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Cost of Equity, Target Leverage, and Capital Structure Adjustment: Evidence from Industrial and Energy Companies

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Abstract:

This study examines the relationship between the cost of equity and estimated target leverage and investigates capital structure adjustment dynamics in ten industrial and energy companies over 2010–2022. Using a balanced panel of 130 firm-year observations, target leverage is approximated through a fixed-effects model, while leverage dynamics are examined using two-step System Generalized Method of Moments estimation. The findings indicate that the cost of equity is positively but insignificantly associated with estimated target leverage. Similarly, the adjustment-gap coefficient is positive but statistically insignificant, providing insufficient evidence of a systematic adjustment response. Although the diagnostic tests do not reject selected specification restrictions, the small cross-sectional dimension limits the reliability and generalizability of the estimates. The findings highlight the importance of cautious interpretation and suggest that future research should employ larger samples, richer target-leverage specifications, and direct tests of the cost-of-equity effect on adjustment speed.

Keywords: Cost of Equity; Capital Structure; Speed of Adjustment; System GMM; Financial Leverage.

JEL Classification Codes : C23 – G12 – G32.

1. INTRODUCTION

1.1 Background of the Study and Research Problem

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Capital structure decisions constitute one of the most important strategic financial decisions facing corporate management because of their direct implications for financing costs, firm value, and financial risk. Since the seminal work of Modigliani and Miller (1958), the financial literature has sought to explain how firms determine the optimal mix of debt and equity financing. However, subsequent theoretical and empirical developments have demonstrated that firms do not instantaneously achieve their target capital structure. Instead, they adjust their capital structure gradually due to adjustment costs, information asymmetry, and financing constraints, providing the foundation for the development of the Speed of Adjustment (SOA) theory.

The cost of equity occupies a central position among the determinants of financing decisions, as it represents the minimum rate of return expected by investors in exchange for bearing investment risk. It also directly affects the overall cost of capital and firms' ability to attain their target capital structure. As the cost of equity increases, firms tend to become more cautious in relying on equity financing, prompting them to restructure their financing mix in a manner that balances financing costs with expected returns.

1.2 Research Problem

Although the dynamic trade-off theory suggests that firms adjust their leverage toward a target level, empirical evidence indicates that such adjustments may be incomplete and influenced by financing conditions and firm-specific characteristics. The cost of equity represents an important component of financing decisions, yet its association with target leverage remains empirically uncertain. Furthermore, deviations between actual and estimated target leverage do not necessarily result in systematic adjustment. Against this background, the present study examines the relationship between the cost of equity and estimated target leverage and investigates the extent to which actual leverage responds to deviations from that target among the sampled industrial and energy companies.

1.3 Research Question

In light of the foregoing discussion, this study seeks to answer the following main research question:

To what extent is the cost of equity associated with target leverage, and what evidence exists of adjustment toward the estimated target capital structure among the sampled industrial and energy companies during the period 2010–2022?

This main question gives rise to several subsidiary questions concerning the existence of a dynamic effect of past leverage, the suitability of dynamic panel data models in explaining firms' adjustment behavior, and the robustness of the empirical findings after conducting the required diagnostic and specification tests.

1.4 Importance and Objectives of the Study

This study is significant from both theoretical and practical perspectives. From a theoretical standpoint, it contributes to the literature on dynamic capital structure theory by incorporating the cost of equity as a determinant of the speed of adjustment within

an advanced econometric framework. From a practical perspective, the findings provide valuable insights for corporate managers and investors regarding the formulation of financing policies that facilitate the attainment of the target capital structure while minimizing financing costs and enhancing firm value.

Accordingly, the study aims to:

- Examine the relationship between the cost of equity and target leverage among the sampled industrial and energy companies.
- Assess the dynamic persistence of financial leverage and its response to deviations from the estimated target.
- Evaluate the empirical evidence of capital structure adjustment using a dynamic panel specification.
- Identify the methodological limitations and managerial implications associated with the observed financing patterns.

2. Theoretical Framework and Literature Review

2.1 Capital Structure and the Target Leverage Ratio

Capital structure refers to the mix of debt and equity used by firms to finance their assets and investments. Financing decisions affect the cost of capital, financial risk, financing flexibility, and firm value. According to the trade-off theory, firms seek a target leverage ratio that balances the tax benefits of debt against financial distress, bankruptcy, and agency costs. This target is not fixed but varies with firm characteristics, market conditions, and the institutional environment (Liu et al., 2024, p. 1).

Recent studies view capital structure as a dynamic process rather than a static equilibrium. Firms adjust their leverage gradually in response to financial and market conditions, with the adjustment influenced by firm characteristics, corporate governance, institutional factors, and macroeconomic conditions (Liu et al., 2026, p. 1).

The target leverage ratio is estimated as:

$$LEV^*_{it} = \beta_0 + \beta_1 COE_{it} + \beta_2 ROA_{it} + \beta_3 SIZE_{it} + \beta_4 MTB_{it}$$

where LEV^* denotes the target leverage ratio, COE represents the cost of equity, ROA denotes profitability, $SIZE$ refers to firm size, and MTB represents growth opportunities. These variables are selected because they influence financing flexibility, access to external finance, target leverage, and adjustment speed (Liu et al., 2026, pp. 3, 6).

2.2 Dynamic Trade-off Theory and the Partial Adjustment Model

Dynamic trade-off theory explains why firms do not continuously maintain their capital structure at its target level. When actual leverage deviates from the optimum, managers compare the costs of deviation with the costs of adjustment, including equity issuance or repurchase, debt financing, taxes, disclosure, contractual expenses, and financing restructuring risks (Liu et al., 2026, p. 3).

Accordingly, firms do not adjust leverage instantaneously but eliminate only part of the gap between actual and target leverage each period, as described by the partial

adjustment model:

$$LEV_{it} - LEV_{i,t-1} = \lambda\left(LEV^{*}{}_{it} - LEV_{i,t-1}\right) + \varepsilon_{it}$$

where λ denotes the speed of adjustment. Values close to one indicate rapid adjustment, whereas values near zero indicate slow adjustment. A statistically insignificant coefficient implies insufficient evidence of systematic adjustment toward the target leverage.

Empirically, estimation involves two stages: first, estimating target leverage; second, calculating the adjustment gap and estimating the proportion eliminated in the following period (Liu et al., 2024, p. 2; Liu et al., 2026, p. 6).

Adjustment speed reflects financing efficiency and the firm's ability to respond to changing financing costs and market conditions. However, adjustment may slow when external financing is costly or access to capital markets is limited (Kumar & Pathak, 2025, p. 1).

2.3 Cost of Equity and Its Role in Capital Structure Adjustment

The cost of equity is the return required by shareholders for bearing the risks of investing in a firm's equity. It reflects the cost of equity financing and is affected by operating and financial risks, leverage, information quality, the institutional environment, and investors' expectations. It is commonly estimated using the Capital Asset Pricing Model (CAPM) (Sharpe, 1964, p. 428):

$$COE_{it} = R_{f,t} + \beta_{it}\left(R_{m,t} - R_{f,t}\right)$$

where R_f denotes the risk-free rate, β represents the systematic risk (beta coefficient), and $\left(R_m - R_f\right)$ denotes the market risk premium.

The cost of equity influences capital structure adjustment through two opposing channels. First, a higher cost of equity resulting from deviations from the target leverage ratio increases the cost of remaining away from the target, encouraging faster adjustment. Second, if restoring the target structure requires issuing costly new equity, firms may delay adjustment because of higher financing costs.

The second channel is more pronounced under high information asymmetry, where investors demand higher returns, increasing external financing costs and reducing adjustment speed (Kumar & Pathak, 2025, p. 2). Likewise, better ESG performance improves disclosure quality, reduces information asymmetry and financing costs, and facilitates more efficient capital structure adjustment (Xu et al., 2026, p. 2).

Accordingly, the effect of the cost of equity on adjustment speed is theoretically ambiguous. It may accelerate adjustment by increasing the cost of deviating from the target leverage, or slow it by raising the cost of external financing. The overall effect depends on which of these forces is stronger.

2.4. Transmission Channels of the Effect of Cost of Equity

a. Information Asymmetry

Information asymmetry between managers and investors increases uncertainty about firm value, raising investors' required returns. It may also discourage equity

issuance when managers believe shares are undervalued, increasing financing costs and hindering capital structure adjustment.

Reducing information asymmetry lowers transaction costs, improves access to external finance, and accelerates adjustment toward target leverage. Supplier concentration, for example, enhances monitoring and reduces leverage adjustment costs (Liu et al., 2024, pp. 1–2).

b. Financing Constraints

Financing constraints limit firms' ability to obtain external funds or increase their cost, reducing their capacity to correct deviations from target leverage. These constraints are more severe for smaller firms due to lower transparency, higher risk, and weaker collateral.

Su and Zheng show that SMEs adjust their capital structures more slowly because of financing constraints caused by information asymmetry, particularly during credit contractions. Poor disclosure and high borrowing costs further delay adjustment (Su & Zheng, 2025, pp. 1–2, 5–6).

c. Agency Costs and Corporate Governance

Agency conflicts may lead managers to maintain inefficient leverage or excessive cash holdings, delaying capital structure adjustment.

These costs increase under concentrated ownership, where controlling shareholders may pursue private benefits at the expense of minority investors, raising required returns and slowing adjustment. Strong corporate governance reduces agency problems and facilitates faster adjustment (Kumar & Pathak, 2025, pp. 2–3).

d. Financial Flexibility and Financial Technology (FinTech)

Financial flexibility enables firms to access financing efficiently, while FinTech improves information processing, credit assessment, and financing access, reducing costs and agency problems.

Li et al. find that firms' participation in FinTech accelerates capital structure adjustment by improving capital allocation, expanding financing opportunities, and reducing financial frictions and agency costs (Li et al., 2026, pp. 1–3).

2.5. Control Determinants of Target Leverage

In addition to the cost of equity, the study includes three control variables.

Profitability reflects a firm's ability to generate internal funds. According to the pecking order theory, more profitable firms rely more on retained earnings, reducing their dependence on debt. Conversely, stronger profitability may enhance borrowing capacity and increase target leverage or the speed of adjustment. Therefore, its expected effect remains theoretically ambiguous and depends on the adopted framework and sample characteristics.

Firm size is another important determinant of target leverage. Larger firms generally have greater diversification, stronger collateral, and easier access to capital markets at lower financing costs. In contrast, smaller firms tend to adjust more slowly

because of information asymmetry and higher borrowing costs, although effective institutional environments can reduce these constraints (Su & Zheng, 2025, pp. 1–2).

Growth opportunities, measured by the market-to-book ratio, may lead firms to target lower leverage because of higher agency costs associated with debt financing. However, greater investment needs can also increase demand for external financing, affecting the speed of capital structure adjustment. Previous studies identify growth opportunities, asset structure, profitability, and cash flows as key determinants of target leverage and adjustment decisions (Liu et al., 2026, pp. 3, 6).

2.6. Literature Review

The capital structure literature has evolved from explaining leverage determinants within a static framework to examining how firms adjust toward target leverage over time. This approach is based on the partial adjustment model, which assumes that firms have a target leverage ratio but cannot reach it immediately because of transaction costs, information asymmetry, financing constraints, and market risk. Consequently, the speed of adjustment (SOA) has become a key indicator of firms' movement toward target leverage. Recent studies show that SOA varies across firms, industries, and periods, while the cost of equity affects this process directly through financing costs or indirectly through market conditions, information effects, financing constraints, and digital transformation.

2.6.1. Cost of Equity and Deviations from Target Capital Structure

Zhou et al. (2016) provide the closest evidence to the present study by examining the relationship between deviations from target capital structure, the cost of equity, and the speed of adjustment. Using implied cost of equity measures and first-difference and System GMM estimators, they found that firms with greater sensitivity of the cost of equity to leverage deviations adjusted more rapidly, especially over-leveraged firms. The estimated adjustment speed reached about 51% for the high-sensitivity group compared with 22.5% for the low-sensitivity group. These findings suggest that the cost of equity can motivate firms to restore financial equilibrium. However, the weaker evidence for under-leveraged firms indicates an asymmetric adjustment process, limiting the generalization of a uniform effect across firms.

Karpates and Viverita (2022) extended this analysis to non-financial firms in the ASEAN-5 countries. Measuring the cost of equity with the CAPM and estimating the model using Difference GMM, they found that firms with higher sensitivity adjusted more quickly, whereas ignoring such heterogeneity produced biased SOA estimates. Although the study confirms this relationship in emerging markets, it focuses on sensitivity groups rather than directly estimating the effect of the cost of equity within capital-intensive sectors such as manufacturing and energy.

Hussain et al. (2023) examined the interaction between equity mispricing, Shariah compliance, and capital structure adjustment among Malaysian firms. Their findings showed that over-leveraged Shariah-compliant firms adjusted more rapidly when equity

was overvalued, whereas under-leveraged firms followed a more conservative adjustment strategy. The study highlights the roles of market timing and institutional constraints but provides only indirect evidence, since equity mispricing is a market signal rather than a direct measure of the cost of equity.

2.6.2. Heterogeneity in the Speed of Adjustment and Financial and Market Constraints

Another stream of the literature argues that the speed of adjustment (SOA) varies according to firms' risk profiles, financial constraints, debt maturity structures, and economic conditions. Fernando et al. (2021) distinguished between cumulative and marginal adjustment speeds as well as short- and long-term horizons. Their findings show that financially distressed firms adjust more rapidly than non-distressed firms due to higher borrowing, agency, and external financing costs. The study suggests that financial pressures accelerate adjustment, although this effect reflects overall financing conditions rather than the cost of equity alone. It also shows that adjustment speed estimates depend on the measurement approach and time horizon.

From the perspective of debt structure and market competition, Mirza et al. (2020) analyzed Chinese listed firms over 1998–2015 using a fractional dynamic panel estimator. They found that short- and long-term debt adjust at different speeds depending on product market competition, while larger firms adjust faster because of easier access to external finance and lower transaction costs. Although the study links adjustment to debt maturity rather than the cost of equity directly, it demonstrates that aggregate leverage may conceal important differences across financing sources.

Using GMM, Choi et al. (2024) examined 271 Korean non-financial firms during 1995–2021. They found that adjustment is faster under normal economic conditions than during financial crises and the COVID-19 pandemic, as worsening market conditions, uncertainty, and financing costs slow adjustment despite stronger incentives to reach target leverage. Thus, the costs of implementing adjustment may exceed its benefits during crises.

Similarly, Ju (2024) examined Korean listed firms and reported an average annual adjustment speed of 43.1%, showing that higher equity valuations encourage equity financing over debt. However, this average estimate may overlook differences across firms and industries, particularly between industrial and energy companies.

2.6.3. Digital Transformation, Information Channels, and the Cost of Financing

Recent literature has incorporated the technological dimension into explaining capital structure dynamics. Niu et al. (2023) examined the impact of digital transformation on the speed of capital structure adjustment among Chinese listed firms using the LSDVC estimator. Their findings show that digital transformation accelerates adjustment by reducing information asymmetry, agency costs, and financing constraints, while improving access to debt and equity financing. Although the study identifies lower

external financing costs as a transmission mechanism, it does not examine the cost of equity as a direct explanatory variable.

Similarly, Li and Li (2025) analyzed Chinese listed firms over 2010–2022 using fixed-effects models and mediation analysis. Their results indicate that digital transformation accelerates capital structure adjustment by reducing information asymmetry and enhancing financial stability and flexibility, particularly among highly leveraged firms. However, the study relies on a digital transformation index and fixed-effects mediation models rather than dynamic GMM techniques, while the proposed role of lower financing costs is not directly validated through an explicit measure of the cost of equity.

2.7. Critical Evaluation of the Literature and the Research Gap

The review of the selected studies reveals three main findings. First, firms adjust gradually rather than immediately toward target leverage through a partial adjustment process. Second, adjustment speed varies according to financial distress, market conditions, firm size, competition, equity market timing, crises, and digital transformation. Third, studies examining the cost of equity indicate that higher equity financing costs encourage faster adjustment, particularly for overleveraged firms. Likewise, Nguyen et al. (2024) show that adjustment speed is influenced by firm characteristics, governance, managerial incentives, financial markets, and macroeconomic conditions, suggesting that assuming a uniform adjustment speed across firms is unrealistic.

Despite these advances, important gaps remain. Research directly linking the cost of equity to adjustment speed is still limited compared with studies on profitability, firm size, growth opportunities, governance, and liquidity. In addition, the cost of equity is measured using different approaches, including CAPM, implied cost of equity, stock mispricing, and financing constraints, reducing the comparability of empirical findings. Likewise, studies employ diverse estimation techniques, such as Difference GMM, System GMM, LSDVC, fractional estimators, and fixed-effects models, which may partly explain inconsistent results. Most recent evidence also focuses on Asian markets, while sectoral evidence on industrial and energy firms remains scarce.

Another gap is that many studies treat non-financial firms as homogeneous despite the distinctive financing characteristics of industrial and energy firms, including high capital intensity, substantial tangible assets, continuous investment needs, and sensitivity to business cycles and energy prices. Moreover, several studies assess the role of the cost of equity indirectly through stock mispricing or digital transformation rather than incorporating it explicitly into target leverage estimation.

Within the dynamic trade-off framework, firms may establish target leverage ratios based on financing costs, profitability, firm size, and growth opportunities. The cost of equity may be associated with the target capital structure through its relationship with shareholders' required returns and financing decisions. Separately, the partial adjustment

framework suggests that firms may respond to deviations between actual and target leverage, although the magnitude and statistical significance of this response remain empirical questions. Accordingly, the present study distinguishes between the determinants of estimated target leverage and the dynamic response of actual leverage to the adjustment gap.

2.8. Hypotheses Development

Based on the dynamic trade-off framework, the study examines two related aspects of capital structure decisions: the association between the cost of equity and target leverage, and the response of actual leverage to deviations from its estimated target. Accordingly, the following hypotheses are proposed:

H1: *The cost of equity is significantly associated with the estimated target leverage ratio.*

H2: *The adjustment gap has a statistically significant association with subsequent leverage dynamics.*

3. Research Methodology

3.1. Study Sample and Data Sources

The study examines a balanced panel of ten publicly listed industrial and energy companies over the period 2010–2022, comprising 130 firm-year observations. The industrial companies include Siemens AG (Germany, Frankfurt Stock Exchange/Xetra), Caterpillar Inc., General Electric, 3M Company, and Boeing Company (United States, New York Stock Exchange). The energy companies comprise Chevron Corporation and Exxon Mobil Corporation (United States, New York Stock Exchange), TotalEnergies SE (France, Euronext Paris), and Shell plc and BP plc (United Kingdom, London Stock Exchange). The sample covers capital-intensive industries across four countries. Although the balanced panel structure facilitates the examination of within-firm financing dynamics, the limited number of firms restricts statistical power and the generalizability of the findings. Accordingly, the results are interpreted as exploratory evidence specific to the sampled companies rather than as representative evidence for the industrial and energy sectors as a whole.

The empirical analysis uses firm-year observations of financial leverage, cost of equity, profitability, firm size, and market-to-book ratios. However, the original data extraction records and the underlying inputs used to construct the cost-of-equity series were not retained, limiting independent verification of the financial data sources and measurement procedures.

3.2. Study Variables and Their Measurement

Table 1 presents the study variables, their symbols, measurement methods, and roles.

Table 1. Study Variables and Measurement Methods

Variable	Symbol	Measurement	Role
Leverage	**LEV**	Total Debt / Total Assets	Dependent
Cost of Equity	**COE**	$R_{f,t} + \beta_{it}(R_{m,t} - R_{f,t})$	Independent

Profitability	**ROA**	Net Income / Total Assets	Control
Firm Size	**SIZE**	Natural logarithm of Total Assets	Control
Growth Opportunities	**MTB**	Market Value / Book Value	Control

Source: Prepared by the authors based on previous studies

Measurement of the Cost of Equity (COE)

The Capital Asset Pricing Model (CAPM) provides the theoretical framework for the cost of equity:

$$K_{e,it} = R_{f,it} + \beta_{it}(R_{m,it} - R_{f,it})$$

where $R_{f,it}$ represents the risk-free rate, β_{it} denotes the firm's systematic market risk, and $(R_{m,it} - R_{f,it})$ represents the market risk premium. CAPM links shareholders' required returns to systematic market risk. The empirical analysis uses firm-year cost-of-equity values recorded in the study dataset. However, the underlying calculation inputs and estimation procedures were not retained, preventing independent verification of these values or confirmation that each observation was calculated using CAPM. This measurement limitation should be considered when interpreting the empirical results.

3.3. Empirical Model

The empirical analysis follows a two-stage approach. In the first stage, target leverage is approximated using a fixed-effects specification:

$$LEV_{it} = \alpha_i + \beta_1 COE_{it} + \beta_2 ROA_{it} + \beta_3 SIZE_{it} + \beta_4 MTB_{it} + u_{it}$$

The fitted values from this equation are used as estimates of target leverage:

$$\widehat{LEV^*_{it}} = \widehat{\alpha}_i + \widehat{\beta}_1 COE_{it} + \widehat{\beta}_2 ROA_{it} + \widehat{\beta}_3 SIZE_{it} + \widehat{\beta}_4 MTB_{it}$$

The adjustment gap is defined as:

$$Gap_{it} = \widehat{LEV^*_{it}} - LEV_{i,t-1}$$

The standard partial adjustment framework assumes that changes in actual leverage are proportional to the distance from the target:

$$LEV_{it} - LEV_{i,t-1} = \lambda Gap_{it} + \varepsilon_{it}$$

where λ represents the adjustment-speed parameter in the standard partial adjustment model.

The empirical dynamic specification reported in this study is:

$$LEV_{it} = \alpha + \rho LEV_{i,t-1} + \gamma Gap_{it} + \varepsilon_{it}$$

Here, ρ captures the conditional association between lagged and current leverage, while γ measures the conditional response of current leverage to the estimated adjustment gap. Because the estimated specification includes lagged leverage and the adjustment gap as separate regressors, γ cannot be interpreted directly as the standard

partial adjustment speed parameter. The first-stage coefficient of COE addresses H1, while the estimated gap coefficient in the dynamic specification addresses H2. The empirical design does not directly identify whether the cost of equity changes the adjustment-speed parameter.

3.4. Estimation Strategy and Diagnostic Tests

The target leverage model was estimated using the Fixed Effects (FE) estimator, supported by the Redundant Fixed Effects and Hausman tests.

The second stage employed the two-step System GMM estimator to address dynamic panel bias and endogeneity. The adjustment gap was treated as exogenous, whereas lagged leverage was specified as endogenous using second- and third-order collapsed instruments.

The two-step System GMM estimator was employed to account for dynamic persistence and potential endogeneity in leverage decisions. Nevertheless, System GMM is primarily justified under panel settings with a relatively large cross-sectional dimension and a shorter time dimension. Given the limited number of firms in the present sample, its conventional large-sample properties may not hold satisfactorily. To limit instrument proliferation, the estimation employed a restricted set of five instruments. However, maintaining fewer instruments than firms does not, by itself, establish estimator reliability. The resulting estimates and specification tests are therefore interpreted cautiously.

Model validity was assessed using the Arellano–Bond serial correlation test, the Sargan and Hansen tests, and the Difference-in-Hansen test.

4. Results

4.1. Descriptive Statistics

Table 2. Descriptive Statistics of the Study Variables

	LEVERAGE	COST_OF_EQUITY	ROA	SIZE_LN	MARKET_TO_BOOK
Mean	0.501	0.085	0.085	7.679	1.910
Median	0.508	0.085	0.089	7.582	1.859
Maximum	0.694	0.104	0.147	9.964	2.984
Minimum	0.306	0.070	0.021	6.694	0.815
Std. Dev.	0.117	0.010	0.037	0.574	0.662
Skewness	-0.034	0.146	-0.147	1.140	0.098
Kurtosis	1.732	1.833	1.756	4.926	1.705
Jarque-Bera	8.734	7.843	8.842	48.275	9.292
Probability	0.012	0.019	0.012	0.000	0.009
Observations	130	130	130	130	130

Source: Eviews 12 outputs

Table 2 reports the descriptive statistics for the study variables based on 130

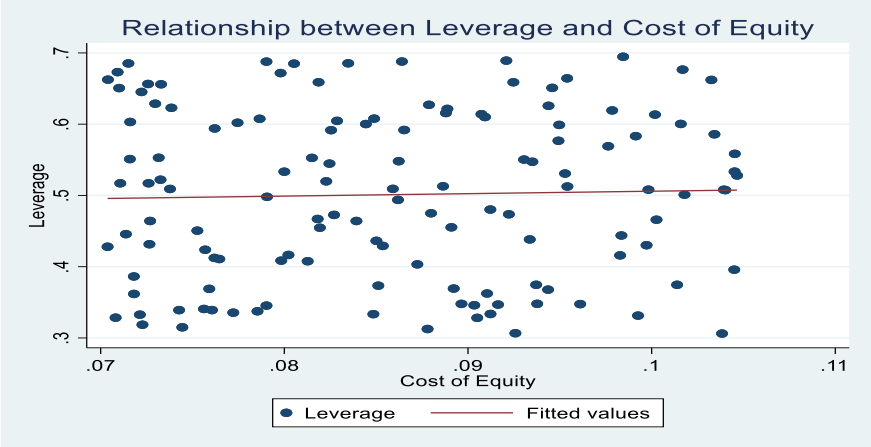
balanced panel observations. The mean leverage ratio is 0.501, indicating that debt finances about 50.1% of total assets on average (SD = 0.117). The average cost of equity and ROA are both 0.085. Mean firm size (SIZE_LN) is 7.679, while the average Market-to-Book ratio is 1.910, suggesting that market value generally exceeds book value.

The skewness values indicate limited asymmetry for most variables. Only firm size has a kurtosis above 3, indicating a more peaked distribution. The Jarque–Bera test rejects normality for all variables at the 5% level. However, this does not affect the validity of the dynamic panel estimation, as normality is not a prerequisite when robust standard errors are used.

4.2. Graphical Analysis of the Study Variables

To complement the descriptive analysis, graphical representations were used to illustrate the main characteristics of the dataset. These figures provide a visual overview of the relationships among the study variables and the variation in financial leverage across the sampled firms, supporting the subsequent econometric analysis.

Fig.1. Relationship between Financial Leverage and Cost of Equity for the Sampled Firms

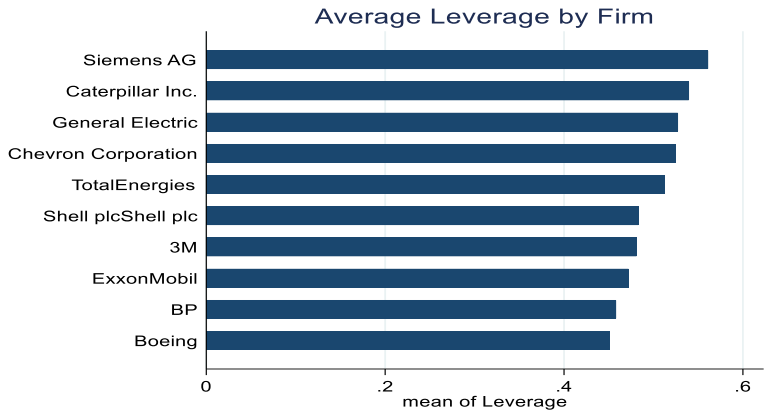


Source: Stata 17 outputs

Figure 1 illustrates the relationship between financial leverage and the cost of equity using a scatter plot with a fitted regression line. The observations are widely dispersed around the line, which shows a slight positive slope, indicating a weak positive association. This result is consistent with the low correlation coefficient reported in the correlation matrix, suggesting that financial leverage is influenced by factors beyond the cost of equity. Accordingly, the figure provides only descriptive evidence and does not imply a causal relationship.

Fig.2. Average Financial Leverage of the Sampled Firms during the Period 2010–2022

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Source: Stata 17 outputs

Figure 2 shows the average financial leverage of the sampled firms during 2010–2022. The results indicate limited variation, with average leverage ranging from approximately 0.45 to 0.56, reflecting broadly similar financing policies. Siemens AG recorded the highest average leverage, whereas Boeing and BP reported the lowest, indicating modest differences in capital structure across the sample.

4.3. Correlation Matrix and Variance Inflation Factor (VIF) Test

4.3.1. Correlation Matrix

Table 3. Correlation Matrix

	LEVERAGE	COST_OF_EQUITY	ROA	SIZE_LN	MARKET_TO_BOOK
LEVERAGE	1				
COST_OF_EQUITY	0.030	1			
ROA	0.049	-0.152	1		
SIZE_LN	0.153	-0.050	0.014	1	
MARKET_TO_BOOK	0.047	0.096	-0.066	-0.004	1

Source: Prepared by the authors based on Eviews 12 outputs.

Table 3 reports the Pearson correlation matrix for the study variables. All pairwise correlations among the independent variables are low, with the highest coefficient (0.1536) remaining well below the accepted threshold of 0.80, indicating no preliminary evidence of serious multicollinearity. Although both positive and negative relationships exist, their weak magnitudes suggest adequate independence among the regressors. These findings are further confirmed using the Variance Inflation Factor (VIF) test.

4.3.2. Variance Inflation Factor (VIF) Test

Table 4. Variance Inflation Factor (VIF)

Variable	VIF
Cost_of_Equity	1.034
ROA	1.026
Size_ln	1.002
Market_to_Book	1.012

Source: Prepared by the authors based on Stata 17 outputs.

Table 4 presents the Variance Inflation Factor (VIF) results used to assess multicollinearity among the explanatory variables. VIF values range from 1.002 to 1.034, well below the thresholds of 5 and 10, indicating no multicollinearity problem. These findings are consistent with the correlation matrix and confirm the suitability of the explanatory variables for the subsequent panel data analysis.

4.4. Cross-sectional Dependence Test

Table 5. Cross-sectional Dependence Test Results (Pesaran CD)

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	60.218	45	0.064
Pesaran scaled LM	1.604		0.109
Pesaran CD	1.238		0.216

Source: Prepared by the authors based on Stata 17 outputs.

Table 5 reports the results of the cross-sectional dependence test. The Pesaran CD and Pesaran Scaled LM tests yield p-values of 0.216 and 0.109, respectively, providing no evidence of cross-sectional dependence at the 5% significance level. The Breusch–Pagan LM test reports a p-value of 0.064, indicating only marginal evidence at the 10% level. Therefore, the null hypothesis of cross-sectional independence cannot be rejected at the 5% level, although the results should be interpreted with caution. Accordingly, first-generation panel unit root tests were employed in the subsequent analysis.

4.5. Panel Unit Root Tests

Table 6. Panel Unit Root Test Results

Variable	LLC	IPS	ADF-Fisher	PP-Fisher	Order of Integration
Leverage	- 9.039 (0.000)	- 4.185 (0.000)	110.564 (0.000)	188.896 (0.000)	**I(0)**
Cost_of_Equity	-11.493 (0.000)	-6.123 (0.000)	128.838 (0.000)	162.834 (0.000)	**I(0)**
ROA	-8.484 (0.000)	-4.405 (0.000)	103.934 (0.000)	176.954 (0.000)	**I(0)**
Size_ln	1.552 (0.060)	0.644 (0.260)	31.808 (0.045)	47.894 (0.000)	**Mixed I(0)/I(1); not I(2)**
Market_to_Book	-9.887 (0.000)	-5.021 (0.000)	111.471 (0.000)	157.872 (0.000)	**I(0)**

Source: Prepared by the authors based on Eviews 12 outputs.

Table 6 reports the results of the LLC, IPS, ADF–Fisher, and PP–Fisher panel unit root tests. Under the Individual Intercept specification, most variables are stationary at level, as the null hypothesis of a unit root is rejected at the 5% significance level.

For Size_ln, the results are mixed: the LLC and IPS tests suggest I(1), whereas the ADF–Fisher and PP–Fisher tests indicate stationarity at level. However, all tests confirm that the variable is stationary after first differencing and is not integrated of order two (I(2)).

Overall, none of the variables is integrated of order two, confirming the suitability

of the data for estimating the dynamic panel model and analyzing the speed of capital structure adjustment.

4.6. Benchmark Model Selection Results

Table 7. Comparison of Panel Data Models

variable	Pooled OLS	Fixed Effects	Random Effects
Cost of Equity	0.477 (0.638)	0.901 (0.380)	0.488 (0.617)
ROA	0.176 (0.527)	0.068 (0.804)	0.168 (0.530)
Size_ln	0.032 (0.081)	**0.086** **(0.001)**	0.034 (0.057)
Market-to-Book	0.008 (0.593)	0.001 (0.966)	0.008 (0.603)
R^2	0.030	0.175	0.032
Adjusted R^2	-0.001	0.083	0.001
F-statistic (Prob.)	0.971 (0.426)	1.893 (0.038)	1.033 (0.393)

Source: Prepared by the authors based on Eviews 12 outputs.

Note: Values reported in parentheses are p-values.

Table 8. Benchmark Model Selection Tests

Test	Statistic	p-value	Decision
Redundant Fixed Effects (F)	2.264	0.0226	Reject the null hypothesis
Redundant Fixed Effects (Chi-square)	21.037	0.0125	Reject the null hypothesis
Hausman Test	14.126	0.0069	Fixed Effects model preferred

Source: Prepared by the authors based on Eviews 12 outputs.

Tables 7 and 8 compare the panel estimators and report the benchmark model selection tests. The Pooled OLS model showed weak explanatory power ($R^2 = 0.030$), with no significant coefficients. The Fixed Effects (FE) model performed better ($R^2 = 0.175$), with firm size as the only positive and significant variable (1% level). The Random Effects (RE) model produced results similar to Pooled OLS, with low explanatory power and mostly insignificant coefficients.

The Redundant Fixed Effects test rejected the null hypothesis under both the F and Chi-square statistics, indicating significant firm-specific effects and favoring the FE model over Pooled OLS. The Hausman test ($p = 0.0069$) also supported the FE specification over RE.

Given the dynamic nature of capital structure adjustment and potential endogeneity, the second stage applies the System GMM estimator to estimate the speed of capital structure adjustment.

4.7. Estimation Results of the Target Leverage Model

In the first stage, the target leverage was estimated using the Fixed Effects (FE) model, after model selection tests confirmed its superiority over the pooled OLS and random-effects specifications. The target leverage equation included cost of equity,

profitability, firm size, and growth opportunities as the main determinants of capital structure. The estimation results are presented in Table 9.

Table 9. Estimation Results of the Determinants of Target Leverage

Variable	Coefficient	Standard Error	t-value	p-value
Cost of Equity	0.9006	1.0209	0.88	0.380
Profitability (ROA)	0.0678	0.2722	0.25	0.804
Firm Size (Size_ln)	0.0857***	0.0250	3.43	0.001
Growth Opportunities (Market-to-Book)	0.0007	0.0156	0.04	0.966
Constant	-0.2414	0.2278	-1.06	0.291
Model Statistics				
Indicator			**Value**	
Number of observations			130	
Number of firms			10	
Within R^2			0.0932	
Between R^2			0.0330	
Overall R^2			0.0259	
F-statistic			2.98	
Prob > F			0.0220	
F-test for individual effects			2.26	
Prob > F			0.0226	
ρ			0.2075	

Source: Prepared by the authors based on Stata 17 outputs.

*** Significant at the 1% level.

The FE model is jointly significant ($F = 2.98$; $p = 0.022$), while the F-test for individual effects ($p = 0.0226$) confirms firm-specific heterogeneity, supporting the use of the FE estimator.

Among the explanatory variables, firm size is the only variable with a positive and statistically significant effect ($\beta = 0.0857$, $p = 0.001$), indicating that larger firms tend to maintain higher target leverage. By contrast, cost of equity has a positive but insignificant effect ($\beta = 0.9006$, $p = 0.380$). Likewise, profitability and growth opportunities are statistically insignificant ($p = 0.804$ and 0.966, respectively).

The within R^2 (0.0932) indicates that the model explains a limited share of the variation in target leverage, suggesting that additional factors may also influence firms' capital structure decisions.

4.8. System GMM Results and Diagnostic Tests

4.8.1. Dynamic Leverage Estimation Using System GMM

In the first stage, target leverage was estimated as a function of the cost of equity

and the control variables (profitability, firm size, and growth opportunities). The adjustment gap (Gap) was then incorporated into a two-step System GMM model to estimate the speed of capital structure adjustment.

Table 10. System GMM Estimation Results for the Speed of Capital Structure Adjustment

Variable	Coefficient	Standard Error	t-value	Prob.
L.Leverage	0.3600	0.7267	0.50	0.632
Gap	0.6574	0.6320	1.04	0.325
Constant	0.3185	0.3736	0.85	0.416

Source: Prepared by the authors based on Stata 17 outputs.

Table 11. Diagnostic Tests for the System GMM Model

Test	Value
Number of observations	120
Number of firms	10
Number of instruments used	05
F-statistic Prob > F	2371.47 0.000
Arellano–Bond AR(1)	0.042
Arellano–Bond AR(2)	0.188
Hansen Test	0.953
Sargan Test	0.977
Difference-in-Hansen: GMM instruments for levels	0.787
Difference-in-Hansen: iv(Gap)	0.763

Source: Prepared by the authors based on Stata 17 outputs.

The two-step System GMM estimator was employed to examine leverage dynamics and the response to the estimated adjustment gap while addressing dynamic panel bias and potential endogeneity.

As shown in Table 10, the coefficient of the lagged leverage variable (L.Leverage) is 0.360, but it is statistically insignificant ($p = 0.632$). Likewise, the adjustment gap (Gap) has a positive but insignificant coefficient (0.657, $p = 0.325$), indicating no statistically significant speed of adjustment toward the target capital structure. This may reflect stable financing policies or omitted institutional and market factors.

Table 11 reports the diagnostic tests associated with the two-step System GMM estimation. The Arellano–Bond test indicates significant first-order serial correlation ($p = 0.042$), whereas the null hypothesis of no second-order serial correlation is not rejected ($p = 0.188$). Similarly, the Hansen ($p = 0.953$) and Sargan ($p = 0.977$) tests do not reject the overidentifying restrictions. The estimation uses five instruments for ten firms, limiting instrument proliferation. Nevertheless, these diagnostic outcomes should not be

interpreted as conclusive evidence of instrument validity or estimator reliability, particularly given the small cross-sectional dimension. Although the reported model-level test is statistically significant, the individual coefficients of lagged leverage and the adjustment gap remain statistically insignificant. Consequently, the estimates provide limited evidence regarding systematic capital structure adjustment.

Nevertheless, the findings should be interpreted cautiously because the sample includes only ten firms, which may limit the power of the diagnostic tests despite the small-sample correction.

Overall, the results indicate that the cost of equity is not significantly associated with estimated target leverage, while the adjustment-gap coefficient is also statistically insignificant. The empirical evidence is therefore insufficient to establish a systematic adjustment response. However, the specification does not directly test whether the cost of equity influences the speed of capital structure adjustment.

4.8.2. Interpretation of the Adjustment-Gap Coefficient

This study adopts the Partial Adjustment Model (PAM), in which the speed of capital structure adjustment is measured by the adjustment gap (Gap) coefficient:

$$\Delta LEV_{it} = \lambda Gap_{it} - \varepsilon_{it}$$

where λ denotes the speed of adjustment toward the target leverage ratio.

The estimated coefficient of the adjustment gap is positive (0.6574) but statistically insignificant (p = 0.325). Although its positive sign is consistent with movement toward the estimated target leverage, the coefficient cannot be interpreted as a statistically established adjustment speed. Moreover, the estimated dynamic specification includes both lagged leverage and the adjustment gap, requiring caution when relating the estimated gap coefficient to the adjustment parameter of the standard partial adjustment model. Therefore, the findings do not provide sufficient evidence to establish a precise or statistically significant speed of adjustment for the sampled firms.

5. Discussion

5.1 Discussion of the Research Hypothesis

The study examined two hypotheses concerning the relationship between the cost of equity and estimated target leverage, and the response of actual leverage to deviations from its estimated target.

Regarding H1, the fixed-effects results indicate a positive but statistically insignificant coefficient for the cost of equity (β = 0.9006; p = 0.380). Thus, the null hypothesis of no association cannot be rejected at conventional significance levels.

Regarding H2, the estimated coefficient of the adjustment gap is positive (γ = 0.6574) but statistically insignificant (p = 0.325). Therefore, the results do not provide sufficient statistical evidence of a systematic response of actual leverage to the estimated adjustment gap.

Taken together, these findings do not establish either a statistically significant association between the cost of equity and estimated target leverage or a statistically

significant adjustment response in the sampled firms. Importantly, they should not be interpreted as evidence that the cost of equity has no effect on adjustment speed, since this specific relationship is not directly identified by the empirical specification.

5.2 Comparison with Previous Literature

The empirical findings reveal no statistically significant association between the cost of equity and estimated target leverage. Similarly, the adjustment-gap coefficient is positive but statistically insignificant, providing insufficient evidence of systematic adjustment toward the estimated target. These results should not be interpreted as demonstrating the absence of capital structure adjustment, particularly given the limited sample size and the uncertainty surrounding the estimated coefficients.

Previous studies, including Zhou et al. (2016) and Karpates and Viverita (2022), have examined the relationship between equity financing costs and capital structure adjustment. However, direct comparisons require caution because the present study incorporates the cost of equity into the target-leverage equation rather than estimating its direct effect on the adjustment-speed parameter. Differences in empirical specification, sample characteristics, and institutional environments may contribute to the variation in reported findings.

The findings are, however, consistent with studies showing that adjustment speed depends on broader determinants. Fernando et al. (2021) linked faster adjustment to financial distress, while Mirza et al. (2020) emphasized product market competition and firm size. Likewise, Ju (2024) and Choi et al. (2024) found that adjustment speed varies across business cycles.

Recent evidence also suggests that digital transformation and lower information asymmetry facilitate capital structure adjustment (Niu et al., 2023; Li & Li, 2025). The present findings imply that these indirect channels may be more influential than the direct effect of the cost of equity.

Overall, the results suggest that the cost of equity affects capital structure adjustment indirectly and within institutional and macroeconomic conditions, consistent with Nguyen et al. (2024), who argued that adjustment speed reflects the combined influence of multiple internal and external determinants rather than a single factor.

5.3. Theoretical Implications

The findings offer limited but relevant evidence concerning the dynamic trade-off framework. The statistically insignificant association between the cost of equity and estimated target leverage does not establish that equity financing costs are irrelevant to capital structure decisions. Likewise, the insignificant adjustment-gap coefficient does not provide sufficient evidence of systematic movement toward estimated target leverage, but neither does it establish that such adjustment is absent.

These results underscore the importance of distinguishing the determinants of target leverage from the factors governing adjustment dynamics. They also suggest the need for empirical specifications that explicitly identify whether financing costs

influence the adjustment-speed parameter. Given the limited sample size and the methodological constraints of the present study, the findings should be interpreted as inconclusive rather than as a rejection of dynamic trade-off theory.

5.4. Methodological Limitations

The findings are subject to several methodological limitations. First, the sample includes only ten firms, which restricts statistical power, external validity, and the reliability of large-sample inference under System GMM. Second, the target leverage model exhibits limited within-firm explanatory power (within $R^2 = 0.0932$), suggesting that the selected regressors capture only a modest proportion of within-firm leverage variation. Third, the empirical specification does not directly identify how the cost of equity changes the adjustment-speed parameter. Finally, the study does not distinguish between over-leveraged and under-leveraged firms, although adjustment behavior may differ across these groups. These limitations should be considered when interpreting the findings and motivate further investigation using larger samples, richer specifications, and alternative estimation approaches.

Additionally, the cost of equity is measured using the CAPM, which relies on estimated systematic risk and may not fully capture forward-looking investor expectations. Future studies could assess the sensitivity of the findings to alternative measures, including implied cost-of-equity estimates derived from valuation models, subject to the availability and reliability of the required inputs.

6. Conclusion

This study examined the relationship between the cost of equity and estimated target leverage and investigated capital structure adjustment dynamics among ten industrial and energy companies during 2010–2022. The analysis employed a fixed-effects model to approximate target leverage and a two-step System GMM specification to examine the response of actual leverage to deviations from the estimated target.

The fixed-effects results indicate that the cost of equity has a positive but statistically insignificant association with estimated target leverage, whereas firm size exhibits a positive and statistically significant coefficient. The dynamic model also produces a positive but statistically insignificant adjustment-gap coefficient. Consequently, the findings do not provide sufficient evidence of a systematic adjustment response among the sampled firms. Importantly, the empirical specification does not directly identify whether the cost of equity influences the speed of capital structure adjustment.

From a managerial perspective, firms should periodically assess deviations between actual and target leverage and evaluate financing decisions in light of liquidity conditions, refinancing requirements, transaction costs, and financial flexibility. Strengthening financial disclosure and monitoring access to alternative funding sources may also support more informed capital structure decisions. These recommendations represent general managerial implications rather than causal effects established by the

empirical analysis.

The findings should be interpreted cautiously because the sample includes only ten firms, the target-leverage model has limited explanatory power, and the small cross-sectional dimension constrains inference under System GMM. In addition, the underlying inputs used to construct the cost-of-equity series were not retained, limiting independent verification of its measurement. Future research should employ larger and better-documented datasets, investigate asymmetric adjustment among over-leveraged and under-leveraged firms, compare alternative cost-of-equity measures, and directly estimate the interaction between equity financing costs and leverage deviations. Such extensions would provide a stronger basis for understanding the determinants and dynamics of capital structure adjustment.

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