Impact of Agency Cost of Debt on Capital Structure: A Study on DSE-listed Manufacturing Firms

Dr. Samia Sultana Tani[1]
Dr. A. A. Mahboob Uddin Chowdhury[2]
Hussain Ahmed Enamul Huda[3]

Abstract:

The study explored the nature of relationship between agency cost of debt and leverage ratio. The theoretical motivation largely stems from Jensen and Meckling's (1976) seminal work whereby it is postulated that managers would refrain from using debt amidst underinvestment, and asset substitution risk. The study used DSE-based manufacturing firms' panel data covering a 12-year timeframe [2014-2025]. Using regression-led causal research, the study concluded that there exists a negative impact of agency cost of debt on leverage decision. The estimated negative effect of agency cost of debt on leverage ratio is theoretically supported, and meaningful from both economic and statistical perspectives. The estimated effects remain robust to endogeneity concerns like omitted variable bias, reverse causality problem, and measurement issues. A gamut of robustness tests has also solidified the results as the estimated effects remain valid in cross-sectional heterogeneity tests, outlier tests, out-of-sample predictability tests etc.

Keywords: Agency Cost of Debt, Capital Structure, Leverage Ratio, Manufacturing Firms

JEL Classification: G32, G34, C33, L60

DOI: https://www.doi.org/10.61607/JFB.V22N1-2.A1

Article Info: Submission Date: July 11, 2025; Acceptance Date: November 28, 2025.

1.0 Introduction

Capital structure decision is shaped by tax considerations, the possibility of financial distress, information asymmetry often prevailing between managers and investors, and the conflicts of interest that often exist among different stakeholder groups. Out

[1] Corresponding Author and Associate Professor, Department of Finance, Faculty of Business Studies, University of Dhaka, Dhaka, Bangladesh, E-mail: samia@du.ac.bd.

[2] Professor, Department of Finance, Faculty of Business Studies, University of Dhaka, Dhaka, Bangladesh, E-mail: mchy17@du.ac.bd.

[3] Assistant Professor, Department of Finance, Faculty of Business Studies, University of Dhaka, Dhaka, Bangladesh, E-mail: haehuda@du.ac.bd.

of these stakeholder conflicts, the friction between shareholders and creditors has attracted theoretical and empirical attention. Conflict of interest between shareholders and bondholders is known as agency cost of debt, and this agency cost often influences how much debt firms are willing and able to carry (Jensen & Meckling, 1976). Despite the depth of this scholarship, the exact way in which agency cost of debt influences capital structure policy in developing economies such as Bangladesh has received comparatively little examination — a gap the present study addresses.

Agency cost of debt, as postulated by Jensen and Meckling (1976), is defined as the loss in firm value arising from conflicts of interest between equity holders and creditors. Because shareholders hold a residual, option-like claim, they gain from upside risk but face limited downside, creating incentives to act at the expense of creditors in at least three well-documented ways. It is worth mentioning that agency of cost intensifies when firm's distress condition gets worse. First, asset substitution occurs when shareholders redirect investment toward riskier projects than creditors foresaw, capturing potential gains while transferring downside risk to lenders (Jensen & Meckling, 1976). Second, the underinvestment problem arises when a heavily leveraged firm bypasses positive net-present-value projects because the gains would flow predominantly to creditors rather than shareholders (Myers, 1977). Third, excessive dividend payouts effectively withdraw creditor-financed assets from the firm for shareholder benefit (Black & Scholes, 1973). Rational creditors anticipate these behaviors, price them into lending spreads or writing protective covenants into debt contracts, both of which raise the effective cost of borrowing and constrain firms' appetite for leverage (Smith & Warner, 1979).

The literature does present an academic tension. The most dominant view, embedded in trade-off theory, holds that high agency costs reduce the attractiveness of debt because creditors demand risk premiums and restrict credit availability – thereby driving firms toward lower leverage (Myers, 1977; Kraus & Litzenberger, 1973). A dissenting view, however, casts debt in a disciplinary rather than a destructive role. Jensen (1986) argued that debt obligations drain free cash flow and thereby curtail the managerial discretion, suggesting that in high managerial-agency-cost environments, more leverage — not less — may be value-enhancing. This unresolved tension means the direction of impact of agency cost of debt on leverage cannot be assumed in advance; it must be determined empirically.

Bangladesh-based capital market provides a distinctive and under-studied setting. Its listed manufacturing sector has grown substantially over the past two decades,

propelled by ready-made garments, pharmaceuticals, and engineering industries. The institutional backdrop, however, differs considerably from the developed markets. Weak creditor protection, concentrated family ownership, nascent bond markets, and limited institutional investor monitoring all characterize Bangladeshi corporate environment (La Porta et al., 1998), and these features can amplify or dampen agency costs of debt in ways that established theory — calibrated largely on advanced-economy data — may not anticipate.

The study uses panel data extracted from listed manufacturing firms traded in Dhaka Stock Exchange (DSE) to examine how agency cost of debt affects leverage ratios. The paper proceeds as follows: Section 2 reviews the relevant theoretical and empirical literatures; Section 3 describes the data and research methodology; Section 4 presents the results along with analysis; and Section 5 discusses implications and concludes.

2.0 Literature Review

Modigliani and Miller (1958) demonstrated that under perfect capital markets —— a firm's value is independent of how it is financed. Modigliani and Miller (1963) then introduced corporate taxation into the model and showed that because interest payments are tax-deductible, debt generates a tax shield that adds to firm value, leading — in the absence of countervailing costs — to the corner solution of full debt financing.

Trade-off theory, postulated Kraus and Litzenberger (1973) and subsequent contributors, holds that firms select leverage by equating the marginal tax benefit of debt with its marginal cost, where the latter encompasses both expected financial distress costs and agency frictions. At moderate leverage, the tax shield dominates; beyond a threshold, rising default probability and the associated costs borne by employees, customers, and other stakeholders erode its value (Myers, 1984). For manufacturing firms — which tend to hold significant tangible assets usable as collateral — trade-off theory predicts relatively high debt capacity, a prediction that Frank and Goyal (2009) confirm empirically, identifying asset tangibility as one of the most robust cross-sectional determinants of leverage.

Myers and Majluf (1984) challenged the trade-off framework with the pecking order theory, grounded in information asymmetry between better-informed managers and less-informed outside investors. When a firm issues equity, the market interprets this as a signal that management regards the stock as overvalued, depressing the share price; to avoid this adverse selection cost, firms rank financing sources, preferring

internal funds first, then debt, and resorting to equity only as a last resort. Pecking order theory therefore predicts no single target leverage ratio. Shyam-Sunder and Myers (1999) provided supportive evidence showing that debt issuance tracks financing deficits closely, while Lemmon and Zender (2010) showed the theory performs especially well for firms with constrained equity market access — a condition relevant to smaller manufacturers.

Baker and Wurgler (2002) added a behavioral dimension through market timing theory, arguing that managers issue equity when market valuations appear generous and buy it back when they seem depressed. Unlike trade-off and pecking order theories, market timing imposes no particular leverage target; the observed debt ratio at any moment is simply the cumulative residue of past opportunistic financing decisions. Baker and Wurgler (2002) showed empirically that past market-to-book ratios leave persistent imprints on leverage, consistent with this path-dependent view of capital structure.

Jensen and Meckling (1976) decompose agency costs of debt into three elements: the monitoring expenditures incurred by bondholders, the bonding costs borne by the firm in committing to creditor-protective behaviour (such as covenant compliance), and the residual loss — the value that is destroyed despite monitoring and bonding. All three components are real economic costs that reduce firm value and shape the terms on which debt can be raised.

The three principal mechanisms of shareholder expropriation are well established. Asset substitution occurs when shareholders, shielded from full downside risk, substitute riskier investment projects for safer ones after debt has been placed, transferring volatility risk to creditors (Jensen & Meckling, 1976). The underinvestment problem arises when leverage is so high that equity holders decline profitable projects whose returns would flow mainly to creditors rather than themselves (Myers, 1977). Excessive dividend distributions drain firm assets, shifting value from creditors to shareholders in ways that were not priced into the original lending terms (Black & Scholes, 1973). Leland (1994) showed formally that the optimal capital structure reflects a balance between the tax shield and these agency-induced distortions, and that structuring debt with shorter maturities or conversion features can mitigate risk-shifting by aligning incentives more closely.

Parallel to the agency cost literature, a signaling strand treats debt issuance as an informational event rather than a source of conflict. Ross (1977) argued that because managers bear personal losses from financial distress, committing to high debt levels is a costly signal that only managers of fundamentally sound firms would be

prepared to send. Outside investors, unable to directly observe firm quality, rationally interpret leverage as a positive quality signal. Masulis (1980) provided early empirical corroboration, documenting positive abnormal stock returns around leverage-increasing exchange offers and negative returns around leverage-reducing ones, consistent with debt carrying positive informational content.

The agency cost framework generates testable predictions: firms exposed to more severe shareholder–creditor conflicts should, all else equal, carry less debt, because the risk premium demanded by lenders and the restrictions imposed through covenants raise the effective cost of borrowing (Smith & Warner, 1979). Myers (1977) formalized a related prediction by linking the composition of assets to leverage capacity: firms whose value is concentrated in growth opportunities face the steepest underinvestment problem and should therefore borrow least, while firms with predominantly tangible, collateralizable assets face milder agency conflicts and can sustain higher leverage.

Titman and Wessels (1988) found that asset uniqueness — a proxy for liquidation difficulty and financial distress severity — was negatively associated with leverage. Manufacturers of highly specialized or proprietary equipment fall naturally into this high-uniqueness category. Rajan and Zingales (1995), concluded that tangibility relates positively to leverage and growth opportunities negatively — an agency-cost pattern that proved robust across different institutional environments. Faulkender and Petersen (2006) added a supply-side dimension, showing that firms with access to public debt markets carry significantly more leverage than those relying on private lenders, which they attribute partly to the superior monitoring capacity of public bondholders reducing effective agency costs. Dang (2011) tested the asset substitution prediction directly in a UK sample, finding that firms with higher R&D intensity — a proxy for the scope for risk-shifting — maintained lower leverage ratios, lending direct support to Jensen and Meckling's original framework.

Beyond the firm's asset structure, debt covenants serve as a central mechanism for managing agency costs in practice. Smith and Warner (1979) identified restrictions on investment, dividend policy, and further borrowing as the most prevalent protective provisions in bond indentures. Roberts and Sufi (2009) demonstrated that covenant violations set off renegotiations that lead to measurable reductions in capital expenditure and employment, underscoring that agency costs of debt produce tangible real effects.

Several firm and institutional characteristics modify the baseline agency cost–leverage relationship. Firm size matters because larger firms typically enjoy lower

information asymmetry — they attract more analyst coverage and are subject to more rigorous disclosure obligations — and have well-established credit reputations that reduce the risk premium demanded by lenders (Titman & Wessels, 1988). Large manufacturing incumbents with diversified product lines accordingly face lower effective agency costs than smaller, newer entrants and can therefore sustain higher leverage.

Growth opportunities constitute a second moderating channel. Myers (1977) showed that the underinvestment problem intensifies with the proportion of value attributable to future investment discretion; consequently, firms in high-growth sub-sectors — electronics, pharmaceuticals, advanced materials — should exhibit lower leverage than counterparts in capital-intensive, mature segments such as basic metals or commodity chemicals. This prediction has found empirical support across multiple studies (Frank & Goyal, 2009; Rajan & Zingales, 1995).

Corporate governance quality and the broader legal environment also play a conditioning role. Effective internal governance mechanisms curtail both managerial and shareholder opportunism, reducing agency costs overall (Shleifer & Vishny, 1997). La Porta et al. (1998) demonstrated that the strength of statutory creditor protection is a significant determinant of both the cost and availability of debt, with weak creditor rights pushing lenders toward higher spreads and tighter covenants, which in turn suppresses equilibrium leverage. These institutional constraints are especially consequential in emerging market settings. Booth et al. (2001) found that while the determinants of capital structure identified in developed market research — tangibility, growth opportunities, profitability — are directionally consistent across developing countries, their magnitudes differ substantially, reflecting the mediating role of institutional quality. Bangladesh, with its underdeveloped bond market and relatively weak creditor protection regime, is precisely the kind of setting where institutional frictions may reshape or amplify the agency cost dynamics documented in the developed market literature.

According to the literature, capital structure determination emerges as a process shaped by multiple, sometimes competing forces. The MM theorem defines the frictionless benchmark; trade-off theory introduces distress costs and tax benefits; pecking order theory foregrounds information asymmetry; and market timing theory adds behavioural path-dependence. The agency cost framework, drawing primarily on Jensen and Meckling (1976) and Myers (1977), threads through each of these accounts by explaining how the specific conflicts of interest between shareholders and creditors influence both the demand for debt and the terms on which it is supplied.

For manufacturing firms, the empirical evidence points to countervailing pressures: high tangibility reduces agency conflicts and supports borrowing capacity, while firm-specific assets, innovation intensity, and growth optionality heighten those frictions and push toward more conservative financing. In emerging market contexts such as Bangladesh, these tensions are further conditioned by institutional imperfections that can amplify agency costs above what developed market models predict. Whether the net effect on leverage is negative — the dominant theoretical expectation — or positive, through the disciplinary channel identified by Jensen (1986), is ultimately an empirical question that the present study sets out to answer.

3.0 Methodology and data

This section sets out the methodological choices made by the researchers to investigate how agency cost of debt influences the leverage decisions. This study is firmly aligned with the positivist philosophy. The research never required the subjective judgment of participants or the interpretive input from the researchers (Saunders et al., 2007).

This research followed a deductive approach. Capital structure literature has long been documented [which firm-level characteristics — including proxies for the agency cost of debt — are likely to influence leverage ratios are well-known]. The research question addressed here was contextual with specific reference to Bangladesh's listed manufacturing sector. Null hypotheses derived from established theoretical frameworks were tested against collected secondary data.

All variables in this study are financial ratios – constructed using data from the annual reports. The research is quantitative throughout. Multiple regression analysis forms the backbone of the empirical work, supplemented by machine learning techniques like KNN algorithm, Naïve Bayesian algorithm, Decision-tree etc. This research is grounded in archival research. Financial data were extracted from the publicly available annual reports of listed manufacturing firms and compiled into a purpose-built Excel-based database.

The population comprised all firms listed on the Dhaka Stock Exchange (DSE). From this wider pool, financial service firms — banks, insurance companies, and NBFIs — were excluded. The rationale is straightforward: these entities operate under a regulatory framework that differs fundamentally from the one governing manufacturing firms, rendering their capital structure decisions incomparable on the same analytical terms. So, the chosen sampling technique was purposive sampling — whereby firms are selected on the basis of their relevance to the research question rather than at random (Kothari, 2014).

The study draws on a panel dataset spanning 2014 to 2025 [twelve years of annual observations per firm]. This particular window was chosen to capture meaningful variation in leverage behavior across different phases of the business cycle. As already mentioned, all the data were sourced from publicly accessible annual reports.

Research data were recorded annually and were in ratio format, making them amenable to the full range of statistical operations. Missing observations were handled by Stata – a package which automatically excludes incomplete cells — a standard and well-accepted convention in empirical corporate finance (Kothari, 2014). For the baseline regressions, no data-smoothing techniques were applied. As a robustness check, the dataset was subsequently winsorized at the 5% threshold – again a procedure routinely employed in empirical finance research (Dougherty, 2021).

Ethical considerations related to this study were minimal. Annual reports are publicly available, freely accessible and unrestricted in their use for academic purposes. Their adoption raises none of the consent, confidentiality, or non-discrimination concerns that commonly arise in studies involving primary data (Hayashi, 2021). The following table has presented the operational definition of research variables.

Table 1: Operational definition of research variables

Dimension	Label [Variable name]	Operational Definition	Major theory behind variable's inclusion
Dependent variable	LR (Financial leverage)	[Total debt/ (Total debt + book value of equity)] [data was collected at firm-level]; it was a ratio-variable.	
Agency Variable (Key independent variables)	AD (Agency cost of debt)	Agency cost of debt = [1-(Gross fixed asset/Total asset)] [data was collected at firm-level]; it was a ratio-variable.	Agency theory (Jensen and Meckling, 1976)
	Bankruptcy risk (BR)	Coefficient of variation of EBIT [data was collected at firm-level]; it was a ratio-variable.	Trade-off theory (Kraus and Litzenberger, 1973)
	Effective tax rate (TR)	Effective tax rate = Tax expense/EBT ([data was collected at firm-level]; it was a ratio-variable.	MM Proposition with tax (1963)

Control/independent variables	NDTS (Non-debt tax shields)	NDTS = [{Operating income-interest expense-(total tax paid/average corporate tax rate)}/Total sales] [data was collected at firm-level]; it was a ratio-variable.	De Angelo and Masulis (1980)
	PROF (Past profitability)	Profitability = 3 -year average of (Net income/sales) [data was collected at firm-level]; it was a ratio-variable. Rolling-average was used to construct the variable.	Pecking order theory (Myers, 1984)
	UNIK (Firm uniqueness)	Uniqueness index = Selling expense/sales [data was collected at firm-level]; it was a ratio-variable.	Stakeholder theory (Titman, 1988; Cornell and Shapiro, 1987)
	GR (Growth Rate)	3-year growth rate in assets [data was collected at firm-level]; it was a ratio-variable. Rolling-average was used to construct the variable.	Toy, et al. (1974)
	TDE (target debt-equity ratio)	3-year average of [Total debt/(Total debt + equity)] [Data was collected at a firm-level data]; it was a ratio-variable. Rolling-average was used to construct the variable.	Graham and Harvey (2001)

Compiled by: The Researchers

The following table would provide a snapshot [through various descriptive statistics namely mean, standard deviation, minimum value, and maximum value] of the research variables.

Table- 2: Descriptive Statistics

Variable	Number of observations	Mean	Standard deviation	Minimum	Maximum
Financial leverage	953	0.2908	0.33379	.02488	1.0887
Agency cost of debt	953	0.5806	0.21954	0.1169	1.0095
Bankruptcy risk	953	0.2731	0.68588	.07562	3.8402
Effective tax rate	953	0.1805	1.8197	.20509	.54965
Non-debt tax shields	953	0.2264	0.9092	.08086	4.3998
Firm profitability	953	0.04648	0.4477	-2.6661	1.50176
Firm Uniqueness	953	0.01499	0.0428	0	0.27192
Growth rate	953	0.08680	0.1463	-0.35945	0.75415
Target debt-to-equity ratio	953	0.28031	0.2978	.037472	1.02196

Compiled by: The Researchers

The above table represents descriptive statistics of key research variables. Due to the presence of outliers, average value of most of the research variables hardly represents central tendency of the variables. The reported minimum and maximum values also confirm the presence of the outliers; the calculated dispersion level [measured through standard deviation] is pretty high. The average debt-equity ratio is 29%; so, in order to pay off Taka .29 of long-term debt, there was on an average Taka 1 of equity. The standard deviation of financial leverage variable was 33% - an indication that debt-absorption capacity varied across industries.

Table- 3 : Correlation Table

Variables	AD	BR	TR	NDTS	PROF	UNIK	GR	TD
AD	1.00	-0.016	0.038	0.024	0.094	-0.031	0.068	-0.079
BR	-0.016	1.00	-0.003	-0.002	0.025	-0.001	0.027	0.029
TR	0.038	-0.003	1.00	0.002	0.013	-0.017	-0.046	0.008
NDTS	0.024	-0.002	0.002	1.00	0.676	0.009	0.017	-0.065
PROF	0.094	0.025	0.013	0.676	1.00	0.001	0.130	0.016
UNIK	-0.031	-0.001	-0.017	0.009	0.001	1.00	-0.076	0.216
GR	0.068	0.027	-0.046	0.017	0.130	-0.076	1.00	0.059
TD	-0.079	0.029	0.008	-0.065	0.016	0.216	0.059	1.00

Compiled by: The Researchers

The above table represents pair wise correlation coefficients between key research variables. Since all the research variables were continuous, Pearson correlation coefficient was calculated. Pearson correlation coefficient is a bounded number, ranges from 1 to -1. It is evident that none of the control variables are not excessively connected with the key independent variable – agency cost of debt [the correlation coefficients are between .1 to -.1 range]. While performing VIF test, condition index tests, it was also evident that multicollinearity is not too big of a concern.

4.0 Results

Before running the baseline regression, the standard diagnosis protocols were performed. According to Ramsey's RESET test and Harvey-Collier test results, it was concluded that the relationship between the dependent and key independent variables is linear. B-P test and White test results confirmed the presence of heteroscedasticity; this concern was later on managed by employing robust standard error and panel corrected standard error in the baseline and other auxiliary models. The regression errors followed a quasi-normal distribution [evident in Anderson-Darling test and Jarque-Bera test]. Finally, as per the COV ratio and Cook's distance test results, it was evident that the dataset contains outliers [extremely large and small values]. Outlier issue was resolved through using winsorized dataset [as a part of the test of robustness]. Before presenting the baseline regression results, the regression equation is denoted first:

$$\text{Financial leverage}_{i,t} = \beta_0 + \beta_1 \text{ Agency Cost of Debt}_{i,t} + \beta_2 \text{ Bankruptcy Risk}_{i,t} + \beta_3 \text{ Tax Rate}_{i,t} + \beta_4 \text{ Non-debt Tax Shields}_{i,t} + \beta_5 \text{ Firm Uniqueness}_{i,t} + \beta_6 \text{ Growth Rate}_{i,t} + \beta_7 \text{ Profitability}_{i,t} + \beta_8 \text{ Target Debt-Equity Ratio}_{i,t} + V_{i,t}$$

The above-mentioned regression error [V_{it}] can be decomposed into three components – a_i [cross-sectional, unobserved heterogeneity], λ [time-varying error], and $u_{i,t}$ [random noise]. In the baseline regression, fixed effects model was run. Fixed effects model eliminates cross-sectional heterogeneity [through its time-demeaning approach]. Time dummy variables were used in the baseline regression [2015 was used as the reference category]. So, the coefficient vector presented through the below mentioned table was extracted by minimizing the squared sum of residuals [as fixed effects model is a refined version of OLS].

Table- 4: Baseline Regression Results

Variables	Fixed effects model [Robust standard error]	PCSE model [Panel-corrected standard error]
Agency cost of debt	-0.0206**	-0.00645**
Bankruptcy risk	-0.00183***	-.00135**
Effective tax rate	0.00235	0.00181*
Non-debt tax shields	-0.001026	-.000842
Firm profitability	-0.0205	-0.0581*
Firm Uniqueness	-0.457*	-.234*
Growth rate	0.0109	0.0469
Target debt-to-equity ratio	1.153***	1.071***
Constant	-0.00531	0.0141
Observations	953	953
R-squared	0.719	.796
Number of firms	157	157
Firm Fixed Effects	Yes	No
Firm Cluster	No	No
Seasonal adjustment	No	No
F-stat	56.54	468.21
Prob > F	0	0
*** p<0.01, ** p<0.05, * p<0.1		

Compiled by: The Researchers

It is evident from the above-mentioned table that agency cost of debt exerts a negative impact on financial leverage [a result confirming the pre-established hypothesis]. The observed effect in the fixed effects model is statistically significant at a 5% level. So, when the agency cost of debt increases, management's willingness to take more loan drastically reduces. The relatively high R-square of the fixed-effects model is an indicator of the model's superior explanatory power in the within-the-sample case. Results related to the joint test of hypothesis [whether is overall model is adequate or not] reveal that the overall model is significant at a 1% level.

PCSE model is generally used to manage panel-heteroscedasticity issue and contemporaneous cross-sectional correlation. It is evident from the above-mentioned table that agency cost of debt exerts a negative impact on financial leverage [a result confirming the pre-established hypothesis]. The observed effect in the PCSE model is statistically significant at a 5% level. So, when the agency cost of debt increases, management's willingness to take more loan drastically reduces. The relatively high R-square of the PCSE model is an indicator of the model's superior explanatory power in the within-the-sample case. Results related to the joint test of hypothesis [whether is overall model is adequate or not] reveal that the overall model is significant at a 1% level.

It was important to investigate whether the baseline results would become invalid, once endogeneity concerns are raised. Endogeneity stems from different sources – namely omitted variable bias, reverse causality, and measurement error in the independent variable. At first, endogeneity concerns channeled through omitted variable channel were mitigated.

Before presenting the regression results, the regression equations are denoted first:

$$\text{Financial leverage}_{i,t} = \beta_0 + \beta_1 \text{ Agency Cost of Debt}_{i,t} + \beta_2 \text{ Bankruptcy Risk}_{i,t} + \beta_3 \text{ Tax Rate}_{i,t} + \beta_4 \text{ Non-debt Tax Shields}_{i,t} + \beta_5 \text{ Firm Uniqueness}_{i,t} + \beta_6 \text{ Growth Rate}_{i,t} + \beta_7 \text{ Profitability}_{i,t} + \beta_8 \text{ Target Debt-Equity Ratio}_{i,t} + \beta_9 \text{ Operating Leverage}_{i,t} + V_{i,t} \text{ [Model 1]}$$

$$\text{Financial leverage}_{i,t} = \beta_0 + \beta_1 \text{ Agency Cost of Debt}_{i,t} + \beta_2 \text{ Bankruptcy Risk}_{i,t} + \beta_3 \text{ Tax Rate}_{i,t} + \beta_4 \text{ Non-debt Tax Shields}_{i,t} + \beta_5 \text{ Firm Uniqueness}_{i,t} + \beta_6 \text{ Growth Rate}_{i,t} + \beta_7 \text{ Profitability}_{i,t} + \beta_8 \text{ Target Debt-Equity Ratio}_{i,t} + \beta_9 \text{ Firm Size}_{i,t} + V_{i,t} \text{ [Model 2]}$$

$$\text{Financial leverage}_{i,t} = \beta_0 + \beta_1 \text{ Agency Cost of Debt}_{i,t} + \beta_2 \text{ Bankruptcy Risk}_{i,t} + \beta_3 \text{ Tax Rate}_{i,t} + \beta_4 \text{ Non-debt Tax Shields}_{i,t} + \beta_5 \text{ Firm Uniqueness}_{i,t} + \beta_6 \text{ Growth Rate}_{i,t} + \beta_7 \text{ Profitability}_{i,t} + \beta_8 \text{ Target Debt-Equity Ratio}_{i,t} + \beta_9 \text{ Lagged Leverage}_{i,t} + V_{i,t} \text{ [Model 3]}$$

$$\text{Financial leverage}_{i,t} = \beta_0 + \beta_1 \text{ Agency Cost of Debt}_{i,t} + \beta_2 \text{ Bankruptcy Risk}_{i,t} + \beta_3 \text{ Tax Rate}_{i,t} + \beta_4 \text{ Non-debt Tax Shields}_{i,t} + \beta_5 \text{ Firm Uniqueness}_{i,t} + \beta_6 \text{ Growth Rate}_{i,t} + \beta_7 \text{ Profitability}_{i,t} + \beta_8 \text{ Target Debt-Equity Ratio}_{i,t} + \beta_9 \text{ Operating Leverage}_{i,t} + \beta_{10} \text{ Firm Size}_{i,t} + \beta_{11} \text{ Lagged Leverage}_{i,t} + V_{i,t} \text{ [Model 4]}$$

The above-mentioned regression error [V_{it}] can be decomposed into three components – a_i [cross-sectional, unobserved heterogeneity], λ [time-varying error], and $u_{i,t}$ [random noise]. In all the above-regressions, fixed effects models were run. Fixed effects model eliminates cross-sectional heterogeneity [through its time-demeaning approach]. Time dummy variables were used in these regressions [2015 was used as the reference category]. So, the coefficient vectors presented through the below mentioned table were extracted by minimizing the squared sum of residuals [as fixed effects model is a refined version of OLS].

Table- 5: Endogeneity Management [omitted variable channel]

Variables	Model 1	Model 2	Model 3	Model 4
	Operating leverage	Firm size	Lagged leverage	Combined
Agency cost of debt	-.0181**	-.0338***	-.0296**	-.0393***
Bankruptcy risk	.00181*	-.00186*	-.00257*	-.00251**
Effective tax rate	0.00256**	0.00232**	0.00175*	0.00174*
Non-debt tax shields	-.001105*	-.001003*	-.000532*	-.000523
Firm profitability	-0.0210	-0.0175	-0.0318	-0.0282
Firm Uniqueness	-.500***	-.459***	-.441***	-.446***
Growth rate	0.0146	0.0321	0.01048	0.0312
Target debt-to-equity ratio	1.245***	1.159***	1.544***	1.540***
Operating Leverage	0.000145*			-.000814
Firm size		-0.0268		-0.0241
Lagged leverage			-0.386***	-0.376***
Observations	953	953	953	953
R-squared	0.779	0.720	0.744	0.745
Number of firms	157	157	157	157
Firm Fixed Effects	Yes	Yes	Yes	Yes
Firm Cluster	No	No	No	No
Seasonal adjustment	No	No	No	No
R2 within	0.779	0.720	0.744	0.745
R2 overall	0.393	0.226	0.364	0.246
R2 between	0.0924	0.0437	0.0833	0.0481
F-stat	156.9	144.6	159.9	133.2
Prob > F	0	0	0	0
*** p<0.01, ** p<0.05, * p<0.1				

Compiled by: The Researchers

It is evident from the above-mentioned table that even after adding probable omitted variable [for model I, it was operating leverage], agency cost of debt still exerts negative impact on financial leverage [a result confirming the pre-established hypothesis]. The observed effect is statistically significant at a 5% level. So, when agency cost of debt increases, management's willingness to take more loan drastically reduces. The relatively high R-square is an indicator of the 1st model's superior explanatory power in the within-the-sample case. Results related to the joint test of hypothesis [whether model I is adequate or not] reveal that model I is significant at a 1% level. In a nutshell, probable endogeneity [channeled through omitted variable bias, operating leverage in this case] did not influence the reported baseline results.

It is evident from the above-mentioned table that even after adding probable omitted variable [for model II, it was firm size], agency cost of debt still exerts negative impact on financial leverage [a result confirming the pre-established hypothesis]. The observed effect is statistically significant at a 1% level. So, when agency cost of debt increases, management's willingness to take more loan drastically reduces. The relatively high R-square is an indicator of the 2nd model's superior explanatory power in the within-the-sample case. Results related to the joint test of hypothesis [whether model II is adequate or not] reveal that model II is significant at a 1% level. In a nutshell, probable endogeneity [channeled through omitted variable bias, firm size in this case] did not influence the reported baseline results.

It is evident from the above-mentioned table that even after adding probable omitted variable [for model III, it was lagged leverage], agency cost of debt still exerts negative impact on financial leverage [a result confirming the pre-established hypothesis]. The observed effect is statistically significant at a 5% level. So, when agency cost of debt increases, management's willingness to take more loan drastically reduces. The relatively high R-square is an indicator of the 3rd model's superior explanatory power in the within-the-sample case. Results related to the joint test of hypothesis [whether model III is adequate or not] reveal that model III is significant at a 1% level. In a nutshell, probable endogeneity [channeled through omitted variable bias, lagged leverage in this case] did not influence the reported baseline results.

It is evident from the above-mentioned table that even after adding all the probable omitted variables together, agency cost of debt still exerts negative impact on financial leverage [a result confirming the pre-established hypothesis]. The observed effect is statistically significant at a 1% level. So, when agency cost of debt increases, management's willingness to take more loan drastically reduces. The relatively high

R-square is an indicator of the 4th model's superior explanatory power in the within-the-sample case. Results related to the joint test of hypothesis [whether model IV is adequate or not] reveal that model IV is significant at a 1% level. In a nutshell, probable endogeneity [channeled through omitted variable bias,] did not influence the reported baseline results.

Then, endogeneity concerns channeled through reverse causality channel were mitigated. Before presenting the regression results, the regression equations are denoted first:

$$\text{Agency Cost of Debt}_{i,t} = \beta_0 + \beta_1 \text{ Governance Index}_{i,t} + \beta_2 \text{ Bankruptcy Risk}_{i,t} + \beta_3 \text{ Tax Rate}_{i,t} + \beta_4 \text{ Non-debt Tax Shields}_{i,t} + \beta_5 \text{ Firm Uniqueness}_{i,t} + \beta_6 \text{ Growth Rate}_{i,t} + \beta_7 \text{ Profitability}_{i,t} + \beta_8 \text{ Target Debt-Equity Ratio}_{i,t} + V_{i,t}$$ [1st stage regression : Governance index was used as an instrument]

$$\text{Financial leverage}_{i,t} = \beta_0 + \beta_1 \text{ Instrumented Agency Cost of Debt}_{i,t} + \beta_2 \text{ Bankruptcy Risk}_{i,t} + \beta_3 \text{ Tax Rate}_{i,t} + \beta_4 \text{ Non-debt Tax Shields}_{i,t} + \beta_5 \text{ Firm Uniqueness}_{i,t} + \beta_6 \text{ Growth Rate}_{i,t} + \beta_7 \text{ Profitability}_{i,t} + \beta_8 \text{ Target Debt-Equity Ratio}_{i,t} + V_{i,t}$$ [2nd stage regression]

Before using, governance index as the instrument, the relevance and exogeneity of the instrument were tested. Based on Pearson correlation, it was established that good governance is strongly connected with agency cost of debt (relevance); and it is not related with financial leverage (exogeneity). As evident in the above-equations, at first, agency cost of debt was regressed over governance index [an instrument] and a set of control variables. Then, financial leverage was regressed over the instrumented agency cost of debt and the set of control variables. While running the 1st-stage and 2nd-stage regression, fixed effects model was used along with time-dummies.

Table 6: Endogeneity Management [Reverse causality channel]

Variables	Model [Reverse causality: agency cost of debt channel]	
	First-stage Regression	Second-stage Regression
Governance Index	-0.0134	
Agency cost of debt		
Bankruptcy risk	-.00373**	-.00217**
Effective tax rate	0.000580*	0.0114*
Non-debt tax shields	-.0524***	-0.969***
Firm profitability	-0.201**	4.078**
Firm Uniqueness	0.119***	-2.203
Growth rate	0.0224	1.565***
Instrumented Agency cost of debt		-19.54***
Constant	0.546***	-9.801
Observations	953	953
R-squared	0.058	0.720
Number of firms	157	157
Firm Fixed Effects	Yes	Yes
Firm Cluster	No	No
Seasonal adjustment	No	No
R2 within	0.0586	0.720
R2 overall	7.42e-05	0.289
R2 between	0.000222	0.0617
F-stat	4.510	157.8
Prob > F	3.16e-05	0

Compiled by: The Researchers

It is evident from the above-mentioned table that agency cost of debt exerts negative impact on financial leverage [a result confirming the pre-established hypothesis]. So, it was concluded that reverse causality is not a legit channel to introduce endogeneity in the model. The observed effects are statistically significant at a 1% level – an indication that agency cost of debt and financial leverage are negatively associated. The relatively high R-square is an indicator of the model's superior explanatory power in the within-the-sample case. F-test results indicate that the overall model is significant at a 1% level.

Then, endogeneity concerns channel through measurement error channel were mitigated. Before presenting the regression results, the regression equations are denoted first:

Financial leverage$_{i,t}$ = β_0+ β_1 Agency Cost of Debt Proxy$_{i,t}$ + β_2 Bankruptcy Risk$_{i,t}$ + β_3 Tax Rate$_{i,t}$ + β_4 Non-debt Tax Shields$_{i,t}$ + β_5 Firm Uniqueness$_{i,t}$ + β_6 Growth Rate$_{i,t}$ + β_7 Profitability$_{i,t}$ + β_8 Target Debt-Equity Ratio$_{i,t}$ + + V$_{i,t}$ [Model 1: here agency cost of debt was calculated as a ratio (R&D expenditure/total sales)]

Financial leverage$_{i,t}$ = β_0+ β_1 Agency Cost of Debt Proxy$_{i,t}$ + β_2 Bankruptcy Risk$_{i,t}$ + β_3 Tax Rate$_{i,t}$ + β_4 Non-debt Tax Shields$_{i,t}$ + β_5 Firm Uniqueness$_{i,t}$ + β_6 Growth Rate$_{i,t}$ + β_7 Profitability$_{i,t}$ + β_8 Target Debt-Equity Ratio$_{i,t}$ + V$_{i,t}$ [Model 2: here agency cost of debt was calculated as a ratio (working capital/total sales)]

Table 7: Endogeneity Management [Measurement error in the independent variable]

Variables	Model 1	Model 2
	1st proxy for agency cost of debt	2nd proxy for agency cost of debt
Agency cost of debt [proxy]	-2.471**	-.0620**
Bankruptcy risk	-.00185*	-.00186**
Effective tax rate	0.00228**	0.00232**
Non-debt tax shields	-.001000*	-.00132**
Firm profitability	-0.0215	-0.0525
Firm Uniqueness	-.442***	-.496***
Growth rate	0.0625	0.0153
Target debt-to-equity ratio	1.164***	1.165***
Constant	0.0110	0.00953
Observations	953	953
R-squared	0.720	0.725
Number of UID	157	157
Firm FE	Yes	Yes
Firm Cluster	No	No
seasonal adjustment	No	No
R2 within	0.720	0.725
R2 overall	0.345	0.246
R2 between	0.0791	0.0496
F-stat	159.3	163.5
Prob > F	0	0

Compiled by: The Researchers

It is evident from the model I result that after managing for measurement error concerns, agency cost of debt still exerts negative impact on financial leverage [a result confirming the pre-established hypothesis]. The observed effects are statistically significant at a 5% level – a strong confirmation that agency cost of debt and financial leverage are negatively associated. R- square value is very high from a panel database context; so, model I has explanatory power in the within-the-sample case. F-test results indicate that model I is significant at a 1% level.

It is evident from the model II result that after managing for measurement error concerns, agency cost of debt still exerts negative impact on financial leverage [a result confirming the pre-established hypothesis]. The observed effects are statistically significant at a 5% level – a strong confirmation that agency cost of debt and financial leverage are negatively associated. R- square value is very high from a panel database context; so, model II enjoys superior explanatory power in the within-the-sample case. F-test results indicate that model II is significant at a 1% level.

Then a battery of robustness tests was performed. Firstly, alternative definitions of 'Financial Leverage' were introduced in the regression model [it is worth mentioning that different corporate finance literatures have defined leverage in different ways, and there is no best way to define leverage]. Then, out of sample predictability of the baseline model was checked using a gamut of machine learning tools. The baseline model was re-run using winsorized dataset. Cross-sectional heterogeneity of estimated effects was evaluated based on two parameters namely business size and leverage ratio.

As mentioned, the robustness of the estimated effects was tested by changing the definition of the dependent variable. Before presenting the regression results, the regression equations are denoted first:

Financial leverage $\text{Proxy}_{i,t} = \beta_0 + \beta_1$ Agency Cost of $\text{Debt}_{i,t} + \beta_2$ Bankruptcy $\text{Risk}_{i,t} + \beta_3$ Tax $\text{Rate}_{i,t} + \beta_4$ Non-debt Tax $\text{Shields}_{i,t} + \beta_5$ Firm $\text{Uniqueness}_{i,t} + \beta_6$ Growth $\text{Rate}_{i,t} + \beta_7$ $\text{Profitability}_{i,t} + \beta_8$ Target Debt-Equity $\text{Ratio}_{i,t} + + V_{i,t}$ [Model 1: here financial leverage was measured through a ratio (interest expense/EBIT)]

Financial leverage $\text{Proxy}_{i,t} = \beta_0 + \beta_1$ Agency Cost of $\text{Debt}_{i,t} + \beta_2$ Bankruptcy $\text{Risk}_{i,t} + \beta_3$ Tax $\text{Rate}_{i,t} + \beta_4$ Non-debt Tax $\text{Shields}_{i,t} + \beta_5$ Firm $\text{Uniqueness}_{i,t} + \beta_6$ Growth $\text{Rate}_{i,t} + \beta_7$ $\text{Profitability}_{i,t} + \beta_8$ Target Debt-Equity $\text{Ratio}_{i,t} + V_{i,t}$ [Model 2: here financial leverage was measured through another ratio (long-term debt/total debt + book value of equity)]

Table 8: Test of Robustness [Alternative definition of 'Leverage' variable]

Variables	Model 1	Model 2
	Leverage [Proxy 1]	Leverage [Proxy 2]
Agency cost of debt	-17.95***	-2.12**
Bankruptcy risk	-.224**	-.00164**
Effective tax rate	-.233***	0.00247**
Non-debt tax shields	-.00703	-0.000745
Firm profitability	-3.481	0.129***
Firm Uniqueness	-8.306***	-.0308*
Growth rate	14.33***	0.0273*
Target debt-to-equity ratio	4.479***	0.556***
Constant	6.448	-0.0352
Observations	953	953
R-squared	0.026	0.388
Number of firms	157	157
Firm Fixed Effects	Yes	Yes
Firm Cluster	No	No
Seasonal adjustment	No	No
R2 within	0.0260	0.388
R2 overall	7.65e-05	0.0159
R2 between	7.75e-07	0.00536
F-stat	1.982	45.09
Prob > F	0.0637	0
*** p<0.01, ** p<0.05, * p<0.1		

Compiled by: The Researchers

Model I results indicate that that even after introducing an alternative definition for financial leverage variable [for model I, leverage = interest expense/EBIT], agency cost of debt still exerts negative impact on financial leverage [a result confirming the pre-established hypothesis]. The observed effects are statistically significant. R-square value is moderate in case of in case of model I (a regularly observed phenomenon in case of panel database). F-test results indicate that the overall model is statistically significant.

Model II results indicate that that even after introducing an alternative definition for financial leverage variable [for model II, leverage = long-term debt/(total debt +

book value of equity)], agency cost of debt still exerts negative impact on financial leverage [a result confirming the pre-established hypothesis]. The observed effects are statistically significant. R- square value is moderate in case of in case of model II (a regularly observed phenomenon in case of panel database). F-test results indicate that the overall model is statistically significant.

In order to check the out-of-the-sample predictability status, a number of machine learning tools [namely logistic regression, decision-tree, random forest, SVM, Naïve Bayesian algorithm, and KNN algorithm] were employed. Logistic regression helps modeling a binary or multinomial variable that represents probability. Support vector machine [also known as SVM] uses hyperplane to classify data. Random forest protocol runs a number of regressions using randomly chosen truncated dataset and summarizes the results. KNN algorithm uses Euclidian distance for classifying the data. As the name suggests, Naïve Bayesian algorithm uses Bayesian probability to categorize data. It is worth mentioning that all these machine learning tools employed here belong to the supervised learning category.

Table 9: Test of Robustness [Out-of-sample predictability]

Machine learning tools employed	Accuracy score	Training-testing split	Target variable
Logistic Regression	63%	80%-20%	Categorical [transformed]
Decision-tree	59%	80%-20%	Categorical [transformed]
Random Forest	64%	80%-20%	Categorical [transformed]
Support vector machine	59%	80%-20%	Categorical [transformed]
Naïve Bayesian Algorithm	58%	80%-20%	Categorical [transformed]
KNN Algorithm	52%	80%-20%	Categorical [transformed]

Compiled by: The Researchers

The dependent variable [financial leverage in this case] was continuous. At first, using the 'encoding' command [in the Python eco-system], the variable was transformed into a categorical one. Then using an 80%-20% split, the dataset was divided into two segments. At first, the machine learning tools were trained on the 80% data and then these tools were instructed to generate predictions for the rest of the data. Different standard performance measurement techniques like accuracy, recall, F-1 score, precision were calculated [even though, only the accuracy scores have been reported]. The accuracy scores with respect to all machine learning tools are satisfactory. Apart from the test-retest results, the cross-validation results have also indicated stellar out-of-sample predictability.

Robustness of the estimated effects was then tested by winsorizing the dataset at a 5% level. Winsorizing means replacing the extreme numbers by the closest normal number. Winsorizing is a common practice often employed in corporate finance research. Before presenting the regression results, the regression equations are denoted first:

$$\text{Financial leverage}_{i,t} = \beta_0 + \beta_1 \text{ Agency Cost of Debt}_{i,t} + \beta_2 \text{ Bankruptcy Risk}_{i,t} + \beta_3 \text{ Tax Rate}_{i,t} + \beta_4 \text{ Non-debt Tax Shields}_{i,t} + \beta_5 \text{ Firm Uniqueness}_{i,t} + \beta_6 \text{ Growth Rate}_{i,t} + \beta_7 \text{ Profitability}_{i,t} + \beta_8 \text{ Target Debt-Equity Ratio}_{i,t} + + V_{i,t} \text{ [Model 1]}$$

Table 10: Test of Robustness [Winsorized data]

Variables	Model 1
	Leverage
Agency cost of debt	-.000800*
Bankruptcy risk	-.0124**
Effective tax rate	0.00187
Non-debt tax shields	-.00160
Firm profitability	-0.118***
Firm Uniqueness	-1.412***
Growth rate	0.0841
Target debt-to-equity ratio	0.944***
Constant	-0.0147
Observations	953
Number of firms	157
Firm Fixed Effects	Yes
Firm Cluster	No
Seasonal adjustment	No
R2 within	0.590
R2 overall	0.821
R2 between	0.930
F-stat	96.51
Prob > F	0
*** p<0.01, ** p<0.05, * p<0.1	

Compiled by: The Researchers

The above table represents the regression results when outliers were managed through winsorizing. It is evident that even after winsorizing, agency cost of debt still exerts negative impact on financial leverage [a result confirming the pre-established hypothesis]. The observed effects are statistically significant. So, agency cost of debt and financial leverage are negatively associated. R- square is very high - an indicator of the model's excellent explanatory power in the within-the-sample case. F-test results indicate that the overall model is statistically significant.

At first, the existence of cross-sectional heterogeneity was tested using 'leverage ratio' parameter. At first, the median leverage ratio was calculated; firms belonging to the above-median leverage ratio were labeled as 'High-levered firm', and firms belonging to the below-median leverage ratio were labeled as 'low-levered firm'. Then two regressions were run using the split databases. Before presenting the regression results, the regression equations are denoted first:

Financial leverage$_{i,t}$ = β_0+ β_1 Agency Cost of Debt$_{i,t}$ + β_2 Bankruptcy Risk$_{i,t}$ + β_3 Tax Rate$_{i,t}$ + β_4 Non-debt Tax Shields$_{i,t}$ + β_5 Firm Uniqueness$_{i,t}$ + β_6 Growth Rate$_{i,t}$ + β_7 Profitability$_{i,t}$ + β_8 Target Debt-Equity Ratio$_{i,t}$ + + $V_{i,t}$ [Model 1: using firm-level data belonging to high levered firms]

Financial leverage$_{i,t}$ = β_0+ β_1 Agency Cost of Debt$_{i,t}$ + β_2 Bankruptcy Risk$_{i,t}$ + β_3 Tax Rate$_{i,t}$ + β_4 Non-debt Tax Shields$_{i,t}$ + β_5 Firm Uniqueness$_{i,t}$ + β_6 Growth Rate$_{i,t}$ + β_7 Profitability$_{i,t}$ + β_8 Target Debt-Equity Ratio$_{i,t}$ + + $V_{i,t}$ [Model 2: using firm-level data belonging to low levered firms]

Table- 11: Cross-sectional heterogeneity [Dimension – Leverage ratio]

Variables	Model 1	Model 2
	Highly levered firms	Low-leverage firms
Agency cost of debt	-5.35***	-6.58***
Bankruptcy risk	-.549**	-1.064**
Effective tax rate	-1.066***	-.971***
Non-debt tax shields	-.0473	-0.0793
Firm profitability	-.085	0-.098
Firm Uniqueness	-8.26***	-.5.09***
Growth rate	8.93***	5.50***
Target debt-to-equity ratio	3.33***	2.73***
Constant	11.97	12.27
Observations	279	674
R-squared	0.080	0.098

Number of firms	49	108
Firm Fixed Effects	Yes	Yes
Firm Cluster	No	No
Seasonal adjustment	No	No
R2 within	0.0498	0.0694
R2 overall	.0082	0.0147
R2 between	.0369	0.0611
F-stat	13.80	14.76
Prob > F	0.0637	0.070
*** p<0.01, ** p<0.05, * p<0.1		

Compiled by: The Researchers

Model I results represent a very high, negatively signed, regression coefficient for agency cost of debt variable. So, the null hypothesis that the beta coefficient with respect to agency cost of debt variable is rejected [at a 1% level] and it can be concluded that agency cost of debt negatively influences financial leverage, controlling all other partial effects. The explanatory power of the model is not very high [a widely cited phenomenon in case of panel database]. Finally, the F-test results suggest that the null hypothesis related with the joint test [none of the regression coefficients is anything different from zero] is rejected.

Model II results represent a very high, negatively signed, regression coefficient for agency cost of debt variable. So, the null hypothesis that the beta coefficient with respect to agency cost of debt variable is rejected [at a 1% level] and it can be concluded that agency cost of debt negatively influences financial leverage, controlling all other partial effects. The explanatory power of the model is not very high [a widely cited phenomenon in case of panel database]. Finally, the F-test results suggest that the null hypothesis related with the joint test [none of the regression coefficients is anything different from zero] is rejected.

In a nutshell, the negative relationship between agency cost of debt and financial leverage holds both in the high-leverage and low-leverage case. In both cases, the observed effects are statistically significant. F-test results indicate that the both models are statistically significant. So, there exists no evidence of cross-sectional heterogeneity in the leverage-agency cost of debt relationship as per 'leverage' benchmark.

The existence of cross-sectional heterogeneity was tested using 'business size' parameter. At first, the median leverage ratio was calculated; firms belonging to the above-median size were labeled as 'large firm', and firms belonging to the below-median size were labeled as 'small firm'. Then two regressions were run using the

split databases. Before presenting the regression results, the regression equations are denoted first:

Financial leverage$_{i,t}$ = β_0+ β_1 Agency Cost of Debt$_{i,t}$ + β_2 Bankruptcy Risk$_{i,t}$ + β_3 Tax Rate$_{i,t}$ + β_4 Non-debt Tax Shields$_{i,t}$ + β_5 Firm Uniqueness$_{i,t}$ + β_6 Growth Rate$_{i,t}$ + β_7 Profitability$_{i,t}$ + β_8 Target Debt-Equity Ratio$_{i,t}$ + + $V_{i,t}$ [Model 1: using firm-level data belonging to large firms]

Financial leverage$_{i,t}$ = β_0+ β_1 Agency Cost of Debt$_{i,t}$ + β_2 Bankruptcy Risk$_{i,t}$ + β_3 Tax Rate$_{i,t}$ + β_4 Non-debt Tax Shields$_{i,t}$ + β_5 Firm Uniqueness$_{i,t}$ + β_6 Growth Rate$_{i,t}$ + β_7 Profitability$_{i,t}$ + β_8 Target Debt-Equity Ratio$_{i,t}$ + + $V_{i,t}$ [Model 2: using firm-level data belonging to small firms]

Table 12: Cross-sectional heterogeneity [Dimension – business size]

Variables	Model 1	Model 2
	Large firm	Small firm
Agency cost of debt	-3.59***	-4.57***
Bankruptcy risk	-.406**	-.795**
Effective tax rate	-.904***	-.612***
Non-debt tax shields	-.127	-0.221
Firm profitability	-.063	0-.103
Firm Uniqueness	-5.49***	-.8.98***
Growth rate	5.50***	5.19***
Target debt equity ratio	2.04***	2.28***
Constant	7.66	9.87
Observations	321	632
R-squared	0.186	0.208
Number of firms	55	102
Firm Fixed Effects	Yes	Yes
Firm Cluster	No	No
Seasonal adjustment	No	No
R2 within	0.116	0.170
R2 overall	.099	0.085
R2 between	.069	0.064
F-stat	8.74	10.18
Prob > F	0.0006	0.027
*** p<0.01, ** p<0.05, * p<0.1		

Compiled by: The Researchers

Model I results represent a very high, negatively signed, regression coefficient for agency cost of debt variable. So, the null hypothesis that the beta coefficient with respect to agency cost of debt variable is rejected [at a 1% level] and it can be concluded that agency cost of debt negatively influences financial leverage, controlling all other partial effects. The explanatory power of the model is not very high [a widely cited phenomenon in case of panel database]. Finally, the F-test results suggest that the null hypothesis related with the joint test [none of the regression coefficients is anything different from zero] is rejected.

Model II results represent a very high, negatively signed, regression coefficient for agency cost of debt variable. So, the null hypothesis that the beta coefficient with respect to agency cost of debt variable is rejected [at a 1% level] and it can be concluded that agency cost of debt negatively influences financial leverage, controlling all other partial effects. The explanatory power of the model is not very high [a widely cited phenomenon in case of panel database]. Finally, the F-test results suggest that the null hypothesis related with the joint test [none of the regression coefficients is anything different from zero] is rejected.

In a nutshell, the negative relationship between agency cost of debt and financial leverage holds both in the large-firm and small-firm case. In both cases, the observed effects are statistically significant. F-test results indicate that the both models are statistically significant. So, there exists no evidence of cross-sectional heterogeneity in the leverage-agency cost of debt relationship as per 'business size' benchmark.

5.0 Conclusion

The study has explored the dynamic relationship between agency cost of debt and capital structure choices. Using listed manufacturing data, the study concluded that there exists a negative influence of agency cost of debt on leverage decision. The estimated effects were economically and statistically meaningful. The estimated effects remain robust to several endogeneity concerns. Further a battery of robustness tests has solidified the results as the estimated effects remain valid in cross-sectional heterogeneity, proxy variable, out-of-sample tests.

This research has certainly paved the way for multiple research projects. Future studies can explore the dynamic relationship between agency cost of equity and capital structure choices. Since there exists cross-sectional heterogeneity in the estimated effect, relationship between agency cost of debt and capital structure choices can also be explored from different industry perspectives.

References

Baker, M., & Wurgler, J. (2002), "Market timing and capital structure," *Journal of Finance*, *57*(1), 1–32. https://doi.org/10.1111/1540-6261.00414

Black, F., & Scholes, M. (1973), "The pricing of options and corporate liabilities," *Journal of Political Economy*, *81*(3), 637–654. https://doi.org/10.1086/260062

Booth, L., Aivazian, V., Demirguc-Kunt, A., & Maksimovic, V. (2001), "Capital structures in developing countries," *Journal of Finance*, *56*(1), 87–130. https://doi.org/10.1111/0022-1082.00320

Cornell, B., & Shapiro, A. C. (1987), "Corporate stakeholders and corporate finance," *Financial management*, 5-14.

Dang, V. A. (2011), "Leverage, debt maturity, and firm investment: An empirical analysis," *Journal of Business Finance & Accounting*, *38*(1–2), 225–258. https://doi.org/10.1111/j.1468-5957.2010.02215.x

DeAngelo, H., & Masulis, R. W. (1980), "Optimal capital structure under corporate and personal taxation," *Journal of financial economics*, *8*(1), 3-29.

Dougherty, C. (2021), "Introduction to econometrics (6th ed.)," *Oxford University Press.*

Faulkender, M., & Petersen, M. A. (2006), "Does the source of capital affect capital structure?," *Review of Financial Studies*, *19*(1), 45–79. https://doi.org/10.1093/rfs/hhj003

Frank, M. Z., & Goyal, V. K. (2009), "Capital structure decisions: Which factors are reliably important?," *Financial Management*, *38*(1), 1–37. https://doi.org/10.1111/j.1755-053X.2009.01026.x

Graham, J. R., & Harvey, C. R. (2001), "The theory and practice of corporate finance: Evidence from the field," *Journal of financial economics*, *60*(2-3), 187-243.

Jensen, M. C., & Meckling, W. H. (1976), "Theory of the firm: Managerial behavior, agency costs and ownership structure," *Journal of Financial Economics*, *3*(4), 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

Hayashi, F. (2021), "Econometrics," *Princeton University Press.*

Kothari, C. R. (2014), "Research methodology: Methods and techniques (3rd ed.)," *New Age International Publishers.*

Kraus, A., & Litzenberger, R. H. (1973), "A state-preference model of optimal financial leverage," *Journal of Finance*, *28*(4), 911–922. https://doi.org/10.1111/j.1540-6261.1973.tb01415.x

La Porta, R., Lopez-de-Silanes, F., Shleifer, A., & Vishny, R. W. (1998), "Law and finance," *Journal of Political Economy*, *106*(6), 1113–1155. https://doi.org/10.1086/250042

Leland, H. E. (1994), "Corporate debt value, bond covenants, and optimal capital structure," *Journal of Finance*, *49*(4), 1213–1252. https://doi.org/10.1111/j.1540-6261.1994.tb02452.x

Lemmon, M. L., & Zender, J. F. (2010), "Debt capacity and tests of capital structure theories," *Journal of Financial and Quantitative Analysis*, *45*(5), 1161–1187. https://doi.org/10.1017/S0022109010000499

Masulis, R. W. (1980), "The effects of capital structure change on security prices: A study of exchange offers," *Journal of Financial Economics*, *8*(2), 139–178. https://doi.org/10.1016/0304-405X(80)90015-X

Modigliani, F., & Miller, M. H. (1958), "The cost of capital, corporation finance and the theory of investment," *American Economic Review*, *48*(3), 261–297.

Modigliani, F., & Miller, M. H. (1963), "Corporate income taxes and the cost of capital: A correction," *American Economic Review*, *53*(3), 433–443.

Myers, S. C. (1977), "Determinants of corporate borrowing," *Journal of Financial Economics*, *5*(2), 147–175. https://doi.org/10.1016/0304-405X(77)90015-0

Myers, S. C. (1984), "The capital structure puzzle," *Journal of Finance*, *39*(3), 574–592. https://doi.org/10.1111/j.1540-6261.1984.tb03646.x

Myers, S. C., & Majluf, N. S. (1984), "Corporate financing and investment decisions when firms have information that investors do not have," *Journal of Financial Economics*, *13*(2), 187–221. https://doi.org/10.1016/0304-405X(84)90023-0

Rajan, R. G., & Zingales, L. (1995), "What do we know about capital structure? Some evidence from international data," *Journal of Finance*, *50*(5), 1421–1460. https://doi.org/10.1111/j.1540-6261.1995.tb05184.x

Roberts, M. R., & Sufi, A. (2009), "Control rights and capital structure: An empirical investigation," *Journal of Finance*, *64*(4), 1657–1695. https://doi.org/10.1111/j.1540-6261.2009.01476.x

Ross, S. A. (1977), "The determination of financial structure: The incentive-signalling approach," *Bell Journal of Economics*, *8*(1), 23–40. https://doi.org/10.2307/3003485

Saunders, M., Lewis, P., & Thornhill, A. (2007), "Research methods for business students (4th ed.)," *Pearson Education.*

Shleifer, A., & Vishny, R. W. (1997), "A survey of corporate governance," *Journal of Finance*, *52*(2), 737–783. https://doi.org/10.1111/j.1540-6261.1997.tb04820.x

Shyam-Sunder, L., & Myers, S. C. (1999), "Testing static tradeoff against pecking order models of capital structure," *Journal of Financial Economics*, *51*(2), 219–244. https://doi.org/10.1016/S0304-405X(98)00051-8

Smith, C. W., & Warner, J. B. (1979), "On financial contracting: An analysis of bond covenants," *Journal of Financial Economics*, *7*(2), 117–161. https://doi.org/10.1016/0304-405X(79)90011-4

Titman, S., & Wessels, R. (1988), "The determinants of capital structure choice," *Journal of Finance*, *43*(1), 1–19. https://doi.org/10.1111/j.1540-6261.1988.tb02585.x

Toy, N., Stonehill, A., Remmers, L., Wright, R., & Beekhuisen, T. (1974), "A comparative international study of growth, profitability, and risk as determinants of corporate debt ratios in the manufacturing sector," *Journal of financial and quantitative analysis*, *9*(5), 875-886.