indicates that during periods of declining sales, costs decrease faster and, as a result, the cost structure becomes more flexible. This finding fully confirms the first hypothesis (H1). Theoretically, this result is also consistent with the Adjustment Cost Theory, because companies with lower levels of unused resources incur lower adjustment costs and have a greater ability to quickly reduce committed resources during times of decline. The magnitude of the coefficients (with a t-statistic of about 2 to 3 and a significance level of less than 5 percent) indicates that the effect is also significant from an economic perspective. From a managerial perspective, the results suggest that adopting an aggressive approach to working capital management enables the company to adjust costs more quickly and effectively when faced with declining sales.

To examine the second hypothesis, we first examine the second model (Table 3) to see if there is a significant association between the WCM approach and financial constraints. If found, that association is then examined for its mediating effect. The Fisher statistics and their significance levels ($p < 0.001$) indicate the joint significance of the regression models in each of the three specifications. Both times, the Hausman test results, which are significant at the 0.1% level, prefer the fixed effects specification. Due to the significant LR test for heteroscedasticity and the Wooldridge test for autocorrelation, we employ the GLS model to adjust for these. Average VIF values still remain below 3 for all three models and below 4 for individual variables, confirming the absence of multicollinearity. The $\beta 1$ coefficients of all three WCM measures (CCC, NTC, and WCTA) are positive and significant at the 1% level, indicating that more aggressive WCM is associated with

higher financial constraints. As such, these results confirm the mediation path specified in Hypothesis 2. Moreover, the introduction of the interaction term between WCM and sales decline for cost stickiness management confirmed the sign and significance of all coefficients obtained for Hypothesis 2 (see Table 4). The moderating role of financial constraints is in accordance with the Adjustment Cost Theory (Anderson et al., 2003), which argues that liquidity constraints increase cost stickiness due to a lack of flexibility. The positive and statistically significant coefficients of aggressive policies in all three WCM indices (namely, WCTA, CCC and NTC) suggest that more aggressive working capital management policies tend to raise companies' financial constraints. A positive coefficient indicates that the reduction in liquidity and higher dependence on external financing increase the tightening of financial constraints. This outcome supports path A of the second hypothesis (H2).

Table 2. Testing the First Hypothesis (fixed effect vce (robust))

ΔlnCost		**WCM Proxy**								
		CCC			**NTC**			**WCTA**		
Sym	**Variables**	**Coef**	**T-value**	**Prob**	**Coef**	**T-value**	**Prob**	**Coef**	**T-value**	**Prob**
β_1	ΔlnSales	0.892	19.570	0.000	0.897	19.460	0.000	0.866	18.610	0.000
β_2	D*ΔlnSales	-0.020	-0.140	0.887	-0.019	-0.130	0.893	0.089	0.880	0.380
β_3	D*ΔlnSales* WCM	0.320	1.740	0.084	0.332	2.030	0.044	0.535	2.040	0.043
β_4	WCM	0.202	2.240	0.027	0.218	3.130	0.002	0.227	3.070	0.003
β_5	FCF	-0.682	-2.960	0.004	-0.681	-2.990	0.003	-0.592	-2.580	0.011
β_6	EMINT	-0.520	-2.410	0.018	-0.470	-2.280	0.024	-0.414	-2.130	0.035
β_7	SIZE	0.022	2.460	0.015	0.022	2.460	0.015	0.022	2.630	0.010
β_8	ROA	-0.110	-5.900	0.000	-0.109	-6.000	0.000	-0.12	-6.170	0.000
β_9	Cashholding	0.799	3.510	0.001	0.801	3.630	0.000	0.681	3.170	0.002
β_{10}	ΔGDP	0.0153	3.160	0.002	0.015	3.280	0.001	0.015	3.460	0.001
	Constant		YES			YES			YES	
	Firm control		YES			YES			YES	
	Industry control		YES			YES			YES	
	Year control		YES			YES			YES	
	Adjusted R^2		0.582			0.583			0.583	
	F-statistics		134.360			163.710			177.460	
	Prob		0.000			0.000			0.000	
	Hausman		46.930			51.910			50.870	
	Prob		0.000			0.000			0.000	
	Lr test		3180.520			3176.150			3169.110	
	Prob		0.000			0.000			0.000	
	Wooldridge		4.500			4.834			5.098	
	Prob		0.035			0.029			0.025	
	Mean VIF		2.250			2.24			2.270	

Table 3. Testing the SA and WCM relationship (GLS)

SA		WCM Proxy								
		CCC			NTC			WCTA		
Sym	Variables	Coef	Z-value	Prob	Coef	Z-value	Prob	Coef	Z-value	Prob
β_1	WCM	0.0382	4.330	0.000	0.035	3.990	0.000	0.0331	4.250	0.000
β_2	Leverage	0.023	2.720	0.007	0.0236	2.670	0.008	0.333	3.690	0.000
β_3	SIZE	0.503	341.400	0.000	0.503	3410	0.000	0.504	3430	0.000
β_4	Cashholding	-0.002	-0.100	0.918	-0.000	-0.040	0.970	-0.0035	-0.290	0.769
β_5	ROA	0.0215	1.430	0.154	0.023	1.590	0.112	0.014	0.900	0.366
β_6	Salesgrowth	0.0113	2.970	0.003	0.011	2.870	0.004	0.0073	1.980	0.048
β_7	ΔGDP	0.0097	12.790	0.000	0.009	12.840	0.000	0.0096	12.700	0.000
	Constant		YES			YES			YES	
	Firm control		YES			YES			YES	
	Industry control		YES			YES			YES	
	Year control		YES			YES			YES	
	Wald		154391			154058			154566	
	Prob		0.000			0.000			0.000	
	Hausman		78.180			76.740			80.680	
	Prob		0.000			0.000			0.000	
	Lr test		2961			2960			2958.460	
	Prob		0.000			0.000			0.000	
	Wooldridge		278.600			278.616			304.600	
	Prob		0.000			0.000			0.000	
	Mean VIF		1.480			1.470			1.590	

Theoretically, these items are completely in line with the liquidity-yield trade-off theory and Pecking Order Theory since a reduction in working capital may enhance liquidity risk and force the company to pay much more, depending on external financing. However, the CCC index coefficient was found to be the largest among all five treatment variables of time-mismatch liquidities, suggesting that the liquidity time cycle has a greater impact on financial constraints. From a managerial perspective, companies that reduce working capital too much should expect to become more dependent on costly and difficult financing during periods of economic downturn or volatility.

The covariance-based structural equation model (SEM), estimated by maximum likelihood, provides the result of the second hypothesis as shown in Table 4. The results of the confirmatory factor analysis (CFA), presented in the bottom panel of the table, indicate a good fit of the model, as it meets the following goodness-of-fit criteria (RMSEA < 0.08, CFI > 0.90, TLI > 0.90, and SRMR < 0.05).

The SEM results show that aggressive WCM has both a direct and an indirect effect on cost stickiness. The significant negative path WCM → SA indicates that these policies increase financial constraints. Also, the significant negative path SA → cost stickiness indicates that higher financial constraints strengthen cost stickiness. Therefore, although aggressive WCM directly reduces cost stickiness (efficiency channel), it can increase stickiness through increasing financial constraints (vulnerability channel). This finding supports the hypothesis that there is partial mediation, as outlined in Hypothesis 2. This regularity fits the theory of adjustment costs, in that liquidity constraints preclude firms from realizing fast cost adjustments. From a manager's perspective, the finding suggests that aggressive activities toward WCM policies are desirable, provided the firm has reasonable access to financial resources or credit lines; otherwise, such tendencies for alleviating cost stickiness may be counterbalanced by financial pressures.

Table 5 presents the outcome of the bootstrapping mediation analysis (MacKinnon et al., 2004), a nonparametric resampling method that eliminates the normality assumption inherent in the Sobel test

by empirically estimating the sampling distribution. The indirect effects were calculated with 2,000 bootstrap resamples. Bootstrap results show that the indirect effects of all three WCM proxies (CCC, NTC, and WCTA) on cost stickiness through the SA index are significant at the 95% confidence level. Since neither the minimum nor the maximum confidence interval includes zero, mediation is definitely confirmed. The mediation for the CCC index is stronger than for the other indices, indicating that the timing of the cash cycle is the most important channel of the effect of WCM on cost stickiness. These results fully support the second hypothesis and highlight the key role of financial constraint in cost adjustment behavior.

Table 4. SEM Results- WCM and cost stickiness mediated by SA index

Mediated SEM	**WCM Proxy**								
		CCC			**NTC**			**WCTA**	
Path	**Coef**	**Z-value**	**Prob**	**Coef**	**Z-value**	**Prob**	**Coef**	**Z-value**	**Prob**
WCM→SA Index	-1.468	-25.890	0.000	-1.074	-18.840	0.000	-1.21	-9.650	0.000
SA ndex→Cost sticky	-0.639	-17.370	0.000	-0.658	-19.110	0.000	-0.671	-20.810	0.000
WCM→Cost sticky	0.334	3.190	0.001	0.277	3.010	0.003	0.717	4.020	0.000
Controled		YES			YES			YES	
Chi-square χ^2		26.950			29.150			37.150	
RMSEA		0.037			0.040			0.048	
CFI		0.985			0.980			0.968	
TLI		0.962			0.951			0.921	
SRMR		0.025			0.026			0.031	
N		1848			1848			1848	

Table 5. Bootstrap mediation test

Mediation	**Estimate**	**Lower**	**Upper**	**Prob**	**Result Mediation**
CCC→SA→ Cost sticky	0.939	0.811	0.999	0.000	Supported
NTC→SA→Cost sticky	0.707	0.604	0.810	0.000	Supported
WCTA→SA→Cost sticky	0.813	0.631	0.995	0.000	Supported

Overall, the findings lend support to both hypotheses, which is that the relationship between WCM strategies and cost behavior is significant in both direct and indirect (through financial constraints) ways. The results strengthen the theoretical premise that liquidity decisions by management influence cost responsiveness and provide partial support for the Adjustment Cost Theory in an emerging market environment.

5. Conclusion

The findings delivered robust support for the study's core hypothesis; sets of working capital management that are aggressive exhibit lower cost stickiness, but their beneficial effect is partial because they also lead to higher levels of financial frictions. Not only does this dual effect confirm hypothesis H1, but it also supports the partial mediation shown by hypothesis H2. The positive and significant interaction term (D × ΔlnSales × WCM) also suggests that firms with aggressive WCM are reacting faster to the decline in sales, confirming the premise that WCM serves as a driver of operational flexibility. To be more specific, when a company suffers a 10% decrease in sales, firms with high (versus low) WCM are able to reduce their operating costs by 2–3% more than they would otherwise (and doing so within the confines of its working capital policy), demonstrating that aggressive levels of working capital are not just quantitative concepts but has direct application in simple operational settings?

Incorporating financial constraints into the model adds to recent calls in the literature (Kayani et al., 2019; Jabbouri et al., 2024) for integrating contextual factors that drive cost behavior. The results

also indicated that while aggressive WCM improves cost adaptability, the extent of this improvement is contingent upon the firm's financial flexibility. The positive relationship between aggressive WCM and financial constraints is in line with the pecking-order theory and reflects liquidity risk existing in aggressive WCM policies. Partial mediation through SEM and bootstrap analysis suggests that financial constraints are not only a result of liquidity decisions but represent an active course of action driving the direction of cost adjustment. One caveat is that these results are observed in an emerging market with relatively high inflation, credit constraints, and an underdeveloped capital market. So, the extent to which working capital management will reduce cost stickiness could differ owing to institutional factors like restricted access to external financing and macroeconomic volatility, and thus, we need to consider contextual characteristics while explaining these results.

The findings expand WCM research, which traditionally focused on profitability and liquidity, to newly developed structural retention costs for asymmetric resource adjustments. By linking these two streams, the results clarify the role of liquidity management vis-à-vis adjustment-cost mechanisms in determining cost rigidity. That builds on earlier work like Lyngstadaas (2020), Baños-Caballero et al. (2013), Anderson and Lanen (2007) and Chen et al. (2012).

From a managerial perspective, the findings warned against implementing aggressive WCM strategies without factoring in their financial by-products. While managers might gain/cost flexibility in downturns due to better cost-pass-throughs, they can only do so if the firm has sufficient access to external finance/long-term liquidity buffers that nullify the clutches of financial constraints. Firms without these buffers may be subject to jitters that create additional financial friction, dissipating the net benefits in terms of cost responsiveness. This implies that aggressive WCM strategies yield positive effects only if enough financial resources or liquidity reserves are present.

So balancing efficiency gains with resilience becomes necessary.

The findings underscore the need for targeted liquidity-support mechanisms (particularly in the context of SMEs), whereas policymakers should heed them by emphasizing targeted liquidity-support mechanisms. And, since enhanced credit access can also mitigate cost stickiness (Banerjee and Duflo, 2005), firms are likely to reap the full benefit of aggressive WCM strategies in times of economic turmoil.

In sum, this study reinterpreted WCM not only as a liquidity instrument but also as an emerging strategic enabler of cost flexibility, whose effectiveness is contingent on the financial health of the firm. These findings supported the view that while WCM can improve operational flexibility, this is context-specific, especially in emerging markets characterized by strong institutional and macroeconomic constraints. Subsequent research might expand these insights by studying such cross-industry differences or examining the extent to which factors that determine manager behavior may have implications for the efficiency versus adaptability trade-off when liquidity is constrained.

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