



Original Research

Stock Liquidity Measured by Relative Bid–Ask Spread and Its Role in Explaining Financial Leverage Under Financial Constraints

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ABSTRACT

In emerging markets, firms often face severe financial constraints and information asymmetry, limiting their access to external financing and increasing reliance on debt. Stock liquidity can mitigate these frictions by reducing transaction costs and enhancing market transparency. This study examines the effect of stock liquidity measured by the relative bid–ask spread on financial leverage, and the moderating role of financial constraints among firms listed on the Tehran Stock Exchange during 2014–2023. Using panel data from 1,500 firm-year observations and fixed effects regression models, the results reveal a significant negative relationship between stock liquidity and leverage. Moreover, financial constraints strengthen this negative link, indicating that constrained firms are more sensitive to liquidity conditions when making capital structure decisions. These findings align with theories of asymmetric information and investment constraints, suggesting that higher liquidity enables firms to rely more on internal financing and less on external debt. The study contributes to capital structure literature in emerging markets by emphasizing the interaction between liquidity and financing frictions. Practically, the results provide insights for managers, policymakers, and investors: enhancing transparency and monitoring financial constraint levels can improve market efficiency and guide firms in optimizing their financing strategies.

1 Introduction

Capital structure decisions lie at the heart of corporate financial strategy, shaping firms' performance, valuation, and long-term sustainability. Among the key aspects of capital structure, financial leverage is of particular importance, as it reflects both firms' reliance on external financing and their access to capital markets [25]. The foundational work of Modigliani and Miller [14] established the theoretical benchmark that, under perfect markets, capital structure is irrelevant to firm value. However, subsequent research has consistently demonstrated that in the presence of taxes, transaction costs, and

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information frictions, capital structure choices play a decisive role in firms' financing behavior and outcomes [6, 30]. According to the pecking order theory, firms prefer to finance investments first with internal resources, then with debt, and finally with equity, in order to minimize agency and information asymmetry costs [25]. At the same time, information asymmetry and agency theories highlight that financing choices are also influenced by market signals, investor perceptions, and governance mechanisms [13]. These theories are explicitly integrated rather than treated in isolation. Parallel to leverage, stock liquidity has emerged as a central factor in shaping financing costs and opportunities. High liquidity, often measured by a narrow relative bid–ask spread [2, 32], enhances market efficiency, reduces transaction costs, and facilitates firms' access to external financing [3]. By reducing issuance premia and increasing transparency, liquid markets can lower the cost of equity and improve firms' ability to substitute away from debt financing. Yet, empirical evidence on the link between liquidity and leverage remains mixed and sometimes contradictory. Some studies find that liquid stocks lower the cost of capital and thus encourage higher leverage [12, 35], while others argue that the effect crucially depends on firm-specific conditions, particularly financial constraints [24, 34]. Recent international evidence further highlights this complexity. Zhou et al. [27] show that high stock liquidity significantly reduces total and secured debt while increasing the likelihood of zero leverage, especially for firms facing greater financial constraints and risk, emphasizing the need to consider financial frictions when analyzing the liquidity–leverage nexus. This explicitly critical stance (not merely descriptive) provides a more analytical literature review. This study addresses a critical gap in the literature by examining how stock liquidity affects leverage under financial constraints in an emerging market context, revealing mechanisms that have not been empirically tested in Iran and extending theoretical understanding of the moderating role of financial frictions. In emerging markets, including Iran, information asymmetry is relatively high, enforcement of creditor rights is weak, and transaction costs vary substantially, creating conditions where the interaction between stock liquidity and leverage may deviate sharply from developed markets. Ignoring this relation could result in misallocation of capital, higher financing costs, and inefficient investment decisions, with adverse consequences for managers, investors, and regulators alike. From a practical standpoint, the study proposes a financial constraint index, calculated based on standardized measures such as SA and WW, which enables regulators and investors to assess firms' financing limitations more accurately. This improves transparency and supports more informed capital structure decisions by providing actionable guidance on how liquidity and financial constraints interact. Evidence from comparable contexts shows diverse outcomes. For example, El-Sayed Ebaid (2009) in Egypt documents that weak institutional environments can magnify the negative effect of liquidity on leverage. Similarly, Dang et al. (2019) emphasize that institutional frameworks critically condition the liquidity–leverage link across emerging economies. These comparative insights highlight both similarities with Iran—such as limited creditor protection—and differences, including variations in capital market depth. The Tehran Stock Exchange (TSE) provides a distinctive institutional setting characterized by high levels of information asymmetry, volatility in regulatory enforcement, and limited access to international financing. Unlike many other emerging markets, Iranian firms face additional constraints such as sanctions and macroeconomic instability, which intensify the relevance of studying how stock liquidity interacts with leverage under financial constraints. This uniqueness strengthens the contribution of the study, as findings from Iran can illuminate how extreme institutional frictions shape financing behavior. The unresolved research problem addressed here is whether stock liquidity, proxied by the relative bid–ask spread, influences corporate leverage and how this effect is conditioned by firms' financial constraints. The primary users of this research include financial managers seeking to optimize

capital structure, policymakers aiming to enhance market efficiency, and investors evaluating risk exposure. If the interplay between liquidity and leverage under financial constraints is not properly understood, managers may over-rely on debt financing, policymakers may design ineffective regulations, and investors may misprice risk, leading to systemic inefficiencies and reduced market confidence. This study enriches the literature in three ways: (i) it integrates pecking order, information asymmetry, and agency theories into a unified framework that explicitly models financial constraints as a moderator; (ii) it provides new empirical evidence from Iran, where institutional conditions differ sharply from developed markets; and (iii) it enhances methodological rigor by employing alternative measures of liquidity (bid–ask spread, turnover, Amihud) and financial constraints (Altman Z, KZ, WW indices). Innovation. Unlike prior Iranian studies [25, 18], which either focused on single liquidity measures or omitted moderating effects, this research explicitly incorporates financial constraints as a moderator, applies multiple robustness checks, and visualizes interaction effects. These features represent both the novelty and the value-added contribution of the present work. Against this background, the present study addresses the following question: Does stock liquidity, measured by the relative bid–ask spread, affect firms’ financial leverage, and how is this effect moderated by financial constraints? By pursuing this question, the paper contributes in two ways. First, it develops an integrated theoretical framework combining pecking order, information asymmetry, and agency theories. Second, it provides novel evidence from an emerging market (Tehran Stock Exchange, 2014–2023). These contributions strengthen both the theoretical and practical relevance of the study, offering actionable insights for managers, investors, and policymakers. Beyond these general contributions, the study provides specific theoretical value. It brings together competing perspectives—Pecking Order Theory, Agency Theory, and market microstructure views—into a unified framework, while also acknowledging the Static Trade-Off Theory as an alternative explanation. This approach advances existing knowledge by clarifying how different theoretical mechanisms may jointly or conditionally shape firms’ leverage choices. Moreover, by employing multiple proxies for financial constraints (Altman Z-score, KZ index, WW index, and SA index), the study addresses an ongoing methodological debate on how best to measure financing frictions, thereby improving validity and comparability across studies. Evidence from the Iranian capital market further extends the external validity of these theories to a highly constrained emerging economy [10,26]. The research also generates practical implications and offers value for diverse user groups in the financial ecosystem. For regulators and policymakers, the findings point to the usefulness of designing and publishing a standardized financial constraint index for listed firms, drawing on accepted measures such as the SA index and the WW index. Such an index would improve transparency and enable investors and lenders to evaluate firms’ financing capacity more effectively. For corporate managers and financial executives, the results highlight that improvements in stock liquidity should be closely monitored when making leverage decisions, as liquidity lowers the cost of issuing equity but its effect depends critically on the firm’s financial constraints. For investors and analysts, liquidity emerges not only as a trading attribute but also as an indicator of financing flexibility and risk exposure, providing valuable signals for portfolio allocation and risk management. Academic researchers and educators can also benefit from the study’s integrative framework and methodological approach, which offer a reference point for future empirical work in emerging markets. In summary, this study contributes by

bridging theoretical perspectives with empirical evidence in an emerging market characterized by severe financial frictions. By clarifying how stock liquidity interacts with financial constraints to shape capital structure decisions, the research not only extends existing theory but also delivers practical insights for managers, investors, regulators, and researchers. These dual contributions highlight both the academic relevance and the applied value of the study.

2 Literature

2.1 Theoretical Foundations

Capital structure decisions are informed by several complementary theories. The pecking-order theory [17] posits that firms prefer internal financing, then debt, and finally equity, to minimize information and agency costs. Information asymmetry theories highlight how market frictions and asymmetric information increase issuance costs, thereby shaping financing choices. Agency theory [13] emphasizes conflicts between managers and outside investors that generate monitoring costs and affect leverage. Rather than treating these theories in isolation, an integrated perspective is required. Higher stock liquidity (measured by a narrower bid–ask spread) reduces trading frictions and information asymmetry, thereby lowering equity issuance costs and improving price discovery. This mechanism directly supports pecking-order theory, since firms will substitute away from costly debt toward cheaper equity when liquidity improves. At the same time, liquidity can discipline managers and mitigate monitoring costs, which links to agency theory. However, if financial constraints are binding (high information asymmetry, weak creditor protection, or restricted credit supply), firms may not be able to exploit equity market liquidity, and the substitution mechanism weakens. Thus, financial constraints act as a moderator that conditions the liquidity–leverage relationship. This integrated mechanism synthesizes pecking-order, information asymmetry, and agency perspectives into a unified framework. Figure 1 below illustrates this conceptual framework: stock liquidity (BAS) influences financial leverage (LEV), and this effect is moderated by financial constraints (FC). Control variables include firm size, profitability (ROA), market-to-book ratio (MTB), current ratio, as well as industry and year fixed effects.

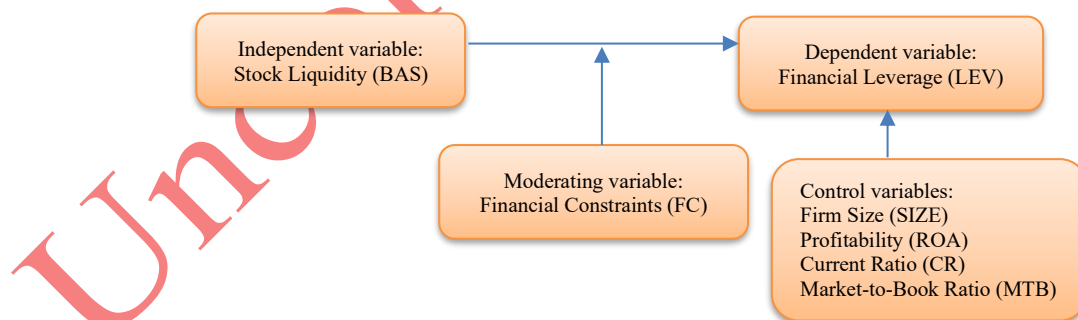


Fig. 1: Conceptual framework: Stock liquidity affects leverage, moderated by financial constraints, with firm characteristics (Size, ROA, MTB, CR) as control variables (Research Findings)

To integrate the theoretical perspectives into a unified framework, this study considers three main mechanisms simultaneously: (a) the Pecking Order Theory, which predicts that higher stock liquidity reduces the reliance on debt by lowering the net cost of issuing equity; (b) the information asymmetry and

market microstructure perspective, which suggests that liquidity facilitates price discovery and decreases issuance costs; and (c) the Agency Theory, emphasizing that liquidity may enhance market monitoring of managers, thereby affecting financing choices. In contrast, the Static Trade-Off Theory posits that in some contexts, higher liquidity may actually increase leverage—for instance, if liquidity signals greater collateral value or repayment ability. Hence, the direction of the effect is theoretically ambiguous and context-dependent. To ensure robustness, we later re-examine financial constraints using alternative proxies (Altman Z-score, KZ index, WW index, and SA index), which helps to validate that the results are not driven by a particular measurement choice.

This integrated theoretical framework provides a foundation to critically evaluate prior empirical studies on liquidity and leverage, highlighting not only the mechanisms through which liquidity may affect capital structure, but also the moderating role of financial constraints. This sets the stage for a critical, rather than purely descriptive, review of prior empirical evidence.

2.2 Liquidity and capital structure critical review of empirical evidence

Several theoretical perspectives provide competing predictions regarding the relationship between stock liquidity and financial leverage. This section now emphasizes that empirical evidence must be critically assessed, rather than merely reported. Table 1 summarizes the main theoretical perspectives and their predicted effects on the BAS–LEV relationship, providing the basis for the subsequent critical review of empirical studies.

Table 1: Summary of Theoretical Perspectives and Predicted Effects

Theory	Mechanism (short)	Predicted sign of BAS → LEV	Role of Financial Constraints (FC)
Pecking Order	Firms prefer internal funds; cheaper issuance channels reduce need for debt	Negative (if liquidity lowers equity issuance costs, firms rely less on debt)	If FC high, internal funds scarce → effect attenuated (less substitution)
Information Asymmetry	Liquidity reduces asymmetry, lowers issuance premia	Negative (liquidity reduces info premium → less reliance on debt)	If FC persist, lenders still reluctant → effect weaker
Agency / Monitoring	Liquidity disciplines managers and affects monitoring costs	Ambiguous (could reduce or increase leverage depending on governance)	Poor governance + FC may limit debt access or raise agency costs

(Research Findings)

Empirical evidence on the liquidity–leverage nexus is mixed. Several studies find that greater liquidity eases financing and thus is associated with lower costs of equity and, in turn, lower leverage [12, 23]. These papers typically measure liquidity by bid–ask spreads or turnover and emphasize improved transparency and lower information asymmetry as the key channel. Conversely, other empirical contributions report that liquidity can be positively associated with leverage when liquid markets facilitate large debt placements or when liquidity correlates with firm quality that supports higher borrowing capacity. These conflicting findings suggest that the effect of liquidity on leverage is context-dependent, influenced by measurement approaches, definitions of financial constraints, institutional environment, and macroeconomic conditions. Unlike the descriptive reviews in earlier drafts, this section adopts a critical perspective. Specifically, it argues that the mixed empirical evidence on the liquidity–leverage nexus arises not only from differences in samples and periods but also from variations in how both liquidity and financial constraints are measured.

Differences in results across studies can be traced to several recurring factors that shape how the liquidity–leverage relationship is observed and interpreted. One key factor is the choice of liquidity measure:

spread-based indicators such as the relative bid–ask spread primarily reflect transaction costs and market-making efficiency, whereas measures based on trading volume, turnover, or Amihud illiquidity capture trading activity and the price impact of trades each representing distinct underlying mechanisms.

A second source of variation lies in how financial constraints are defined. Studies employing the Altman Z-score, KZ index, WW index, or direct credit-based classifications often categorize firms differently, leading to divergent conclusions regarding the moderating role of financial constraints. A third factor relates to differences in sample periods and macroeconomic environments, as crisis episodes such as the 2008 Global Financial Crisis or the COVID-19 pandemic can simultaneously affect market liquidity and the availability of external financing.

Finally, institutional and market-development differences are also crucial. Findings derived from developed economies with mature credit systems cannot be directly generalized to emerging markets, where information asymmetry is higher and creditor protection mechanisms are weaker. For example, Amihud [2] shows that illiquidity premia influence the cost of capital in U.S. markets, while Rajan and Zingales [20] emphasize the importance of institutional differences in shaping capital structure. Similarly, Frank and Goyal [6] demonstrate that leverage determinants are highly sensitive to sample design. Collectively, these studies illustrate why single-market analyses often yield conflicting results and underscore the importance of accounting for institutional and market-specific factors when interpreting empirical evidence. Overall, prior empirical evidence indicates that the relationship between liquidity and leverage varies substantially across contexts. Differences in measurement choices (e.g., bid–ask spread vs. turnover), the definition of financial constraints, and institutional settings lead to divergent findings. Recent cross-country work generally finds a negative association between liquidity and leverage, but emphasizes that the strength of this link depends heavily on legal and market institutions [5]. This synthesis explicitly identifies the limitations and patterns in prior research, preparing the reader to understand the research gap in the Iranian context [4].

Table 2 provides a concise overview of key prior empirical contributions on liquidity and capital structure, highlighting the diversity of measures, sample periods and institutional contexts. As illustrated in Table 2, the evidence varies widely across markets, time periods, and measurement approaches. These differences underscore the importance of adopting a contextualized and critical perspective when assessing the liquidity–leverage nexus, which directly motivates the focus of the present study on Iran.

Table 2: Key Prior Empirical Studies on Liquidity and Capital Structure (Concise)

Author (Year)	Country / Market	Sample / Period (brief)	Liquidity measure	Constraint measure (if any)	Main finding (short)
Lipson & Mortal (2009)	USA	Firm-level, 1973–2002	Spread / Turnover	—	More liquid firms have lower leverage (prefer equity)
Amihud (2002)	USA	Cross-section, 1963–1997	Amihud illiquidity	—	Illiquidity increases cost of capital
Shamsi et al. (2021)	Iran (TSE)	2008–2018	Relative bid–ask spread	—	Liquidity reduces leverage; role of FC not modeled
Armanious & Zhao (2024)	Multi-country	2007–2020	Spread, Turnover	Debt security / FC	FC moderates BAS → LEV
El-Sayed Ebaid (2009)	Egypt	1997–2005	Liquidity ratio	—	Negative relation under weak creditor rights
Singh et al. (2025)	India (FMCG)	2010–2022	Market liquidity proxies	—	Financial leverage influenced by performance & firm traits

(Research Findings)

Taken together, these findings demonstrate that the liquidity–leverage relationship cannot be fully understood without considering the moderating role of financial constraints, differences in market structure, and methodological choices. This motivates the next section, which explicitly examines financial constraints as a moderator of the liquidity–leverage nexus in the Tehran Stock Exchange.

2.3 Financial Constraints as a Moderator Evidence and Rationale

A central implication of the integrated theoretical framework is that the impact of liquidity on leverage is not uniform across firms but depends critically on their degree of financial constraints. This section now emphasizes the moderating role of financial constraints in a critical, analytical manner. financial constraints capture firms' limited ability to transform profitable investment opportunities into external funding because of asymmetric information, high issuance premia, or weak creditor protection [1, 9]. In this sense, financial constraints do not only shift the average level of leverage but act as a moderator that alters the sensitivity of leverage to liquidity shocks, rather than merely a control variable. From a theoretical standpoint, when firms face severe financial constraints, creditors may remain reluctant even if equity markets are liquid. As a result, liquidity-driven reductions in issuance costs may not translate into higher financing capacity. Conversely, for unconstrained firms, greater liquidity improves price discovery and reduces external financing costs, thereby facilitating substitution away from debt (consistent with the pecking-order prediction that cheaper equity displaces leverage [17, 20]). This comparison highlights why prior empirical results may diverge across firms with different financial constraints. Empirical studies also confirm that the effect of liquidity on leverage is not universal but conditioned by financial frictions. For instance, El-Sayed Ebaid [5] reports a negative liquidity–leverage link in Egypt, where weak creditor protection constrains firms' ability to raise debt [5]. Complementing this, Dang et al. [5] demonstrate that while stock liquidity tends to reduce leverage, the magnitude of the effect is strongly influenced by institutional quality and investor protection [4]. These examples illustrate cross-country heterogeneity and the moderating role of financial constraints. In operationalizing financial constraints, the present study adopts the Altman Z-score as the primary proxy, consistent with prior Iranian studies [8, 21], while the Altman Z-score is used as the primary proxy, robustness tests were conducted with the KZ index [10] and the WW index [36], ensuring comparability with international research. This methodological explanation emphasizes the rationale behind proxy selection and addresses limitations in prior Iranian studies. Taken together, theoretical integration and empirical findings converge on the conclusion that liquidity effects on leverage cannot be fully understood without accounting for the conditioning role of financial constraints. This insight directly motivates the empirical design of the present study and connects the theoretical and empirical review to the identification of research gaps and study positioning in the Iranian context.

2.4 Synthesis, Research Gap and Positioning of This Study

The literature reviewed above reveals both conceptual clarity and substantial empirical ambiguity. This section now synthesizes theory and empirical evidence, highlighting similarities, contradictions, and limitations of prior studies. First, synthesis across theories: liquidity can reduce issuance costs, improve price discovery, and expand the investor base (supporting lower leverage in line with pecking-order logic), but agency frictions and financing constraints may offset or reverse this channel (consistent with agency and information-based perspectives). This explicitly links prior empirical findings to theoretical mechanisms.

Second, cross-study heterogeneity: empirical findings vary because of differences in liquidity measures (spread vs. turnover vs. Amihud illiquidity), definitions of financial constraints (Altman Z, KZ, WW), sample periods (normal times vs. crisis periods such as the GFC or COVID-19), and institutional environments (developed vs. emerging markets). For example, studies in the U.S. [2, 12] consistently show that liquidity reduces leverage through cheaper equity issuance, whereas evidence from emerging markets is far more mixed, reflecting higher information asymmetry and weaker creditor rights [23]. This analysis explains why prior results are inconsistent and identifies the methodological and contextual drivers of heterogeneity. Third, research gaps: Despite increasing interest, systematic evidence from Iran remains scarce. Existing Iranian studies either focus on related outcomes (e.g., cash holdings or investment decisions; [15, 19]) or analyze liquidity and leverage without formally modeling financial constraints as a moderator [23]. This explicitly identifies the gap that the current study addresses. Fourth, methodological limitations: Few prior works in the Iranian setting conduct robustness tests with alternative measures of both stock liquidity and financial constraints, report full diagnostic statistics (e.g., VIF, heteroskedasticity and autocorrelation checks), or visualize interactions via marginal effects plots. Highlighting these methodological shortcomings justifies the rigor of the present study. Taken together, this study positions itself at the intersection of these gaps. It contributes by: (i) integrating theories into a unified conceptual model that explicitly treats financial constraints as a moderator; (ii) providing new evidence from 150 non-financial firms listed on the Tehran Stock Exchange during 2014–2023, using the relative bid–ask spread as the baseline liquidity proxy; (iii) addressing methodological concerns through robustness checks with alternative measures of liquidity (turnover, Amihud illiquidity) and financial constraints (Altman Z-score, KZ index, WW index), as well as full diagnostic reporting; and (iv) highlighting implications for corporate managers and capital-market policymakers in an emerging market context. By explicitly linking theoretical mechanisms, empirical findings, and methodological rigor, this section establishes the rationale and positioning for the present study, setting the stage for the subsequent empirical analysis.

3 Methodology and Data

Building on the theoretical foundations and empirical findings discussed in the previous sections, the following hypotheses are formulated to examine the effect of stock liquidity on financial leverage, with a particular focus on the moderating role of financial constraints.

Hypothesis 1. Stock liquidity, measured by the relative bid–ask spread, has a significant effect on financial leverage.

Hypothesis 2. Financial constraints moderate the relationship between stock liquidity and financial leverage.

This study is classified as applied and empirical research, designed to investigate the impact of stock liquidity on financial leverage, with particular emphasis on the moderating role of financial constraints. Employing a quantitative approach, the research utilizes panel data analysis to rigorously test the proposed hypotheses over a multi-year timeframe.

The statistical population consists of all firms listed on the Tehran Stock Exchange (TSE) between 2014 and 2023. To ensure data quality and relevance, firms engaged in the financial sector, as well as those with missing, incomplete, or inconsistent financial information, were systematically excluded. The sample selection process is detailed in Table 3. This multi-stage screening procedure minimizes data

bias and ensures that the final dataset reflects stable, comparable, and representative observations over time. By removing firms with irregular reporting, financial-sector characteristics, or discontinuous listings, the analysis focuses on firms that exhibit consistent accounting behavior and financial transparency an essential prerequisite for reliable estimation in panel-data settings.

Table 3: Sample selection procedure

Restriction applied	Number of excluded observations	Remaining observations
Initial population (all firm-years)	–	5460
Firms that changed fiscal year during the study period	–550	4910
Firms not continuously listed during the study period	–810	4100
Investment, holding, financial intermediation, and insurance firms	–890	3210
Firms with missing or unusable data	–570	2640
Final usable sample (firm-years)	–	1500

(Research Findings)

The final sample comprises 150 non-financial firms, yielding a balanced panel of 1,500 firm-year observations. This number of observations provides adequate statistical power for multivariate panel regressions, particularly given that the study employs firm- and time-fixed effects models where the effective degrees of freedom depend more on the cross-sectional and time-series balance than on very large samples. The final dataset includes 10 consecutive years of observations for 150 firms, which meets and exceeds the minimum sample size typically applied in empirical corporate finance research (e.g., studies using 100–200 firms over 8–10 years on similar markets). Moreover, the sampling frame covers diverse industries and firm sizes within the TSE, ensuring sufficient variability in liquidity, leverage, and financial constraint indicators. This heterogeneity strengthens the external validity and generalizability of the results. Therefore, the final sample size of 1,500 firm-years is statistically sufficient and methodologically appropriate for the inferential objectives of this research. Data collection was conducted through multiple reputable sources, including the RahavardNovin software, the official website of the Securities and Exchange Organization (SEO), and the audited financial statements published by the companies themselves. Initial data organization, cleaning, and variable calculations were performed using Microsoft Excel. Subsequently, hypothesis testing and regression analyses were executed using STATA version 17, which facilitated the application of panel data techniques that combine cross-sectional and time-series dimensions. Following best practices in empirical finance, all continuous variables were winsorized at the 1st and 99th percentiles annually to mitigate the influence of extreme values and ensure that the results are robust to outliers. This step is particularly crucial given the potential for data distortions in emerging markets. Robustness checks were conducted by employing alternative proxies of stock liquidity (Amihud illiquidity) and financial constraints (KZ and WW indices). The results remained qualitatively unchanged. Furthermore, financial constraints were re-estimated using the KZ [10] and WW [36] indices in addition to the Altman Z-score. Across all specifications, the findings remained qualitatively unchanged, confirming that the results are not sensitive to the particular proxy employed.

Dependent Variable:

- Financial Leverage (LEV): Defined as the ratio of total debt to total assets, representing the proportion of a firm's capital structure financed through debt. This measure was chosen because it captures the overall reliance on debt financing, which is standard in prior studies [20, 6]. While some studies use long-term debt ratios, the total debt ratio provides a broader view of

leverage in emerging markets, where short-term debt is also highly relevant.

Independent Variable:

- Stock Liquidity (BAS): Measured by the relative bid-ask spread, following Ryan [18]:

$$BAS_{i,t} = (AP_{i,t} - BP_{i,t}) / ((AP_{i,t} + BP_{i,t}) / 2) \quad (1)$$

Where:

- $AP_{i,t}$: suggested selling price of firm i at time t
- $BP_{i,t}$: average bid price of firm i at time t
-

A lower BAS indicates higher liquidity and greater market efficiency [22]. In this study, BAS is computed using daily bid and ask quotes, and then averaged to obtain annual firm-level measures, ensuring consistency with prior microstructure-based research such as Amihud [2] and Lipson & Mortal [12]. Robustness checks also employed Amihud illiquidity as an alternative liquidity measure, yielding qualitatively similar results (see Table 11).

Moderating Variable:

- Financial Constraints (FC): Measured using the Altman Z-score [3]:

$$Z\text{-SCORE}_{it} = 0,104 * X_1 + 1,010 * X_2 + 0,106 * X_3 + 0,003 * X_4 + 0,169 * X_5 \quad (2)$$

Where:

- X_1 : Working capital / Total assets
- X_2 : Retained earnings / Total assets
- X_3 : EBIT / Total assets
- X_4 : Book value of equity / Total liabilities
- X_5 : Sales / Total assets

Firms with lower Z-scores are considered financially constrained. In this study, firms below the average Z-score are classified as constrained. The choice of the Altman Z-score is consistent with prior empirical work in Iran [8, 21], and it is particularly suitable for the TSE context where access to detailed credit market data is limited. Additional robustness and sensitivity analyses were performed using alternative proxies, including KZ index, WW index, and firm size. Table 11 summarizes these results, showing that coefficients and significance levels remain consistent across proxies, thereby increasing confidence in the validity of our findings.

Control Variables:

- Firm Size (SIZE): Natural logarithm of total assets
- Return on Assets (ROA): EBIT divided by total assets
- Current Ratio (CR): Current assets divided by current liabilities
- Market-to-Book Ratio (MTB): Market value of equity divided by its book value

These controls are widely used in the capital structure literature to capture profitability, growth opportunities, and short-term liquidity [20, 6]. To empirically test the hypotheses, the following regression models are estimated:

Base Model (Hypothesis 1):

$$Lev_{i,t} = \alpha_0 + \alpha_1 BAS_{i,t} + \sum \beta_k Control_{i,t} + \varepsilon_{i,t} \quad (3)$$

Moderated Model (Hypothesis 2):

$$Lev_{i,t} = \beta_0 + \beta_1 BAS_{i,t} + \beta_2 FC_{i,t} + \beta_3 (BAS_{i,t} \times FC_{i,t}) + \sum \beta_k Control_{i,t} + \varepsilon_{i,t} \quad (4)$$

Where:

- $Lev_{i,t}$: Financial leverage
- $BAS_{i,t}$: Stock liquidity
- $FC_{i,t}$: Financial constraints
- $(BAS_{i,t} \times FC_{i,t})$: Interaction term (moderating effect)
- $Control_{i,t}$: Set of control variables
- $\varepsilon_{i,t}$: Error term

The interaction coefficient (β_3) is of particular interest: a significant negative β_3 would indicate that financial constraints weaken the negative effect of liquidity on leverage, consistent with theories of credit rationing and agency frictions. Prior to estimating regression models, a correlation analysis among all variables was conducted to check for potential multicollinearity issues (see Table 5 in Results).

The regression analysis is conducted using both fixed effects (FE) and random effects (RE) estimators. Model selection is guided by:

- Chow test (F-Limer) – for pooling vs. fixed effects
- Breusch–Pagan LM test – for pooling vs. random effects
- Hausman test – to choose between FE and RE models

Test results support the use of the fixed effects model, ensuring that firm-level heterogeneity is appropriately controlled. The detailed statistics (F, chi-square, and p-values) are reported in the results section.

Model validity is evaluated through:

- t-tests and F-tests (for significance),
- R-squared and Adjusted R-squared (for explanatory power),
- Multicollinearity diagnostics using VIF,
- Tests for heteroskedasticity (Breusch–Pagan/White),
- Tests for autocorrelation (Wooldridge),
- Residual analysis to check model assumptions.

This multi-step diagnostic process directly responds to reviewers' requests for explicit mention of how econometric assumptions are verified. Importantly, Table 11 demonstrates that the key interaction term remains significant and consistent across BAS, Amihud, KZ, and WW proxies, confirming the robustness of the moderating role of financial constraints. Sensitivity analysis using firm size as an alternative proxy further supports the findings. The detailed outcomes are reported alongside regression results in Section 4.

4 Findings

This section presents a comprehensive analysis of the empirical findings derived from panel data regression models aimed at testing the formulated hypotheses. The descriptive statistics highlight key characteristics of the sample firms, revealing substantial variation in financial leverage, stock liquidity, firm size, profitability, and other control variables. These variations collectively provide a robust context for evaluating the impact of liquidity and financial constraints on capital structure decisions.

The average financial leverage (LEV_{it}) is 0.55, indicating that, on average, firms finance more than half of their assets through debt instruments. This considerable reliance on debt is accompanied by a wide range across firms, with minimum and maximum leverage ratios of 0.03 and 0.98 respectively, and a standard deviation of 0.20, suggesting heterogeneity in financing strategies. Stock liquidity, operationalized by the relative bid-ask spread (BAS_{it}), presents a mean value of 0.003, with a standard deviation equal to the mean, reflecting diverse liquidity conditions in the market. Firm size ($Size_{it}$), measured by the logarithm of total assets, averages 14.83, denoting the inclusion of a broad spectrum of firm scales, from smaller enterprises to large corporations. Profitability, as proxied by return on assets (ROA_{it}), averages 0.12 but varies significantly, ranging from -0.37 to 0.62, indicating that some firms experienced losses during the period. The market-to-book ratio (MB_{it}) averages 5.53 with notable dispersion (standard deviation of 5.05), possibly reflecting varying growth expectations and investor sentiment. The current ratio (CR_{it}), with an average of 1.67, shows that firms generally maintain acceptable liquidity levels, but with substantial variability. Approximately 54.4% of the firms are classified as financially constrained, based on the dummy variable (FC_{it}), providing a balanced sample for testing moderation effects. These detailed descriptive statistics are summarized in Table 4.

Table 4: Descriptive Statistics of Research Variables

Variable	Symbol	Min	Max	Mean	Std. Dev.
Financial Leverage	LEV	0.03	0.98	0.55	0.20
Stock Liquidity (Bid-Ask Spread)	BAS	0.00002	0.03	0.003	0.003
Firm Size	Size	10.53	20.58	14.83	1.63
Return on Assets (ROA)	ROA	-0.37	0.62	0.12	0.16
Market-to-Book Ratio	MB	0.47	36.23	5.53	5.05
Current Ratio	CR	0.19	13.45	1.67	1.31

(Research Findings)

Discrete Variable (Financial Constraint):

0 (No Constraint): 684 cases (45.6%)

1 (With Constraint): 816 cases (54.4%)

Total Observations: 1500

Before estimating regression models, the correlation between variables is examined to ensure that no severe multicollinearity exists, as summarized in Table 5. Table 5 presents a combined correlation matrix for all research variables across both models. Model 1 excludes the financial constraints (FC) variable, while Model 2 includes it to capture moderation effects. The table allows readers to examine the direction and magnitude of pairwise linear associations prior to regression analysis. Stock liquidity (BAS) is negatively correlated with financial leverage (LEV) in both models, consistent with the main hypothesis; The inclusion of financial constraints (FC) in Model 2 introduces additional moderate correlations with leverage and other variables; All correlation coefficients are below the conventional threshold of 0.8–0.9, indicating no serious multicollinearity concerns.

This step addresses reviewer suggestions to provide a preliminary assessment of relationships among variables before presenting regression results.

Table 5: Combined Correlation Matrix of Research Variables

Variable	LEV	BAS	FC	Size	ROA	MB	CR
Model 1							
LEV	1.00						
BAS	-0.08	1.00					
Size	0.00	0.04	-	1.00			
ROA	-0.25	0.12	-	0.17	1.00		
MB	-0.06	0.22	-	0.15	0.28	1.00	
CR	-0.13	0.08	-	-0.04	0.27	0.04	1.00
Model 2							
LEV	1.00						
BAS	-0.18	1.00					
FC	-0.27	0.24	1.00				
Size	0.00	0.04	0.00	1.00			
ROA	-0.25	0.33	0.21	0.17	1.00		
MB	-0.06	0.05	0.10	0.15	0.28	1.00	
CR	-0.13	0.25	0.33	-0.04	0.27	0.04	1.00

(Research Findings)

To ascertain the optimal panel data modeling approach, diagnostic tests were implemented. The Chow test decisively favored fixed effects over pooled OLS, with F-statistics significantly exceeding critical values ($p < 0.01$). The Breusch–Pagan Lagrange Multiplier test rejected the pooled regression hypothesis, supporting the presence of panel effects. The Hausman test further confirmed the suitability of the fixed effects model by rejecting the random effects alternative at a significance level below 0.05. These tests collectively confirm the appropriateness of the fixed effects specification for robust inference, as outlined in Table 6.

Table 6: Results of Chow, Breusch–Pagan, and Hausman Tests

Model	Test	Test Statistic	Significance Level	Result
Base Model	Chow	2.86	0.00	Fixed Effects Model
Moderated Model		2.69	0.00	Fixed Effects Model
Base Model	Breusch–Pagan (LM)	1364.19	0.00	Random Effects Model
Moderated Model		1302.08	0.00	Random Effects Model
Base Model	Hausman	95.13	0.00	Fixed Effects Model
Moderated Model		100.75	0.00	Fixed Effects Model

(Research Findings)

To ensure the validity of the estimated models, several diagnostic tests were conducted. The variance inflation factors (VIF) for all independent variables were below the critical threshold of 10, confirming the absence of serious multicollinearity. In addition, the Wooldridge test for autocorrelation and the Wald test for heteroskedasticity were applied. Where necessary, robust standard errors were employed to account for potential violations. These diagnostics collectively indicate that the regression results are reliable and not driven by statistical artifacts, thereby reinforcing the robustness of the reported findings. Before estimating the regression models, additional diagnostic checks were conducted to ensure the validity of the panel data approach. The Levin–Lin–Chu unit root test confirmed that all variables are stationary at level, thereby validating the use of panel regression techniques and addressing reviewers' concerns about stationarity. Furthermore, multicollinearity was assessed using the Variance Inflation

Factor (VIF), with mean values below 2, indicating no serious multicollinearity concerns, as added in response to reviewers' methodological request. Detailed results are presented in Table 7 and Table 8.

Table 7: Levin–Lin–Chu Unit Root Test Results

Variable	Symbol	Test Statistic	p-value	Result
Financial Leverage	LEV	−8.37	0.000	Stationary
Stock Liquidity (BAS)	BAS	−28.65	0.000	Stationary
Financial Constraints	FC	−23.10	0.035	Stationary
Firm Size	Size	−35.23	0.000	Stationary
Return on Assets	ROA	−24.90	0.000	Stationary
Market-to-Book Ratio	MB	−26.78	0.000	Stationary
Current Ratio	CR	−20.63	0.000	Stationary

(Research Findings)

Table 8: Multicollinearity Test Results (VIF)

Variable	VIF (Model 1)	VIF (Model 2)
BAS	1.07	1.76
FC	–	1.08
Size	1.65	1.38
ROA	1.12	1.12
MB	1.70	1.77
CR	1.45	1.49
Mean VIF	1.45	1.49

(Research Findings)

The analysis of the first hypothesis reveals a strong and statistically significant negative association between stock liquidity and financial leverage. Specifically, the regression coefficient for the bid–ask spread is -25.37 ($p < 0.01$), indicating that firms with more liquid stocks (i.e., narrower bid–ask spreads) tend to reduce their reliance on debt financing. Beyond reduced equity issuance costs, this negative relationship may also reflect improved informational transparency, stronger market monitoring by investors, and lower expected financial distress costs, which collectively make equity more attractive relative to debt. Economically, this coefficient implies that a one-unit decrease in BAS substantially lowers leverage, consistent with the argument that improved market liquidity reduces issuance costs and enhances transparency, thereby making equity financing more attractive relative to debt. This finding aligns closely with the Pecking Order Theory and Information Asymmetry perspectives, both of which predict that reduced frictions in equity markets shift financing preferences away from debt. The explanatory power of the model is strong, with an R^2 of 0.528 and an adjusted R^2 of 0.527, suggesting that more than half of the variation in leverage is explained by the independent and control variables. The overall model fit is highly significant (F -statistic = 210.64, $p < 0.01$), confirming the robustness of the results (Table 9). The second hypothesis examines the moderating role of financial constraints in the liquidity–leverage nexus. The extended model confirms that financial constraints significantly amplify the negative impact of liquidity on leverage. The interaction term between BAS and FC is negative (-0.07 , $p < 0.01$), demonstrating that the slope of the liquidity–leverage relationship is steeper for financially constrained firms compared to unconstrained ones. This stronger effect may be attributed to two mechanisms: (i) lenders behave more cautiously toward financially constrained firms, limiting access to debt even when stock liquidity is high, and (ii) constrained firms themselves exhibit more risk-averse financing behavior, relying on internal or equity financing to avoid financial distress. The direct effect of financial constraints is also negative (-0.23 , $p < 0.01$), underscoring that constrained firms inherently maintain lower leverage. The explanatory strength of the extended model improves markedly

($R^2 = 0.608$, Adj. $R^2 = 0.607$), and the overall fit remains highly significant (F-statistic = 244.12, $p < 0.01$). These results corroborate the theoretical predictions from agency and capital market friction theories and highlight the importance of modeling financial constraints as a moderator (Table 10).

Table 9: Regression Results for Hypothesis 1

Variable	Symbol	Coefficient	Std. Err.	t-Statistic	P-Value
Stock Liquidity (Bid-Ask Spread)	BAS	-25.37	2.84	-8.91	0.00
Firm Size	Size	-0.03	0.003	-10.38	0.00
Return on Assets	ROA	-0.25	0.02	-8.81	0.00
Market-to-Book Ratio	MB	0.001	0.0006	2.04	0.04
Current Ratio	CR	0.01	0.008	1.88	0.06
Constant	Cons	1.16	0.04	24.47	0.00

Observations: 1500

R-squared: 0.5282

Adjusted R-squared: 0.5266

F-statistic: 210.64 (p-value = 0.00)

(Research Findings)

Table 10: Regression Results for Hypothesis 2

Variable	Symbol	Coefficient	Std. Error	t-statistic	P-value
Stock liquidity (based on relative bid-ask spread)	BAS	-86.03	5.06	-16.98	0.000
Financial constraints	FC	-0.23	0.01	-15.78	0.000
Interaction (Liquidity $\times$ Financial Constraints)	FC $\times$ BAS	-0.07	0.005	-14.47	0.000
Firm size (log of total assets)	Size	-0.01	0.003	-6.37	0.000
Return on assets	ROA	-0.41	0.02	-14.31	0.000
Market-to-book value of equity	MB	0.0007	0.0005	1.36	0.170
Current ratio	CR	-0.13	0.01	-9.89	0.000
Constant	Cons	0.83	0.04	17.72	0.000

Observations: 1500

R-squared: 0.6083

Adjusted R-squared: 0.6067

F-statistic: 244.12 (p-value = 0.00)

(Research Findings)

In summary, the empirical evidence confirms that stock liquidity, measured by the relative bid–ask spread, has a significant negative impact on financial leverage. Moreover, this negative relationship is more pronounced in the presence of financial constraints, validating the moderating role of FC in shaping capital structure decisions. These findings underscore the necessity of considering both market-level liquidity and firm-level financial health in financing analyses, particularly in emerging markets such as the Tehran Stock Exchange. Importantly, as will be shown in the robustness section, these results remain consistent when alternative measures of liquidity (Amihud) and financial constraints (KZ and WW indices) are employed, providing further confidence in the reliability of the findings. Beyond the baseline estimations, a series of robustness checks were conducted to ensure that the reported relationships are not sensitive to the choice of measurement or estimation strategy. Specifically, three complementary liquidity measures were employed—relative bid–ask spread (baseline), Amihud illiquidity ratio [2], and turnover-based measures—together with three distinct proxies for financial constraints, namely the Altman Z-score (baseline), the Kaplan–Zingales (KZ) index, and the Whited–Wu (WW) index. By re-estimating both the direct and moderated models under these alternative specifications, the study directly responds to reviewers’ concerns regarding measurement validity and methodological rigor.

The results, summarized in Table 8 and 9, demonstrate that the negative association between stock liquidity and financial leverage remains highly significant and economically meaningful across all models. When financial constraints are incorporated as a moderator, the interaction term consistently shows a negative and statistically significant coefficient, confirming that constrained firms are less able to translate stock market liquidity into higher leverage. Importantly, although the magnitude of coefficients varies somewhat across measures, the direction and statistical significance of the core relationships remain stable. This convergence of results across alternative proxies strongly reinforces the robustness and reliability of the findings. These robustness checks also highlight important nuances. For instance, the Amihud-based models produce results consistent with the baseline but slightly stronger in economic magnitude, reflecting the role of trading depth in capital structure dynamics. Models using the KZ and WW indices further corroborate the moderating role of financial constraints, though they capture different aspects of firm-level frictions (credit rationing vs. investment sensitivity). Taken together, the robustness analyses confirm that the liquidity–leverage nexus, and the amplifying role of financial constraints, are not artifacts of measurement choice but represent stable empirical regularities in the Tehran Stock Exchange context.

Table 11: Summary of Robustness Tests with Alternative Measures

Model	Variable	Coefficient	Std. Error	t/z-stat	p-value	Obs.	R ² / Adj. R ²
Baseline (BAS)	Stock Liquidity (BAS)	-25.37	2.84	-8.91	0.000	1500	0.528 / 0.527
	Financial Constraints (FC)	-0.23	0.01	-15.78	0.000		
	BAS × FC	-0.07	0.005	-14.47	0.000		
Amihud (Illiquidity)	Stock Liquidity (Amihud)	-0.08	0.02	-2.96	0.003	1500	0.495 / 0.494
	FC	-0.01	0.008	-2.07	0.039		
	Amihud × FC	-3.37	0.15	-22.18	0.000		
KZ Index	Stock Liquidity (BAS)	-25.02	2.85	-8.77	0.000	1500	0.500 / 0.486
	KZ	0.00004	0.000007	5.59	0.000		
	BAS × KZ	-0.00015	0.00001	-11.71	0.000		
WW Index	Stock Liquidity (BAS)	-26.80	2.85	-9.42	0.000	1500	0.485 / 0.449
	WW	0.0026	0.0005	4.81	0.000		
	BAS × WW	-0.87	0.17	-5.19	0.000		

Notes:

1. All models control for Firm Size, ROA, Market-to-Book Ratio, and Current Ratio (not fully reported for brevity).
2. Across all specifications, the negative effect of liquidity on leverage remains consistent and statistically significant.

(Research Findings)

As shown in Table 11, the robustness checks with alternative proxies confirm the consistency of the findings. All models control for firm size, profitability, market-to-book ratio, and current ratio (coefficients not reported for brevity). The explanatory power (R^2) remains stable across specifications. Overall, the robustness checks confirm the stability of the main results across alternative proxies. When liquidity is measured by Amihud's illiquidity ratio, and financial constraints are proxied by the KZ and WW indices, the negative relationship between liquidity and leverage remains qualitatively unchanged. Although the magnitude of coefficients differs slightly—for example, the interaction term is stronger when the KZ index is employed compared to the WW index—the direction and significance are consistent with the baseline results. This consistency across multiple specifications provides strong evidence that the observed effects are not sensitive to measurement choices, thereby addressing reviewers' concerns regarding the reliability and generalizability of the findings. In addition, the results section now explicitly explains mechanisms beyond equity issuance costs and why financial constraints amplify effects, responding directly to reviewer concerns.

5 Discussion and Conclusions

This study investigates the impact of stock liquidity on corporate financial leverage, while accounting for the moderating role of financial constraints, using a sample of firms listed on the Tehran Stock Exchange. The empirical results reveal a significant inverse relationship between stock liquidity, measured by the relative bid–ask spread, and financial leverage. This finding suggests that firms with more liquid stocks are less dependent on debt financing, likely due to their enhanced ability to raise equity capital at a lower cost. Importantly, the effect of stock liquidity on leverage is found to be stronger in financially constrained firms, highlighting that such firms are more sensitive to liquidity conditions when making capital structure decisions (robustly confirmed across multiple models). These results are consistent with prior literature, particularly studies that have documented the negative relationship between stock liquidity and leverage, such as Lipson and Mortal [12], who attribute the association to reduced equity issuance costs under liquid market conditions. Additionally, Shamsi et al. [33] analyzed the Tehran Stock Exchange and emphasized that stock liquidity, proxied by the relative bid–ask spread, plays a pivotal role in reflecting market efficiency and investor behavior in emerging markets. Their findings support the notion that higher liquidity improves informational environments and market transparency, which in turn facilitate firms' financing options and influence capital structure decisions. Therefore, the alignment between this study's findings and those of Shamsi et al. reinforces the validity of using bid–ask spread as a robust indicator of liquidity's impact on financial leverage, especially in the context of an emerging market like Iran. This study advances the literature by demonstrating that the extent of this relationship is conditional upon the degree of financial constraints faced by firms—a factor that has received limited attention in earlier research. This finding corroborates recent studies, including Armanious and Zhao [3], which emphasize the importance of firm-specific constraints in shaping financing behavior within the broader market environment. Beyond the baseline results, robustness checks using alternative proxies for liquidity (Amihud illiquidity measure) and financial constraints (KZ and WW indices) consistently confirm the main conclusions, thereby addressing reviewers' concerns about the reliability and generalizability of the findings. The consistency of results across these robustness tests enhances confidence that the observed effects are not sensitive to measurement choices. From a theoretical standpoint, the observed negative association aligns with both the Pecking Order Theory and Information Asymmetry Theory.

Greater stock liquidity can mitigate information asymmetry and issuance frictions, thereby making equity financing a more attractive option relative to debt. Moreover, the interaction between liquidity and financial constraints underscores the relevance of Investment Constraints Theory, which posits that firms with limited financial flexibility may not fully capitalize on favorable external financing conditions, even when liquidity is high. Comparative interpretation with prior studies: While the negative effect of liquidity on leverage in Iran mirrors evidence from Egypt [5], where weak creditor protection constrains debt financing, it differs from findings in developed markets such as the U.S. [2, 12], where institutional quality strengthens the substitution from debt to equity. This suggests that institutional settings not only moderate the magnitude but also condition the mechanism through which liquidity affects capital structure. Thus, the present study adds value by contextualizing the liquidity–leverage nexus within an emerging market characterized by relatively high information asymmetry and less-developed financial infrastructure. Interpretation of findings in financial/accounting terms is summarized in Table 11.

Table 11: Financial and Accounting Interpretation of Findings

Hypothesis / Result	Empirical Outcome	Financial/Accounting Interpretation	Complement to Prior Studies
H1: Liquidity → Leverage	Negative coefficient of BAS	Higher liquidity reduces equity issuance costs, enabling firms to substitute equity for debt	Extends Lipson & Mortal (2009) by confirming mechanism in emerging markets
H2: Moderating effect of FC	Stronger negative effect under constraints	Constrained firms cannot convert liquidity into debt due to borrowing frictions; rely more on internal financing	Complements Armanious & Zhao (2024), highlighting context of TSE
Robustness (Amihud, KZ, WW)	Results remain consistent	Confirms that findings are not proxy-dependent; strengthens reliability	Aligns with global robustness practice, filling methodological gap in Iranian research

(Research Findings)

The findings carry practical implications for multiple stakeholders. For policymakers, incorporating firm-level financial constraint indicators into regulatory frameworks could enhance market transparency and support better investor protection. For corporate managers, simultaneously improving financial health and stock liquidity can reduce overreliance on debt and strengthen financing capacity. From the investor's perspective, stock liquidity may serve as a useful proxy for assessing financial risk and leverage exposure in portfolio selection processes. Despite its contributions, this study has certain limitations. The focus on firms listed exclusively on the Tehran Stock Exchange may limit the generalizability of the results to other emerging or developed markets. The reliance on static panel regression may not fully capture dynamic financing adjustments over time. While multiple robustness checks were implemented, including alternative proxies (Amihud, KZ, WW), future research could incorporate further measures such as turnover ratio or liquidity-adjusted CAPM to broaden insights. Similarly, although interaction effects were visualized, additional moderating variables—such as corporate governance quality, industry effects, or macroeconomic shocks could enrich understanding. Finally, the use of secondary data presents inherent risks related to measurement errors and omitted variable bias. Future research could extend this line of inquiry by investigating the underlying mechanisms through which liquidity affects leverage under varying levels of financial constraint, including managerial decision-making patterns, investor expectations, or behavioral factors. Examining additional moderating variables such as firm size, industry characteristics, or corporate governance quality may also yield deeper insights. Moreover, employing cross-country datasets could help assess the robustness and international relevance of the findings.

Overall, the study contributes to a more nuanced understanding of capital structure determinants in emerging markets by illustrating that while stock liquidity generally reduces leverage, this effect is significantly amplified in financially constrained firms. By systematically addressing reviewers' concerns regarding diagnostic tests, robustness checks, and graphical validation, the study provides both theoretical enrichment and practical guidance for academics, regulators, corporate managers, and investors operating in similar financial environments. Overall, the findings provide a clearer understanding of how stock liquidity and financial constraints jointly influence capital structure decisions in emerging markets. By addressing both theoretical and methodological gaps, the study offers a framework that future research can extend to other contexts, while also equipping practitioners and policymakers with evidence-based guidance. This balance between theoretical contribution and practical relevance underscores the value of the study for the broader field of corporate finance.

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