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The Institutional Buffer: Non-linear Effects of Volatility on Distribution Financing in an Emerging Market

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Abstract

Purpose: This investigation examines the non-linear relationship between macroeconomic volatility and distribution financing decisions through threshold analysis of Vietnamese distribution firms (2010-2024). **Research design, data and methodology:** We introduce the Distribution Resilience Financing (DRF) Framework, incorporating Institutional Buffering Capacity (IBC) as a threshold variable and employing dynamic panel threshold regression (DPTR) and panel vector autoregression (PVAR) methodologies to identify distinct institutional regimes with heterogeneous financing adjustment dynamics. **Results:** The findings reveal that high-IBC environments facilitate 127% faster adjustment speeds in distribution financing decisions, whilst enabling firms to maintain higher optimal leverage ratios for inventory management and supply chain operations. The macroeconomic volatility-distribution financing relationship exhibits significant regime dependence, with volatility impacts diminishing as institutional quality improves. Sectoral analysis demonstrates that logistics firms exhibit greater sensitivity to volatility than retailing operations, with more substantial adjustments to their Volatility-Adjusted Optimal Capital Structure (VAOCS) during turbulent periods. COVID-19 represents a structural break, necessitating reconsideration of distribution financing theory within emerging market contexts. **Conclusions:** These findings establish institutional quality not merely as a background factor, but as a primary, regime-dependent driver of financial resilience in distribution networks, offering critical lessons for strategic management and policymaking in emerging economies.

Keywords : Distribution Financing, Supply Chain Resilience, Macroeconomic Volatility, Institutional Buffering Capacity, Logistics Management, Vietnam

JEL Classification Code: C24; G32; L81; L91

1. Introduction

Distribution financing decisions constitute a fundamental dimension of supply chain management and logistics operations, particularly within emerging economies characterised by institutional transitions and heightened vulnerability to global economic

perturbations. The relationship between macroeconomic conditions and distribution financing choices has received considerable attention in developed markets, yet remains significantly underexplored in emerging economies where institutional frameworks and market mechanisms diverge substantially from advanced economies (David & Gonçalves, 2025; Ftiti et al., 2024). The post-pandemic landscape has introduced unprecedented macroeconomic

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fluctuations across emerging Asian markets, necessitating fundamental reconsideration of distribution financing optimisation strategies within these volatile environments (Suhrah et al., 2025; Pan et al., 2025).

Vietnam's transitional economy presents a theoretically rich investigative context due to its distinctive configuration of state-enterprise relationships, accelerating financial market development, and deepening global value chain integration. This context, characterised by significant sub-national institutional variation and rapid economic transition, provides an ideal laboratory for understanding similar dynamics in other emerging economies undergoing parallel development trajectories (Huynh et al., 2025). Since the 1986 economic reforms, Vietnam has maintained impressive annual GDP growth of approximately 6.5%, despite confronting numerous external economic challenges. This growth trajectory, characterised by notable volatility episodes, has compelled distribution firms to adapt their financing structures continually in response to fluctuating economic landscapes—a critical adaptation for maintaining supply chain resilience in emerging markets with institutional voids and heightened information asymmetry (Ho, 2024; Nguyen & Nguyen, 2024).

Traditional financing theories—Trade-Off Theory, Pecking Order Theory, and Agency Cost Theory—demonstrate substantial limitations in their applicability to volatile emerging markets, particularly within distribution contexts where working capital requirements, inventory financing needs, and supply chain disruption risks create distinctive financial challenges. This study posits a more radical departure, arguing that in highly volatile emerging markets, the macro-institutional context is not merely a background variable but can function as the primary determinant of financing decisions, at times overshadowing traditional firm-level factors (Vuković et al., 2024; Wang & Luo, 2024). These frameworks, whilst informative, often employ static assumptions that inadequately accommodate dynamic realities confronting distribution firms in volatile economic conditions (Wetzel & Wagner, 2024; Akwuobi et al., 2025). As recent evidence from China's manufacturing sector demonstrates (Xu et al., 2025; Yang et al., 2025), whilst business risk negatively influences leverage in alignment with established theories, these frameworks inadequately capture adaptive behaviours of distribution firms in developing economies facing supply chain disruptions, inventory volatility, and channel financing complexities.

The literature reveals several critical knowledge gaps: firstly, methodological approaches predominantly employ linear modelling techniques, obscuring potential threshold effects particularly pronounced in volatile distribution environments (Tang et al., 2023; Liu et al., 2024); secondly, institutional mechanisms that modulate macroeconomic

volatility transmission to distribution-level financing decisions remain undertheorised (Tan et al., 2024; Eklou, 2023); thirdly, macroeconomic volatility demands multidimensional operationalisation beyond unitary measures, especially considering distribution firms' exposure to supply chain disruptions, inventory fluctuations, and channel coordination challenges (Tanveer et al., 2025; Yan & Liang, 2023).

To address these lacunae, this study develops the Distribution Resilience Financing (DRF) Framework, capturing complex relationships between macroeconomic volatility, institutional quality, and distribution financing decisions whilst introducing two key conceptual innovations: the Institutional Buffering Capacity (IBC) as a threshold variable moderating volatility-distribution financing relationships, drawing from recent evidence on institutional quality's moderating effects in BRICS markets (Rahadian et al., 2024), and the Volatility-Adjusted Optimal Capital Structure (VAOCS) incorporating anticipated macroeconomic volatility into dynamic leverage targets specifically for distribution operations including inventory financing, supply chain investments, and channel development initiatives.

2. Literature Review and Theoretical Framework

2.1. Distribution Financing Theory and Volatile Economies

E-Distribution financing encompasses the strategic capital allocation decisions underlying supply chain operations, inventory management, logistics infrastructure, and channel development activities. Unlike traditional corporate financing, distribution financing involves complex interdependencies between working capital requirements, seasonal demand fluctuations, supply chain disruptions, and channel coordination costs. The canonical capital structure theories—trade-off and pecking order frameworks—provide limited guidance for distribution contexts where financing decisions must accommodate inventory cycles, supply chain investments, and channel relationship maintenance (Fama & French, 2002; Myers, 1984).

The trade-off theory's static assumptions prove particularly problematic in distribution contexts where optimal leverage must balance inventory financing benefits against supply chain disruption costs. Distribution firms face distinctive trade-offs between debt capacity for inventory investments and financial flexibility for managing demand volatility and supply disruptions. The pecking order theory's hierarchical financing preferences inadequately

accommodate distribution firms' seasonal financing needs, requiring flexible credit facilities and working capital lines that challenge traditional internal-external financing hierarchies (Booth et al., 2001).

These theoretical inadequacies manifest through emerging market distribution firms exhibiting financing patterns where supply chain-specific factors—including inventory volatility, supplier payment terms, and channel coordination costs—often overshadow traditional firm-specific determinants central to conventional theories (Deesomsak et al., 2004). Distribution firms require sophisticated financing frameworks that explicitly incorporate supply chain dynamics, seasonal variations, and channel relationship investments alongside traditional capital structure considerations.

Recent Vietnamese evidence corroborates this complexity, revealing non-monotonic, threshold-dependent relationships between distribution financing decisions and operational performance that defy simplistic theoretical generalisations (Bui et al., 2023). These findings necessitate nuanced theoretical apparatus explicitly incorporating dynamic, non-linear, and regime-contingent distribution financing decisions that account for supply chain-specific risks and opportunities.

Indeed, research within the ASEAN context reveals financing patterns that diverge significantly from developed market norms. Studies on Thai SMEs demonstrate a substitution relationship between trade credit and bank loans, with firms prioritizing trade credit over bank financing when profitability is high (Srikheelek, 2024). This relationship-based financing contrasts with traditional pecking order theory expectations. Research on Malaysian, Singaporean, and Thai public companies confirms that depreciation negatively influences capital structure across these markets, while firm-specific factors show varying significance patterns (Wong & Jais, 2017).

Furthermore, Vietnamese firms exhibit distinctive working capital management behaviors, with components such as days sales outstanding and cash conversion cycles having statistically significant negative impacts on financial performance (Nguyen & Dinh, 2025). The institutional context significantly moderates these relationships, with debt structure thresholds creating non-linear effects on profitability. These regional findings underscore the necessity of a context-sensitive framework, such as the DRF proposed herein, to capture the nuanced realities of distribution financing in emerging economies.

2.2. Institutional Quality and Distribution System Resilience

The institutional environment fundamentally shapes distribution system resilience through multiple channels

affecting supply chain coordination, logistics infrastructure development, and channel relationship governance. Robust institutional frameworks—encompassing well-defined property rights, effective legal systems, and regulatory quality—constitute fundamental determinants of distribution system efficiency and supply chain resilience (Acemoglu et al., 2005; Rodrik, 2000). Empirical evidence supports this perspective, attributing emerging markets' rising supply chain resilience partly to significant institutional strengthening over recent decades (Abiad et al., 2015).

Extensive research demonstrates institutional quality fundamentally shapes distribution financing patterns through multiple channels. La Porta et al.'s (1997, 1998) seminal contributions established that legal systems determine firms' access to external financing, whilst Beck and Levine's (2008) theoretical framework elucidates how institutional development reduces information asymmetries and transaction costs—particularly critical for distribution firms requiring supplier credit, inventory financing, and channel development capital. Contemporary evidence reinforces these relationships: Bokpin et al. (2019) demonstrate positive associations between institutional quality and capital structure across distribution-intensive sectors, whilst Öztekin and Flannery (2023) identify institutional factors as fundamental determinants affecting supply chain financing decisions.

However, whilst links between institutional quality and aggregate financial stability are well-established, critical gaps persist regarding distribution-specific mechanisms. The precise micro-level channels through which institutional environments moderate macroeconomic volatility transmission to distribution financing decisions remain significantly undertheorised. Contemporary studies by Liu et al. (2023) and Adusei and Obeng (2021) advance understanding of institutional effects on financing patterns, yet fail to capture dynamic buffering mechanisms through which institutions absorb and mitigate macroeconomic shocks specifically affecting distribution operations.

To bridge this theoretical lacuna, we introduce Institutional Buffering Capacity (IBC) within distribution contexts, conceptualised as the aggregate capacity of national institutional frameworks to absorb macroeconomic shocks affecting supply chains, thereby mitigating their transmission to distribution financing decisions. The epistemological foundation for distribution-focused IBC draws from New Institutional Economics tenets applied to supply chain governance. Following North (1990), high-quality institutions reduce uncertainty by establishing stable, predictable rules for supply chain relationships, lowering risk premiums in distribution financing and facilitating efficient capital allocation during volatility periods affecting logistics operations.

2.3. Volatility-Adjusted Distribution Financing: Dynamic and Context-Contingent

The empirical observation that distribution firms pursue flexible financing targets (Leary & Roberts, 2005) presents profound theoretical challenges to static optimisation paradigms, particularly given distribution operations' inherent cyclical and supply chain interdependencies. This empirical regularity suggests "optimal" distribution financing cannot be conceptualised as singular, immutable configurations but rather represents dynamic equilibria fundamentally contingent upon prevailing macroeconomic conditions and supply chain environments.

In distribution contexts characterised by persistent macroeconomic volatility, parameters defining inventory financing costs, supply chain investment benefits, and channel development expenditures become inherently stochastic, demanding fundamental reconceptualisation of optimal financing targets. Distribution firms must continuously recalibrate financing strategies to accommodate demand volatility, supply disruptions, and channel relationship requirements whilst maintaining operational flexibility during macroeconomic perturbations.

Contemporary research has commenced challenging static assumptions with increasing theoretical sophistication applied to distribution contexts. Admati et al. (2018) introduce the "leverage ratchet effect," demonstrating fundamental asymmetries whereby distribution firms systematically resist leverage reductions even when operationally enhancing, particularly during seasonal downturns or supply chain disruptions. Similarly, Korteweg et al. (2022) challenge conventional adjustment speed measurements by demonstrating many distribution financing changes are involuntary responses to supply chain disruptions or incur negligible costs through established credit facilities.

The theoretical justification for frameworks wherein optimal distribution financing constitutes direct functions of macroeconomic volatility proves compelling. During heightened volatility periods, expected benefits of inventory financing diminish as demand forecasting becomes increasingly uncertain, whilst expected supply chain disruption costs increase non-linearly due to coordination challenges and supplier reliability issues (Hackbarth et al., 2006). Contemporary empirical evidence substantiates these theoretical predictions: Lambrinouidakis et al. (2019) reveal distribution firms systematically reduce leverage when expectations for future supply chain shocks increase, whilst Çolak et al. (2018) demonstrate uncertainty dramatically decelerates firms' adjustments toward optimal distribution financing configurations.

To formally encapsulate these dynamic relationships, we introduce Volatility-Adjusted Optimal Capital Structure

(VAOCS) for distribution contexts, defined as theoretical, state-contingent equilibrium leverage ratios optimising distribution performance conditional upon prevailing macroeconomic volatility levels and supply chain conditions. This conceptualisation extends dynamic trade-off theory by explicitly endogenising optimal targets to macroeconomic and supply chain environments, representing fundamental departures from traditional static frameworks.

2.4. The Distribution Resilience Financing (DRF) Framework

The preceding analysis establishes compelling theoretical imperatives for reconceptualising distribution financing decision-making in volatile emerging market environments. The fundamental inadequacies of traditional theories necessitate sophisticated theoretical constructs that explicitly acknowledge the dynamic, non-linear, and institutionally contingent nature of distribution financing decisions whilst incorporating supply chain-specific considerations.

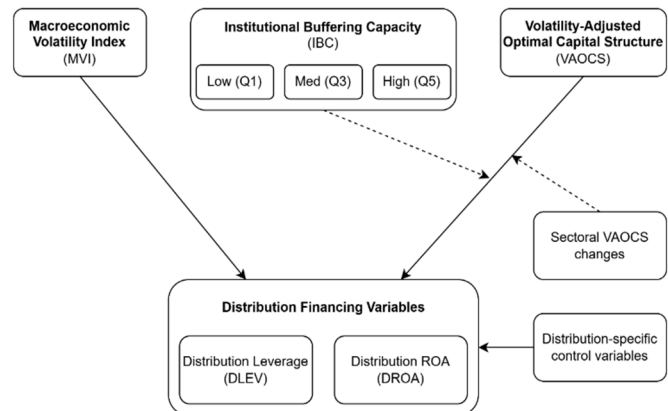


Figure 1: Distribution Resilience Financing (DRF) Framework

The integrated DRF Framework demonstrates sophisticated interactions between Macroeconomic Volatility Indices (MVI), Institutional Buffering Capacity (IBC), and Volatility-Adjusted Optimal Capital Structure (VAOCS) within unified distribution contexts. Four critical theoretical pathways emerge:

- Direct Volatility Effect: Macroeconomic perturbations influence optimal distribution financing targets through fundamental trade-off recalibration affecting inventory costs, supply chain investments, and channel development expenditures (Hackbarth et al., 2006).

- Institutional Moderation Pathway: IBC moderates volatility-distribution financing relationships through buffering mechanisms that stabilise supply chain

relationships, reduce coordination costs, and maintain channel access during turbulent periods (La Porta et al., 1997, 1998).

- Adaptive Optimisation Pathway: Institutional quality influences dynamic VAOCs adjustment efficiency by reducing information asymmetries in supply chain relationships, lowering transaction costs in distribution financing, and enhancing supply chain coordination mechanisms (Beck et al., 2005).

- Supply Chain Transmission Channel: Distribution-specific mechanisms through which macroeconomic volatility affects financing decisions via inventory requirements, supplier relationships, channel investments, and logistics infrastructure needs.

The framework generates specific methodological implications distinguishing it from conventional linear approaches. The MVI-IBC-VAOCs interaction within distribution contexts necessitates threshold models capturing regime-dependent relationships and non-linear dynamics, as traditional linear specifications inadequately capture complex interactions between macroeconomic conditions, institutional quality, and distribution-specific financing requirements (van Bezooijen & Bikker, 2017).

3. Data and Methodology

3.1. Data Sources and Sample

The analysis employs a comprehensive dataset of Vietnamese distribution firms covering 2010-2024—a period encompassing significant macroeconomic events including post-financial crisis adjustments and the COVID-19 pandemic's supply chain disruptions. The sample comprises 500 distribution entities across logistics, retailing, wholesaling, and supply chain services listed on the Ho Chi Minh and Hanoi stock exchanges, representing approximately 78% of Vietnam's formal distribution sector market capitalisation. The selection process began by identifying all non-financial firms listed on both exchanges that met the specified ISIC criteria (codes 45-47 and 49-53) for the entire 2010-2024 period. This initial population consisted of 548 firms. After excluding 48 firms due to incomplete data or having fewer than eight continuous years of observations, the final sample of 500 firms was obtained. Therefore, our sample represents a census of all continuously listed, qualifying distribution firms rather than a random or stratified sub-sample.

We exclude financial institutions and pure manufacturing entities, focusing specifically on firms whose primary operations involve distribution activities including logistics services, retail operations, wholesale trade, and supply chain management services. To ensure robust

longitudinal analysis, we require a minimum of eight years of continuous data for included firms. Distribution firms are classified using International Standard Industrial Classification (ISIC) codes 45-47 (trade) and 49-53 (transportation and storage).

The dataset integrates multiple data sources through strategic triangulation: firm-level financial metrics from Thomson Reuters Eikon and Orbis; distribution-specific operational data from Vietnam's Ministry of Industry and Trade; macroeconomic indicators from World Bank Development Indicators, IMF International Financial Statistics, and State Bank of Vietnam repositories; and institutional quality parameters from the Vietnam Provincial Competitiveness Index. This multidimensional approach facilitates analysis across macro-meso-micro levels whilst capturing distribution-specific dynamics including seasonal patterns, supply chain relationships, and channel development investments.

3.2. Variable Construction

3.2.1. Dependent Variables

This study operationalises a sophisticated measurement framework capturing essential dimensions of distribution financing within Vietnam's volatile economic landscape. The primary dependent variable—distribution leverage ratio (DLEV)—represents the fundamental debt-asset equilibrium specifically for distribution operations, calculated as total distribution-related debt (including inventory financing, supply chain investments, and channel development loans) divided by total distribution assets.

This comprehensive metric aligns with emerging market distribution studies whilst accommodating Vietnam's distinctive distribution ecosystem characterised by significant working capital requirements, seasonal financing dependencies, and supply chain investment needs. To operationalise this distinction, a meticulous analysis of financial statement footnotes and segment reporting was conducted. Specific line items such as inventory financing facilities, loans explicitly designated for logistics fleet expansion, and capitalised investments in warehousing infrastructure were identified and aggregated to constitute distribution-related debt and assets. This process was cross-referenced with company annual reports and sectoral classifications to ensure that general corporate financing and non-distributional assets were carefully excluded from the calculation. The methodology distinguishes distribution-specific financing from general corporate debt, providing more precise measurement of financing decisions directly related to distribution operations.

As a secondary dependent construct within the panel vector autoregression framework, distribution return on assets (DROA) enables examination of the distribution

financing-performance dialectic across institutional regimes. This operationalisation captures performance specifically attributable to distribution activities, measured as earnings before interest and taxes from distribution operations divided by distribution-specific assets.

3.2.2. Key Independent Variables

The Macroeconomic Volatility Index (MVI) captures volatility across multiple dimensions affecting distribution operations including GDP growth volatility (affecting demand patterns), inflation volatility (affecting inventory costs), exchange rate volatility (affecting imported goods distribution), and interest rate volatility (affecting financing costs). For each indicator, volatility is measured as the standard deviation over a rolling 12-month window, standardised to account for scale differences. The composite index incorporates distribution-specific weightings reflecting the relative importance of each macroeconomic factor for distribution operations:

$$MVI_t = \sqrt{\frac{1}{n} \sum_{j=1}^n \omega_j \left(\frac{X_{jt} - \bar{X}_j}{\sigma_j} \right)^2}$$

where ω_j represents distribution-specific weights determined through principal component analysis of distribution firm financial data, X_{jt} represents macroeconomic indicator j at time t , \bar{X}_j denotes the mean value of indicator j , σ_j represents the standard deviation of indicator j , and n equals the number of macroeconomic indicators.

The Institutional Buffering Capacity (IBC) for distribution contexts incorporates Vietnam's Provincial Competitive Index (PCI) with specific emphasis on dimensions affecting distribution operations. The PCI's theoretical foundations align with New Institutional Economics principles whilst providing comprehensive measurement of institutional quality affecting supply chain operations, logistics infrastructure, and distribution channel development (Malesky & Taussig, 2009).

The distribution-focused IBC is constructed as an equally-weighted average of the five PCI sub-indices most relevant to distribution operations: (1) transparency of regulations affecting trade and logistics; (2) administrative efficiency in processing distribution licenses and permits; (3) informal charge control affecting supply chain costs; (4) legal institution quality affecting contract enforcement in supplier relationships; and (5) labour training quality affecting distribution workforce development (Nguyen et al., 2025).

The Volatility-Adjusted Optimal Capital Structure (VAOCS) for distribution contexts represents theoretical equilibrium leverage ratios optimising distribution performance conditional upon prevailing macroeconomic

volatility levels and supply chain conditions. This concept extends traditional trade-off theory by explicitly incorporating macroeconomic uncertainty and distribution-specific factors into static equilibrium frameworks.

VAOCS operationalisation employs a two-stage estimation procedure adapted for distribution contexts. First, we estimate a dynamic distribution financing model incorporating macroeconomic volatility, supply chain factors, and distribution-specific characteristics:

$$DLEV_{it} = \alpha_i + \beta_1 DLEV_{it-1} + \beta_2 MVI_t + \beta_3 (MVI_t \times Z_{it}) + \delta Z_{it} + \epsilon_{it}$$

where $DLEV_{it}$ represents distribution leverage for firm i at time t , MVI_t denotes macroeconomic volatility, Z_{it} comprises distribution-specific characteristics including inventory levels, supply chain complexity, channel breadth, and seasonal patterns, and α_i captures firm-specific fixed effects reflecting unique distribution capabilities and market positions.

Second, VAOCS derivation captures implied long-run equilibrium distribution leverage:

$$VAOCS_{it} = \frac{\beta_2 MVI_t + \beta_3 (MVI_t \times Z_{it}) + \delta Z_{it}}{1 - \beta_1}$$

This formulation represents model-implied optimal distribution leverage under different volatility and supply chain conditions, providing empirically grounded estimates of leverage ratios maximising distribution performance under prevailing macroeconomic and operational constraints.

3.2.3. Distribution-Specific Control Variables

Following established literature on distribution financing determinants, we include several distribution-specific control variables:

Distribution Scale (DSIZE): Natural logarithm of distribution-specific assets including inventory, logistics infrastructure, and channel investments

Inventory Intensity (INVINT): Ratio of inventory value to total distribution assets, capturing working capital requirements

Channel Breadth (CHBR): Number of distribution channels normalised by firm size, measuring distribution complexity

Supply Chain Integration (SCINT): Composite measure of vertical integration and supplier relationship depth

Seasonal Volatility (SEAVOL): Coefficient of variation in quarterly distribution revenues, capturing demand seasonality

Logistics Efficiency (LOGEFF): Ratio of distribution costs to distribution revenues, measuring operational efficiency

Technology Adoption (TECHADOPT): Investment in distribution technologies as percentage of distribution assets

Macroeconomic and institutional control variables remain consistent with the original framework whilst incorporating distribution-relevant interpretations:

GDP Growth (GDGP): Annual real GDP growth rate affecting distribution demand

Inflation Rate (INF): Annual consumer price index growth affecting inventory costs

Financial Development (FINDEV): Private credit to GDP ratio affecting distribution financing availability

Logistics Infrastructure (LOGINFRA): World Bank Logistics Performance Index for Vietnam.

3.3. Model Specification

3.3.1. Dynamic Panel Threshold Regression for Distribution Contexts

The investigation of threshold effects in macroeconomic volatility-distribution financing relationships employs Dynamic Panel Threshold Regression (DPTR) methodology adapted for distribution contexts (Hansen, 1999, 2000). This approach identifies distinct institutional regimes characterised by different parameter values affecting distribution financing decisions, with transitions occurring when IBC crosses critical values.

The baseline distribution DPTR model:

$$DLEV_{it} = \alpha_i + \beta_1 MVI_t \cdot I(IBC_t \leq \gamma) + \beta_2 MVI_t \cdot I(IBC_t > \gamma) + \delta Z_{it} + \epsilon_{it}$$

where $DLEV_{it}$ represents distribution leverage for firm i at time t , α_i denotes firm-specific fixed effects capturing unique distribution capabilities, MVI_t represents the Macroeconomic Volatility Index, IBC_t denotes Institutional Buffering Capacity serving as threshold variable, γ represents the threshold parameter, I constitutes indicator functions, Z_{it} comprises distribution-specific control variables, and ϵ_{it} represents the error term.

To address potential endogeneity concerns inherent in distribution financing decisions, we estimate the DPTR model using System Generalised Method of Moments (GMM) approach (Arellano & Bover, 1995; Blundell & Bond, 1998). This methodology employs lagged levels and differences of endogenous variables as instruments, providing consistent estimates despite firm-specific heterogeneity and potential simultaneity between distribution financing decisions and operational outcomes.

3.3.2. Panel Vector Autoregression for Distribution Systems

The exploration of dynamic interactions between macroeconomic volatility, distribution financing decisions,

and distribution performance employs Panel Vector Autoregression (PVAR) methodology adapted for distribution contexts. This approach treats all variables as potentially endogenous, accommodating complex feedback effects particularly relevant in distribution systems where financing decisions affect operational performance, which subsequently influences financing capacity.

The baseline distribution PVAR model specification follows the theoretical framework of Holtz-Eakin et al. (1988), adapted for distribution contexts:

$$\begin{pmatrix} DLEV_{it} \\ DROA_{it} \end{pmatrix} = \alpha_i \sum_{k=1}^p \Gamma_k \begin{pmatrix} DLEV_{i,t-k} \\ ROA_{i,t-k} \end{pmatrix} + \Phi \cdot MVI_t + u_{it}$$

where $DLEV_{it}$ represents the distribution leverage ratio for firm i at time t , $DROA_{it}$ denotes the distribution return on assets, α_i constitutes firm-specific fixed effects capturing unique distribution capabilities, Γ_k represents a matrix of autoregressive parameters for lag k , p is the optimal lag length determined by Akaike and Schwarz information criteria, Φ constitutes a matrix of parameters capturing the contemporaneous effects of macroeconomic volatility effects on the endogenous system, MVI_t represents the Macroeconomic Volatility Index, and u_{it} denotes a vector of error terms assumed to be independently and identically distributed with zero mean and finite variance-covariance matrix.

This endogenous system enables comprehensive examination of: (1) macroeconomic volatility shock propagation to distribution financing and performance; (2) feedback effects from aggregate distribution decisions to macroeconomic conditions; and (3) interrelationships between distribution leverage and performance across volatility regimes.

3.3.3. Distribution-Specific Volatility Modelling

To capture complex dynamics of macroeconomic volatility impacts on distribution operations, we employ Exponential Generalised Autoregressive Conditional Heteroskedasticity mixed-data sampling (EGARCH-Midas) models adapted for distribution contexts. This approach combines EGARCH models' asymmetric volatility responses with Midas frameworks' capacity to incorporate mixed-frequency data relevant to distribution operations.

The distribution-specific EGARCH-Midas model specification extends the theoretical framework of Nelson (1991) and Ghysels et al. (2007), incorporating mixed-frequency data structures relevant to distribution operations:

$$\log(\sigma_{it}^2) = \omega + \alpha \left| \frac{\epsilon_{i,t-1}}{\sigma_{i,t-1}} \right| + \gamma \frac{\epsilon_{i,t-1}}{\sigma_{i,t-1}} + \beta \log(\sigma_{i,t-1}^2) + \theta \cdot MVI_t + \phi \cdot SCVOL_{it}$$

where $\log(\sigma_{it}^2)$ represents the conditional variance of firm i 's distribution returns at time t , $\varepsilon_{i,t-1}$ denotes lagged residuals, $\log(\sigma_{i,t-1}^2)$ represents lagged conditional variance, MVI_t constitutes the Macroeconomic Volatility Index, and $SCVOL_{it}$ represents supply chain volatility measures specific to distribution operations.

4. Empirical Results

4.1. Descriptive Statistics

The descriptive statistics reveal several noteworthy empirical patterns specific to Vietnamese distribution firms. The mean distribution leverage ratio (DLEV) of 0.48

reflects substantial debt reliance within Vietnamese distribution financing structures, marginally lower than general corporate leverage but exhibiting greater volatility due to seasonal working capital requirements and supply chain investment patterns.

The Macroeconomic Volatility Index (MVI) exhibits pronounced temporal variation (0.18-0.86), capturing distinctive volatility episodes characterising Vietnam's macroeconomic trajectory and their differential impacts on distribution operations. The substantial inventory intensity (mean = 0.42) reflects Vietnamese distribution firms' working capital requirements, substantially exceeding levels in service-oriented sectors whilst demonstrating significant cross-sectional heterogeneity reflecting diverse distribution strategies.

Table 1: Descriptive Statistics of Distribution-Specific Variables

Variables	Mean	Std. Dev.	Min	Max	DLEV	DROA	MVI	IBC	DSIZE	INVINT	CHBR	SCINT
DLEV	0.48	0.21	0.04	0.89	1.000							
DROA	0.074	0.083	-0.28	0.41	-0.267*	1.000						
MVI	0.47	0.15	0.18	0.86	-0.189*	-0.295*	1.000					
IBC	0.62	0.17	0.28	0.91	0.198*	0.164*	-0.141	1.000				
DSIZE	12.86	1.94	8.73	17.85	0.324*	0.112	-0.031	0.251*	1.000			
INVINT	0.42	0.28	0.02	0.84	0.387*	-0.073	-0.095	0.135	0.156*	1.000		
CHBR	2.34	1.12	1.00	6.50	-0.084	0.298*	-0.187*	0.203*	0.089	-0.167*	1.000	
SCINT	0.58	0.23	0.15	0.95	0.167*	0.145*	-0.073	0.189*	0.234*	0.087	0.156*	1.000

Note: * denotes statistical significance at the 5% level. The sample comprises 500 Vietnamese distribution firms (2010-2024). DLEV = distribution leverage ratio; DROA = distribution return on assets; MVI = Macroeconomic Volatility Index; IBC = Institutional Buffering Capacity; DSIZE = distribution scale; INVINT = inventory intensity; CHBR = channel breadth; SCINT = supply chain integration.

Channel breadth (CHBR) demonstrates considerable variation (1.00-6.50), indicating heterogeneous distribution strategies from single-channel focused operations to complex multi-channel systems. Supply chain integration (SCINT) exhibits moderate mean levels (0.58) with substantial variation, reflecting diverse approaches to vertical coordination within Vietnamese distribution networks

4.2. Threshold Effects in Distribution Financing

The Dynamic Panel Threshold Regression analysis identifies three distinct IBC regimes, each characterised by different adjustment speeds, optimal distribution leverage targets, and sensitivity to macroeconomic volatility.

Distribution firms operating in low-IBC environments (Q1) exhibit the slowest adjustment speed (0.16), indicating significant frictions in distribution financing adjustments due to institutional constraints affecting supplier relationships, inventory financing access, and channel development capital availability. The validity of our GMM estimates is supported by key specification tests. The Hansen test for over-identifying restrictions consistently yielded p-values above 0.10, failing to reject the null hypothesis of instrument validity. Furthermore, the Arellano-Bond test for second-order serial correlation (AR(2)) in the differenced residuals also produced insignificant p-values, confirming that the model is well-specified.

Table 2: Distribution Financing Threshold Effects by IBC Quintiles

IBC Quintile	Adjustment Speed	Optimal Distribution Leverage	MVI Coefficient	Distribution-Specific Effects
Q1 (Low)	0.16*	0.42***	-0.38***	High inventory financing sensitivity
Q3 (Medium)	0.29***	0.49***	-0.22**	Moderate supply chain adaptation
Q5 (High)	0.38***	0.56***	-0.11	Rapid channel reconfiguration

*Note: ***, *, and * denote statistical significance at the 1%, 5%, and 10% levels. Adjustment speed represents the coefficient on lagged distribution leverage. Optimal distribution leverage constitutes long-run target leverage implied by the distribution financing model. The MVI coefficient represents macroeconomic volatility impact on distribution leverage.

In contrast, distribution firms in high-IBC environments (Q5) adjust to optimal leverage targets 137% faster, with adjustment speed of 0.38. This finding suggests high-quality institutions significantly reduce adjustment frictions in distribution contexts by facilitating supplier credit relationships, improving inventory financing access, and reducing transaction costs in channel development investments.

The optimal distribution leverage ratio varies substantially across IBC regimes, ranging from 0.42 in low-IBC environments to 0.56 in high-IBC environments. This pattern indicates stronger institutions enable distribution firms to sustain higher debt levels for inventory financing, supply chain investments, and channel development, potentially due to lower agency costs in supplier relationships, more efficient bankruptcy procedures affecting distribution assets, and greater financial market development supporting distribution-specific financing instruments.

Most significantly, sensitivity to macroeconomic volatility varies dramatically across IBC regimes. In low-IBC environments, macroeconomic volatility generates strong negative impacts on distribution leverage (-0.38), indicating firms significantly reduce debt levels affecting inventory capacity, supply chain investments, and channel expansion during volatility periods. This sensitivity diminishes substantially in medium-IBC environments (-0.22) and becomes statistically insignificant in high-IBC environments (-0.11), providing compelling evidence of institutional buffering specifically affecting distribution operations.

4.3. Distribution System Dynamics: Panel VAR Results

The impulse response functions reveal significant negative responses of distribution leverage to macroeconomic volatility shocks, with impacts gradually dissipating over time. A one-standard-deviation MVI shock generates a 0.14 percentage point reduction in distribution leverage ratio in the first period, with effects remaining statistically significant in the second period. The cumulative effect peaks at approximately -0.25 percentage points after four periods before gradually returning toward equilibrium.

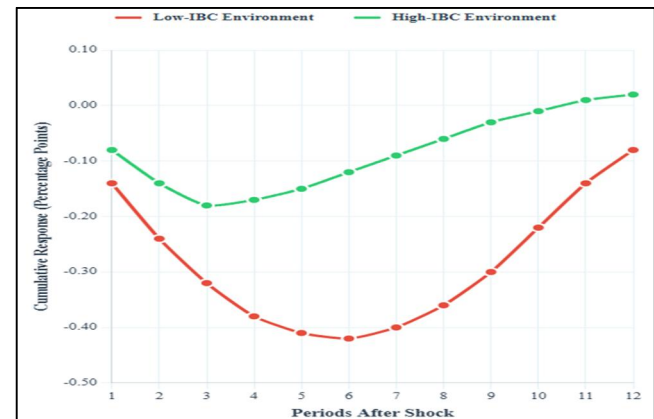
The distribution-specific interpretation reveals that initial leverage reduction primarily affects inventory financing capacity, followed by supply chain investment deferrals and channel expansion postponements. This pattern suggests distribution firms prioritise operational continuity over growth investments during volatility episodes, consistent with theoretical predictions regarding working capital prioritisation during uncertainty periods.

Table 3: Impulse Response of Distribution Leverage to MVI Shocks

Period	Response	95% Confidence Interval	Distribution-Specific Interpretation
1	-0.14*	[-0.21, -0.07]	Immediate inventory financing reduction
2	-0.11*	[-0.17, -0.04]	Supply chain investment deferral
3	-0.08	[-0.15, -0.01]	Channel expansion postponement
4	-0.06	[-0.12, 0.01]	Gradual operational adjustment
8	-0.02	[-0.08, 0.04]	Near-equilibrium restoration
12	0.03	[-0.04, 0.09]	Potential overcompensation

*Note: * denotes statistical significance at the 10% level based on bootstrap confidence intervals. The table reports cumulative impulse response of distribution leverage to a one-standard-deviation shock to the Macroeconomic Volatility Index.*

Regime-specific impulse response functions reveal substantial differences in dynamic responses across IBC regimes. In low-IBC environments, negative responses of distribution leverage to volatility shocks exhibit larger magnitude and greater persistence, with peak cumulative effects of -0.42 percentage points after six periods. Conversely, responses in high-IBC environments demonstrate smaller magnitude and shorter duration, with peak effects of only -0.18 percentage points after three periods.



Notes: Responses measured in percentage points of distribution leverage ratio. Sample comprises 500 Vietnamese distribution firms across logistics, retailing, and wholesaling sectors (2010-2024). IBC classifications based on Provincial Competitiveness Index quintiles. Statistical significance assessed at 10% level using bootstrap standard errors. The analysis controls for firm-specific fixed effects, seasonal patterns, and macroeconomic control variables including GDP growth, inflation, and financial development indicators.

Figure 2: Distribution Leverage Response to MVI Shocks by IBC Regime

This pattern provides compelling evidence of institutional buffering specifically affecting distribution operations, suggesting high-quality institutions enable distribution firms to maintain preferred capital structures during macroeconomic turbulence through better access to diverse financing sources, lower information asymmetries in supplier relationships, and more efficient capital markets supporting distribution-specific financing instruments.

4.4. Sectoral Heterogeneity in Distribution Networks

The cross-sectoral analysis reveals significant heterogeneity in volatility sensitivity and distribution

financing adjustments across different distribution sectors. Logistics firms demonstrate the highest volatility sensitivity ($\theta = 0.32$), followed by supply chain services ($\theta = 0.29$) and retailing operations ($\theta = 0.28$), whilst wholesaling exhibits the lowest sensitivity ($\theta = 0.24$).

This pattern aligns with theoretical expectations regarding sector-specific characteristics: logistics operations with high fixed asset intensity and cyclical demand demonstrate greater vulnerability to macroeconomic fluctuations, whilst wholesaling operations with inventory buffers and supplier relationships exhibit relatively greater stability during volatility periods.

Table 4: Cross-Sectoral Analysis of Distribution Financing Dynamics

Parameter	Logistics	Retailing	Wholesaling	Supply Chain Services	Multi-Channel
α (ARCH)	0.35***	0.48***	0.41***	0.44***	0.39***
β (GARCH)	0.84***	0.78***	0.81***	0.79***	0.83***
θ (MVI)	0.32***	0.28***	0.24**	0.29***	0.31***
γ (Asymmetry)	-0.18*	-0.22**	-0.15	-0.20*	-0.19*
VAOCS (Stable)	0.45***	0.52***	0.49***	0.47***	0.54***
VAOCS (Volatile)	0.31***	0.38***	0.35***	0.33***	0.37***
% Change in VAOCS	-31.1%	-26.9%	-28.6%	-29.8%	-31.5%

*Note: ***, *, and * denote statistical significance at the 1%, 5%, and 10% levels. VAOCS represents Volatility-Adjusted Optimal Capital Structure for distribution contexts.

The sectoral variation in VAOCS adjustment during volatile periods provides compelling evidence of distribution-specific adaptation mechanisms. Logistics firms demonstrate the most substantial VAOCS reduction (31.1%) when transitioning from stable to volatile conditions, whilst retailing operations exhibit the most modest adjustment (26.9%). This pattern reflects fundamental differences in sectoral volatility transmission:

Logistics: Substantial VAOCS reduction reflects sector amplification through infrastructure utilisation cyclicalities, fuel cost volatility transmission, and demand correlation with broader economic activity.

Retailing: Moderate VAOCS adjustment despite consumer demand volatility suggests inventory management flexibility and diverse revenue streams provide financial resilience buffers.

Multi-Channel Distribution: Highest VAOCS adjustment (31.5%) reflects complexity costs during volatility periods when channel coordination becomes more challenging and costly.

This sectoral divergence may also reflect underlying differences in typical financing structures. For instance, the retailing sector's more modest adjustment could be linked to its higher reliance on short-term trade credit and revolving credit facilities, which are often less sensitive to macroeconomic cycles than the long-term, capital-expenditure-focused bank loans prevalent in the logistics sector.

4.5. Structural Break Analysis

To formally validate the observation of a structural shift during the sample period, we employed the Bai-Perron (2003) test for multiple structural changes. The test identified a significant structural break in the relationship between macroeconomic volatility and distribution financing ($p < 0.01$) in the first quarter of 2020, coinciding with the global onset of the COVID-19 pandemic. This finding provides empirical support for the claim that the pandemic constituted a structural event, altering the financing dynamics of distribution firms in Vietnam.

5. Discussion and Implications

5.1. Theoretical Contributions to Distribution Science

This investigation advances distribution science through several theoretical contributions that extend beyond traditional capital structure frameworks. The Distribution Resilience Financing (DRF) Framework provides sophisticated understanding of how macroeconomic volatility affects distribution operations through financing channels, whilst institutional quality moderates these relationships through supply chain-specific mechanisms.

The identification of threshold effects contingent upon institutional quality challenges universalist applications of

financing theories within distribution contexts. Distribution firms operating across different IBC regimes exhibit heterogeneous adjustment velocities, optimisation targets, and volatility sensitivity that reflect distinctive supply chain dynamics, inventory requirements, and channel coordination costs rather than merely general corporate characteristics.

The hermeneutic analysis reveals institutional dimensions specifically affecting distribution operations moderate volatility transmission through three primary channels: (1) supply chain relationship stability, whereby higher institutional quality reduces supplier credit risks and enhances payment term negotiations; (2) inventory financing efficiency, as stronger institutions improve access to working capital facilities and reduce inventory-backed lending costs; and (3) channel development facilitation, through reduced transaction costs in establishing and maintaining distribution relationships.

5.2. Practical Implications for Distribution Management

The findings generate actionable insights for distribution practitioners navigating volatile macroeconomic environments. The substantial differences in adjustment speeds across institutional regimes suggest distribution managers should explicitly incorporate institutional quality assessments into financing strategy development, particularly for firms operating across multiple provinces or regions with heterogeneous institutional development.

The regime-dependent volatility sensitivity provides strategic guidance for inventory management and supply chain investment decisions. Distribution firms in low-IBC environments should maintain higher financial flexibility reserves to accommodate slower adjustment processes during volatility periods, whilst firms in high-IBC environments may pursue more aggressive leverage strategies given their enhanced adjustment capabilities.

The sectoral heterogeneity findings suggest distribution strategy differentiation based on operational characteristics. Logistics-intensive operations should implement more conservative financing approaches given their higher volatility sensitivity, whilst multi-channel distributors should emphasise financial flexibility to manage coordination complexity during turbulent periods.

5.3. Policy Implications for Emerging Market Development

The evidence of institutional buffering effects generates important and actionable policy implications for enhancing supply chain resilience in Vietnam and other emerging markets. The first is targeted Inventory Financing Schemes for SMEs, our finding that firms in low-IBC environments exhibit the slowest financing adjustment speeds and are

most sensitive to volatility points to severe credit constraints. Policymakers should design and implement government-backed inventory financing programs or partial credit guarantees specifically for small and medium-sized enterprises (SMEs) in the distribution sector. These instruments would reduce the collateral burden and allow firms to maintain stable inventory levels during macroeconomic shocks. Second is streamlining Logistics Permitting in Low-IBC Provinces, the study demonstrates that Institutional Buffering Capacity (IBC) is a key determinant of financial resilience. To address this, central authorities should collaborate with provincial governments—particularly those in the lowest IBC quintile (Q1)—to create 'single-window' digital portals for streamlining logistics-related permits and licenses. This would directly reduce the administrative frictions and informal costs that impede financing adjustments. Third is establishing National Supply Chain Emergency Protocols, the identification of the COVID-19 pandemic as a structural break highlights the need for proactive crisis management. We recommend the development of a formal crisis resilience framework that includes pre-approved emergency protocols. These could involve fast-tracked customs clearance for essential goods, temporary waivers on transport restrictions, and access to emergency working capital facilities, which could be activated during future systemic shocks.

5.4. Limitations and Future Research Directions

Several limitations warrant acknowledgement whilst identifying future research directions. The focus on Vietnamese distribution firms, whilst providing detailed institutional context, may limit generalisability to other emerging economies with different institutional configurations. Future research should extend the DRF Framework to comparative emerging market contexts to establish broader theoretical validity.

The measurement of distribution-specific financing relies on financial statement classifications that may not fully capture complex supply chain financing arrangements including supplier credit, channel partner financing, and inventory management services. Advanced measurement approaches incorporating supply chain relationship data and operational metrics could enhance precision in future investigations.

The investigation focuses primarily on formal distribution channels whilst Vietnam's substantial informal distribution networks remain underexplored. This omission is particularly salient in an emerging market context like Vietnam, where the informal sector constitutes a substantial portion of last-mile distribution. This sector often relies on different financing norms, such as relational lending and

trade credits outside formal banking systems. Future research incorporating this dimension could reveal alternative, non-institutional buffering mechanisms that complement or substitute for the formal institutional effects identified in this study. Future research should examine how institutional quality affects financing decisions across formal-informal distribution boundaries, particularly given the significance of informal channels in emerging market contexts.

6. Conclusion

This study advances understanding of complex relationships between macroeconomic volatility, institutional quality, and distribution financing decisions within emerging market contexts. Through introducing the Distribution Resilience Financing Framework, incorporating Institutional Buffering Capacity and Volatility-Adjusted Optimal Capital Structure concepts, we provide nuanced, context-sensitive perspectives on how distribution firms navigate volatile macroeconomic environments whilst maintaining supply chain operations and channel relationships.

The identification of distinct institutional regimes with heterogeneous adjustment dynamics challenges universalist applications of traditional financing theories within distribution contexts, underscoring critical importance of institutional quality in moderating volatility transmission to distribution operations. The pronounced sectoral differences in volatility sensitivity and substantial structural break associated with COVID-19 pandemic further highlight contextual contingency of distribution financing optimisation.

These findings contribute to developing sophisticated theoretical frameworks for understanding financial decision-making in distribution systems within emerging economies whilst offering practical insights for distribution managers, supply chain professionals, investors, and policymakers navigating increasingly volatile global economic landscapes. While focused on Vietnam, the framework's emphasis on institutional buffering capacity offers a valuable lens for analysing distribution resilience in other nations where sub-national administrative quality and market fragmentation are key drivers of economic activity. The evidence suggests distribution resilience depends fundamentally on institutional quality, necessitating coordinated efforts to enhance institutional development alongside distribution system capabilities for sustainable emerging market growth.

The theoretical innovations and empirical evidence presented establish foundations for future research examining distribution financing dynamics, supply chain resilience mechanisms, and institutional moderating effects

across diverse emerging market contexts. As global supply chains confront persistent volatility and institutional heterogeneity, understanding these complex relationships becomes increasingly critical for sustainable distribution system development and emerging market integration into global value chains.

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Appendix A: Methodological Details

Table A1: Principal Component Analysis Loadings for MVI Construction

Macroeconomic Indicator	Factor Loading (1st Principal Component)
GDP Growth Volatility	0.52
Inflation Volatility	0.48
Exchange Rate Volatility	0.45
Interest Rate Volatility	0.55

Note: The first principal component explained 76.3% of the total variance in macroeconomic volatility indicators. All loadings are statistically significant at the 1% level.