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Exploring the Nonlinear Relationship Between Leverage and Corporate Profitability

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Abstract: *This study uses a nonlinear Hansen threshold regression model to analyze the link between leverage and corporate profitability, with firm size as a threshold variable. Data for the study is collected from the State Bank of Pakistan and firms' annual reports for the period 2010–2020. Our findings reveal important insights and patterns pertaining to the interrelationship between leverage, firm size, and corporate profitability. More specifically, results reveal that there are no threshold effects of firm size on the leverage-corporate profitability relationship. This study contributes significantly to the literature, as most empirical studies in this area use linear models but fail to provide meaningful explanations. This study is useful for managers and policymakers as it provides valuable insights about the intricate interrelationship between firm size, leverage, and corporate profitability.*

Keywords: Leverage, corporate profitability, firm size, return on assets, total debt.

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Exploring the Nonlinear Relationship Between Leverage and Corporate Profitability

1. Introduction

Firm leverage and its effect on profitability have long been a topic of discussion among researchers (Abor, 2005; Chandrakumarmangalam & Govindasamy, 2010; Ramli et al., 2019). However, empirical studies have had mixed results. Some researchers conclude a positive association between firm leverage and corporate profitability, emphasizing the benefits of leverage. Other studies conclude that firm leverage influences corporate profitability negatively (see Fama & French, 1998; Negash, 2001; Rahman et al., 2020). As leverage levels rise, the overall cost of capital tends to decline until a certain point, beyond which it rises again as the potential benefits associated with debt are greater than its associated costs. Therefore, low leverage can lead to improvements in profitability due to the lower financial burden of associated interest payments. Accordingly, this saves more of a company's earnings for either reinvestment or dividends. Firms face less risk of going into financial distress with lower debt levels, which improves credit, lowers borrowing costs, and provides greater operational flexibility. Moreover, firms withstand unexpected shocks and economic downturns better if their leverage levels are low, thus contributing to more stable long-term firm performance.

However, firms with consistently lower leverage may not fully exploit the potential benefits of debt, such as tax shield advantages on interest expenses. Despite this, the need to exploit tax shields can lead to high debt levels, even a debt-overhang point where existing debt discourages new investments. Thus, while lower levels of leverage enhance profitability in the short and medium term, the burden of existing debt can become an impediment to further investment and value creation.

Empirical studies involving theories of capital structure help explain the mixed empirical findings (Chen & Chen, 2011). According to financing structures, the preference for financing and information asymmetries contributes to mixed results. Amid these conflicting claims, Robb and Robinson (2014) argue that leverage offers certain benefits that, if used carefully, can enhance corporate profitability. However, this empirical divide on the use of leverage and its impact on profitability necessitates a

closer examination of the role of firm size in shaping the relationship (Khémiri & Noubbigh, 2020).

Existing studies have generally overlooked the conditional impact of firm size on the leverage-performance nexus, possibly contributing to mixed results (Ibhagui & Olokoyo, 2018; Jaisinghani & Kanjilal, 2017). Despite this, Bolarinwa et al. (2022) and Cuong (2014) use firm size as a threshold variable to measure the impact of leverage on profitability but conclude that there are no threshold effects. However, they emphasize the need for further research in the area, particularly in different contexts, to determine whether this relationship and outcome are context-dependent.

To fill this gap and to continue exploring the relationship, the current study seeks to establish whether the size of the firm enlightens the inconsistent relationship between leverage and corporate profitability in the context of Pakistan.

The capital markets of Pakistan especially the bond market are underdeveloped and cost of debt is relatively high in comparison to developed economies. These aspects render firms not to be able to borrow at reduced interest rates. The majority of companies in Pakistan are rather small and not financially skilled and capable enough to issue long-term debt (LTD) in the capital market. This has led them to depend more on bank short term loans or internally generated capital (Khan, 2012; Shah and Hijazi, 2004). Issuing of LTD is on a limited basis to the large firms with good financial backgrounds. Nevertheless, they have no capital market alternatives, with banks loans being the only possibility as asserted by (Khan, 2012). Moreover, debt levels have risen notably since 2006. At the same time, it has witnessed a significant decrease in profitability (Khan, 2012). This means that the relationship between financial leverage and profitability remained negative during this time. Remarkably, there was no such relationship till 2006.

In addition, traditional models fail to provide meaningful explanations for mixed results. Therefore, an attempt is made to use inverted U-shaped models to better explain these mixed results. Traditional linear models assume a constant, unidirectional impact of debt on firm value. This fails to capture the nuanced reality that the benefits of debt (lower cost of capital) can diminish and even turn into disadvantages as debt levels increase. Inverted U-shaped models are more useful than

traditional linear models for capital structure because they acknowledge that the link between capital structure and firm value is not always positive or negative but rather has an optimal point. Financial flexibility initially improves as external borrowing is added to the capital structure. This results in improved financial performance but also increased financial distress and bankruptcy risk due to the increased debt and can eventually lead to a reduction in firm value.

The trade-off theory advocates that an optimal structure (ideal debt-to-equity ratio) exists, and firms can achieve optimal capital structure by striking a balance between the tax benefits of debt and the associated costs of financial distress. The overall cost of capital is at a minimum at this optimal point, while a firm's value is at a maximum. This nonlinear approach between the cost of capital and firm value provides an opportunity to better understand the nature of capital and help businesses identify the right financing mix for sustained growth and value maximization. Therefore, estimating relationships through nonlinear models, particularly in finance, provides a more subtle and accurate understanding of the complex dynamics surrounding capital structure decisions. Theoretically, it goes beyond simple assumptions. It explains variations and complexities at the firm level and the ways in which financial results are influenced by financial factors. This allows the development of more realistic theoretical frameworks. Therefore, this study aims to fill the aforementioned gaps using a nonlinear Hansen threshold regression model to analyze the association between leverage and corporate profitability, with firm size as a threshold variable in the Pakistani context from 2010 to 2020.

Our Hansen model enables us to analyze possible nonlinearities, if any, among leverage and corporate profitability. Based on firm size, this study's sample is divided into two groups, firm size being the threshold variable. Different outcomes across the split samples would signal evidence of nonlinearity between firm leverage and corporate profitability. In this analysis, firm size acts as the nonlinear driver, possibly indicating a critical threshold beyond which the link undergoes a substantial change.

Our study contributes to the literature in various ways. First, we inspect the nonlinearity between leverage and corporate profitability using the Hansen model. We concentrate on emerging markets since they are still

experiencing economic growth and are more susceptible to macroeconomic shocks, such as, interest rates and inflation.

Second, the present study offers a new insight to managers, researchers, and policymakers in order to monitor the impact of firm leverage on corporate profitability. It also highlights the importance of the firm size in making important decisions. For example, large firms tend to be more stable and have a greater market share, enabling them to borrow at lower prices, obtain quantity discounts from suppliers and achieve economies of scale.

Third, the Hansen model adapts to established methodologies and has potential to reveal nonlinearities between financial variables, addressing a substantial gap in empirical studies that examine the association between leverage and profitability, particularly in Pakistan's context.

Pakistan is a mixed economy characterized by both bank-centric and market-oriented features. While the banking sector plays a significant role, Pakistan also has a market-driven economy with government intervention. Finally, Pakistan is characterized by limited debt usage and specific challenges in financing structures, which motivate the need for investigations into the effects of leverage on corporate profitability, especially those of short-term leverage. Thus, this study serves to fill existing literature gaps and will encourage managerial practices that consider firm size as a crucial factor in leveraging decisions.

This paper is organized as follows: Section 2 reviews existing literature. Section 3 details our methodological approach. Section 4 presents the results of the study, and Section 5 provides conclusions and limitations.

2. Literature Review

2.1. Theoretical Background

Researchers continue to focus on the firm performance/capital structure debate and its impact since Modigliani and Miller's (1958) seminal work. This debate continues to captivate interest as the capital structure puzzle remains unsolved, despite significant progress in capital structure theory.

Durand (1952) began the debate on the cost of capital and its impact on firm value in 1952 by arguing that firm value tends to increase as debt increases because debt is less costly and decreases the overall cost of capital. Building on this theory, Modigliani and Miller (1958) initially asserted that capital structure is irrelevant and has no effect on firm value. However, they later acknowledged the impact of corporate taxes on financing decisions and the subsequent impact on firm value (Modigliani & Miller, 1963). Miller (1977) extended this idea and incorporated specific tax benefits and personal taxes, thus suggesting that an increase in debt could potentially lower the overall cost of capital and result in an increase in firm value.

Over the years, various theories pertaining to capital structure have emerged that can be categorized into two broad groups. Two very pertinent theories in this regard are signaling theory (Ross, 1977) and pecking order theory (Myers & Majluf, 1984).

Pecking order theory suggests that firm leverage has a negative effect on profitability, whereas signaling theory posits that they are positively related. Both theories assume that leverage and corporate profitability have a linear relationship. A contrasting perspective is provided by the agency and trade-off theories. Both confirm the presence of an optimal capital structure below which firms can exploit tax shield benefits and beyond which there are disadvantages, such as bankruptcy and agency costs. Therefore, it is necessary for firms to remain cautious of risks that may affect their performance negatively (Kraus & Litzenberger, 1973). In the case of trade-off and agency theory, capital structure can be a good strategy that helps maximize shareholder wealth.

2.2. Empirical Studies

The empirical literature shows mixed evidence of the impact of firm leverage on profitability. These results can be attributed to different time spans, variation in methodological techniques, and changes in firm and country-specific factors. Such literature is classified into three broad categories.

The first group comprises studies that focus on establishing the link that firm leverage and corporate profitability are linearly related. Ramli et al. (2019), for example, highlight the positive effect of leverage on corporate

profitability. Conversely, Zhang et al. (2017) find a negative effect. More recent studies (Ngo et al., 2020; Rahman et al., 2020) find that leverage has a significant negative effect on profitability. These two strands have distinct research and practical implications.

The second group suggests that firm leverage and profitability have a nonlinear relationship. Research shows that financial leverage and business value/profitability have a nonlinear relationship (Berzkalne, 2015; Nieh et al., 2008; Yang et al., 2010). Thus, financial leverage boosts profitability, but business outcomes suffer if borrowed cash is misused. A study by Bae et al. (2017) confirms the existence of a curvilinear relationship between leverage and profitability, categorizing the relationship as either U-shaped or inverted U-shaped.

Similarly, Ngoc and Trang (2023) find a nonlinear relationship between leverage and profitability and identify threshold levels until which leverage would be profitable. They explain that profitability would likely rise even if leverage exceeded the threshold level as long as the cost of debt was low and debt was used effectively.

The third group of studies uses Hansen's model (1999) to probe the relationship between leverage, firm size, and corporate profitability. Ibhagui and Olokoyo (2018) use a threshold approach and conclude that firm size has a direct impact on leverage/corporate profitability relationships. The relationship becomes positive as firm size increases and vice versa.

Other empirical studies confirm the threshold influence of firm size on leverage-corporate profitability relationships (see Jaisinghani & Kanjilal, 2017; Khemiri & Noubbigh, 2020). Similarly, Bolarinwa et al. (2022) identify threshold levels to measure the influence of leverage on corporate profitability and conclude that leverage tends to benefit large firms. In a more recent study, Karaca et al. (2025) use a novel model called method of moments quantile regression and find a nonlinear, inverted U-shaped relationship between corporate value and capital structure.

H1: Short-term debt (STD) in small and large firms has a distinct impact on corporate profitability.

Studies focusing on the linkage between leverage, firm size, and profitability add another layer of complexity. For instance, in some studies, the negative effect of leverage on corporate profitability is much more pronounced in small firms and diminishes as firm size increases (Bolarinwa et al., 2022). Meanwhile, Chen and Chen (2011) add additional factors like industry and firm size as moderators, and profitability as a mediator, emphasizing the uncertain nature of this relationship. On the whole, these empirical studies highlight the complex relationship between firm size, leverage, and profitability, suggesting that a number of factors must be considered to understand this complex relationship.

Another strand of empirical studies focuses on identifying optimal threshold levels. Coricelli (2012), Arcand et al. (2015), and Akhtar et al. (2021) argue that there is evidence of nonlinearity between leverage and profitability in the presence of optimal threshold levels. Firms can experience declines in performance if this optimal threshold level is exceeded.

H2: LTD in small and large firms has a distinct impact on corporate profitability when the threshold variable is firm size.

Other empirical studies have employed the Hansen (1999) model to explore the impact of leverage on profitability in particular industries. Among these, Minnema and Andersson (2018) analyzed consulting and construction firms and confirmed nonlinear relationships with the thresholds that impact profitability. These findings help contextualize the diverse complexities governing the association between leverage and profitability.

In summary, there is a rich body of literature focusing specifically on employing Hansen's model to analyze the multifaceted linkage between leverage, firm size, and profitability. The findings of these empirical studies underscore the significance of firm size, optimal leverage levels, country- and industry-specific dynamics, and the interplay between three variables in shaping this complex association.

Importantly, most of the empirical studies (e.g., Ramli et al., 2019; Vithessonthi & Tongurai, 2015) exploring the leverage-profitability nexus lack the potential impact of other factors, such as firm size. Therefore, this study attempts to address this shortcoming while analyzing the leverage-

profitability relationship. Moreover, due to underdeveloped capital markets, long-term borrowing in Pakistan is not as common as in other countries. As a result, many businesses rely on short-term loans and internally generated funds to meet financing needs (Khan, 2012; Shah & Hijazi, 2004). This makes studying the effects of short-term leverage particularly important, as it may reveal the circumstances under which this type of financing is damaging to firm performance.

H3: Total debt (TD) in small and large firms has a distinct impact on corporate profitability when the threshold variable is firm size.

3. Data and Methodology

We employ a panel data regression since we aim to analyze the leverage-profitability relationship using the Hansen model. Panel data regression models are advantageous as they account for both time-series and cross-sectional variations. Additionally, panel data models are more useful in studies where firm-level financial data is used and the data spans several firms over multiple time periods.

Also, panel regression helps researchers control unobserved heterogeneity by employing random or fixed effects. Such features are more consistent and accurate in estimations compared to traditional time-series and cross-sectional models. This is because panel data models incorporate both types of data, enabling them to utilize more data points. This reduces multicollinearity and improves the degrees of freedom, leading to more robust statistical results.

We collected financial data on the sugar, cement, and automobile sectors from a State Bank of Pakistan database for the period 2010–2020. We selected these sectors because they use debt financing more than other industrial sectors. The final sample comprised 62 firms that employed leverage in their financing mixes and for which financial data was available for 2010–2020. Table 1 provides a sector-wise leverage analysis of firms within the study's time frame.

Table 1: Sector-wise leverage analysis

Sector	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Textile	17.97	14.14	14.05	14.36	11.38	10.48	11.18	12.23	12.95	11.97	15.90
Sugar	19.67	17.47	15.08	15.49	13.51	12.82	14.25	13.64	11.95	9.95	13.38
Food	10.75	15.05	17.60	18.72	11.55	9.97	7.02	14.89	12.01	8.84	16.54
Chemical	29.63	24.35	21.33	19.80	17.48	14.89	15.29	11.75	9.41	9.34	8.42
Manufacturing	8.39	9.27	12.24	10.88	10.07	12.31	8.89	5.98	6.79	8.68	9.96
Cement	19.55	17.85	14.05	12.86	9.79	11.16	9.02	9.09	12.94	16.28	22.07
Auto	2.98	1.36	0.78	0.77	1.19	0.25	0.49	0.44	0.43	0.59	1.79
Fuel/energy	13.26	13.40	10.43	9.30	7.21	6.19	6.71	7.52	5.91	5.04	5.87
Information/ communication	9.29	13.75	19.48	13.56	17.26	17.42	21.91	24.11	31.00	36.01	37.74
Refinery	0.00	0.00	0.00	0.00	0.00	0.00	3.16	3.74	2.60	3.83	5.46
Paper	20.66	18.94	14.18	13.86	10.59	12.80	14.71	13.36	13.35	14.93	15.57

In addition, the study utilized the fixed effects panel regression framework, which helps address endogeneity by controlling for all unobserved time-invariant factors that may be correlated with explanatory variables. Since these unobserved characteristics (such as firm culture, managerial style, or geographic location) can bias estimates if omitted, the fixed effects model eliminates their influence by focusing on within-unit variation over time. This decreases the risk of omitted variable bias and provides more consistent estimates of causal effects.

3.1. Variable Definition

In this study, corporate profitability is measured through return on assets (ROA) and return on equity (ROE). ROA measures overall operating efficiency by assessing profitability relative to total assets, while ROE assesses how efficiently a corporation utilizes shareholder funds to make profits. Both are vital in capital structure studies because ROA reveals operational performance regardless of financing, while ROE shows the benefit of financial leverage to shareholders, providing a comprehensive view of how a firm's chosen capital mix (debt vs. equity) impacts its ability to generate profit from its assets and owners' equity. ROA and ROE become more relevant when analyzing leverage. Since debt is considered less costly, the efficient use of debt should have a positive effect on both ROA and ROE. However, the positive impact will be greater on ROE. Leverage is measured through STD, LTD, and TD. Table 2 provides a list of variables and their measurement.

Table 2: Measurement of variables

Variable	Measurement
ROA, dependent variable	Profit before interest and taxes/total assets × 100
ROE, dependent variable	Profit after tax/shareholder funds × 100
STD, independent variable	STD/total assets × 100
LTD, independent variable	LTD/total assets × 100
TD, independent variable	TD/total assets × 100
Firm size, threshold variable	Natural log of total assets

LTD = Long-term debt, ROA = return on assets, ROE = return on equity, STD = short-term debt, TD = total debt.

3.2. Hansen Threshold Regression Model

The primary motivation for using the Hansen (1999) threshold regression model stems from potential weaknesses in existing empirical studies that contribute to ambiguous results. A notable weakness lies in the assumption that regression models are entirely linear, a premise upon which researchers often base their findings. Many current empirical models impose an ex-ante assumption that the leverage-profitability relationship linearly or monotonically increases or decreases with regressors in each model. Therefore, high leverage levels result in increases or decreases in corporate profitability. This should be true for all values of $Cc > 1$ and $Cc < 1$, where C is either vector's subset or a member of a set that contains c1 and all other regressors (Ibhagui & Olokoyo, 2018). However, we find that this supposition is not supported in many cases. There are instances where firm performance is weakened by leverage for only some C's, i.e., in the case of $Cc < 1$ or $Cc > 1$, but not both. Previous empirical studies addressing the leverage-profitability relationship have overlooked these plausible scenarios. Our study employs a regression-based threshold model to address this concern.

A nonlinear approach is employed in the threshold regression model, allowing for instances where the relationships between two variables can differ across segments of the data. In our threshold model, our sample is divided into two regimes, $Cc < 1$ and $Cc > 1$, for all leverage values. In this way, all possible scenarios can be considered while measuring leverage's impact on profitability. The variable $C \in V$, wherein the model for all probable regressors, V is the vector (threshold variable). The threshold variable divides the sample into two groups. This type of estimation framework is more adaptive and generalized and offers the

opportunity for various combinations of leverage-profitability relationships for different threshold levels, thus ensuring a more holistic measurement of the relationship (Ibhagui & Olokoyo, 2018). Keeping this context in mind, the basic purpose of using firm size is to learn whether firm leverage increases or decreases profitability for firms of varied sizes. Specifically, we adopted the Hansen (1999) approach as employed by Ibhagui and Olokoyo (2018) to estimate the threshold regression model. The primary focus as a regressor in this study is leverage (represented by the debt ratio), which includes short, long, and total debt ratios. While the model can be applied in various ways, we adhere to the Hansen (1999) model wherein all variables used are considered exogenous. Mathematically, the model can be expressed as follows:

$$y_{it} = \beta'_1 x_{it} I(q_{it} \leq \gamma) + \beta'_2 x_{it} I(q_{it} > \gamma) + v_{it},$$

This is used to draw the observed data samples, where time is represented by t and firm indexes are represented by i. The set of regressors also containing the focused regressor is denoted by x_{it} and the threshold variable (which can also be a member of x_{it}) is expected to follow a distribution that is continuous and is denoted by q_{it}. μi constitutes firms' time-invariant unobserved fixed effects (Ibhagui & Olokoyo, 2018).

3.3. Empirical Specification

As the purpose of this study is to explore the possible influence of firm size on the leverage-profitability relationship, we employ a regression model based on a threshold approach where the regressors in focus consist of a vector - debt (TD, STD, LTD), a performance vector that measures control variables and the proxies of financial performance. In this model, firm size is used to determine whether different firm sizes have different impacts on the leverage-profitability relationship. Following Ibhagui and Olokoyo (2018), the model used to estimate the relationship is given below:

$$FP_{it} = \mu_i + \beta_1^s LEV_{it} I(C_{it} \leq c_1) + \beta_2^s LEV_{it} I(C_{it} > c_1) + \emptyset^s Controls_{it} + \varepsilon_{it}^s$$

i = 1,…, n = 62 denotes firms, t = 2010,…, T = 2020, denotes time period, is profitability, is time-invariant specific fixed effect, is the threshold regression model's associated error term generated through threshold variable a, where the indicator function is I(.) and the firm size is a.

4. Results and Discussion

4.1. Descriptive Statistics

Based on Table 3's descriptive statistics, average profitability (ROA) is 0.031, thus showing that firms are earning 3.1 percent on average. Average ROE is 0.057, i.e., 5.7 percent. Total firm debt averages 0.561, indicating that external financing accounts for 56.1 percent of firms' financing for assets, while the remainder is funded through equity. LTD and STD average 21 percent and 35.1 percent, respectively, thus indicating that firms prefer STD over LTD. Among all variables, firm size exhibits the highest volatility. The variables' skewness values indicate that all variables fall within the range of a normal distribution.

Table 3: Descriptive analysis

Var	Mean	S. dev	Min	Max	Skew	Kur
ROE	0.057	0.236	-1.20	0.807	-0.251	2.560
ROA	0.031	0.078	-6.35	4.26	0.047	2.840
TD	0.561	0.217	0.083	0.881	0.379	3.040
LTD	0.210	0.133	0.000	0.874	0.807	2.930
STD	0.351	0.178	0.000	0.652	0.540	2.620
Firm size	15.678	1.197	12.75	18.293	0.116	2.820

LTD = long-term debt, ROA = return on assets, ROE = return on equity, STD = short-term debt, TD = total debt.

4.2. Threshold Analysis

The threshold value estimation and threshold regression results using the Hansen model are provided in Tables 4 and 5, respectively. Firm size (threshold variable) is represented by C. The threshold is divided into lower and upper regimes, i.e., $C_{it} < C$ or $C_{it} > C$). 0 represents firms below the threshold level while 1 represents firms above the threshold level.

Table 4 shows that 15.82 (in log form) is the threshold value, with upper and lower limits of 15.86 and 15.71, respectively. The value 15.82 signifies that firm size lower than this value is treated as small, while those above are treated as large.

Table 4: Estimating threshold value (ROA)

Threshold estimator (level = 95)				
Model	**Var**	**Threshold**	**Upper**	**Lower**
I	TD	15.82	15.86	15.71
II	LTD	16.17	16.20	16.10
III	STD	15.84	15.87	15.70

LTD = long-term debt, STD = short-term debt, TD = total debt.

In Table 5, we note that leverage has a significantly negative influence on ROA in model I. An increase in leverage results in decreased profitability due to the rise in fixed costs (interest expenses), negatively impacting profitability. The results are consistent with the assumptions of pecking order theory. They are also consistent with the findings of Nazir et al. (2021), who find that leverage has a significantly negative influence on profitability.

Our results show that the coefficients of large firms are significant, whereas the coefficients of small firms are insignificant. This implies that firm size has a threshold effect, and the relationship between leverage and firm performance changes as one moves from small firms to large ones. Similarly, Ibhagui and Olokoyo (2018) conclude that the influence of leverage on profitability differs among firms, and that it has no significant impact on large firms.

Table 5: Regression results (ROA): Threshold variable = firm size

Dependent variable: ROA						
	Model I (TD)		**Model II (LTD)**		**Model III (STD)**	
VAR	**Coef**	**t-val**	**Coef**	**t-val**	**Coef**	**t-val**
TD/LTD/STD	-0.002	-10.82	-0.002	-3.47	-0.041	-8.17
1 (large firms)	-0.002	-3.78	-0.003	-4.39	-0.0016	-3.26
0 (small firms)	-0.006	1.15	-0.004	1.59	0.001	1.66
C	2.126	292.7	2.128	259.17	2.119	263.21
F-stat	47.06		11.00		6.86	
Prob > F	0.000		0.000		0.001	

LTD = long-term debt, ROA = return on assets, STD = short-term debt, TD = total debt.

In model II, the threshold value is 16.17, with 16.10 as the lower limit and 16.20 as the upper limit. The overall impact of LTD on ROA is negative and significant. However, the coefficients of large firms are

significant, whereas the coefficients of small firms are insignificant, indicating that firm size has threshold effects on leverage-firm performance relationships.

In model III, the threshold value is 15.84, with 15.70 as the lower limit and 15.87 as the upper limit. The leverage coefficient demonstrates a strong negative impact on ROA. In addition, the coefficient of large firms is significant, whereas the coefficient of small firms is insignificant, indicating that firm size has a threshold effect.

Table 6: Estimating threshold value (ROE)

Threshold estimator (level = 95)				
Model	**Var**	**Threshold**	**Upper**	**Lower**
IV	TD	15.74	15.75	15.74
V	LTD	15.74	15.75	15.74
VI	STD	15.86	15.87	15.72

LTD = long-term debt, STD = short-term debt, TD = total debt.

In model IV, ROE is used as a dependent variable. The threshold value is 15.74, with upper and lower limits of 15.75 and 15.74, respectively. The overall impact of TD on ROE is positive and significant. Here also, we find support for trade-off theory, as the positive effect of leverage on profitability is an indication that profitable firms prefer using external funds to exploit tax shields. The coefficient for large firms is insignificant, whereas the coefficient for small firms is significant, indicating threshold effects of firm size on leverage-firm performance relationships.

Table 7: Regression results (ROE): Threshold variable = Firm size

Dependent variable: ROE						
	Model IV (TD)		**Model V (LTD)**		**Model VI (STD)**	
VAR	**Coef**	**t-val**	**Coef**	**t-val**	**Coef**	**t-val**
TD/LTD/STD	1.028	168.04	2.104	9.07	-2.569	-4.98
1 (large firms)	-0.015	0.90	0.251	2.48	0.772	5.30
0 (small firms)	0.051	-2.00	-0.260	-1.70	-0.147	-0.90
C	3.369	8.95	4.621	2.20	14.50	6.96
F-stat	9504.79		31.07		11.95	
Prob > F	0.000		0.000		0.000	

LTD = long-term debt, ROE = return on equity, STD = short-term debt, TD = total debt.

In model V, the threshold value is 15.74, with upper and lower limits of 15.75 and 15.74, respectively. The overall impact of LTD on ROE is significantly positive. The coefficient of large firms is significant, whereas the coefficient of small firms is insignificant, indicating that firm size influences the leverage-profitability relationship.

In model VI, the threshold value is 15.86, with upper and lower limits of 15.87 and 15.72, respectively. The overall impact of STD on ROE is negative and significant. The coefficient of large firms is significant, whereas the coefficient of small firms is insignificant.

4.3. Discussion of Findings

The empirical results above consistently demonstrate a significantly adverse impact of leverage, particularly LTD, on ROA and ROE. These findings support pecking order theory, which assumes that firms choose internally generated funds instead of debt. The economic significance of leverage's inverse impact on profitability must not be overlooked, as these negative findings highlight the risks associated with excessive borrowing. Therefore, while employing leverage in the financing mix can significantly enhance the earnings of firms experiencing strong financial performance, it also increases fixed financial costs in the form of interest payments. When operating income falls due to a decline in sales or an increase in costs, this fixed financial cost becomes a burden, leading to a decline in net income. Firms may even face losses. This type of scenario threatens firms' financial stability, resulting in lower investment and negative effects on their ability to innovate and expand.

At a broader level, investor confidence can decline due to excessive leverage, which may contribute to financial instability in the economy. Hence, it is imperative for firms, investors, and policymakers to understand the consequences of the negative influence of leverage on profitability, encourage sustainable development, and minimize systemic risk.

Nevertheless, the coefficients of small and large firms are different in all models, indicating a lack of threshold effects. This is inconsistent with the findings of Coricelli (2012), Cuong (2014), and Bolarinwa et al. (2022), who confirm threshold effects. Additionally, Karaca et al. (2025) also conclude a nonlinear inverted U-shaped relationship between capital

structure and corporate value. These contrasting findings indicate that the association between leverage and profitability may be context-dependent.

The study attributes the insignificant findings to Pakistan's challenging economic environment, which is characterized by high interest rates, inflation, and currency depreciation. These factors could be deterring companies from formulating long-term funding decisions. In such settings, firms are reluctant to commit to long-term decisions due to policy uncertainty. Thus, they generally adopt a wait-and-see approach until indicators become positive. In the same vein, Mehmood et al. (2022) report insignificant findings on the leverage-profitability nexus and potentially attribute insignificant findings to high interest rates.

The consistent negative effect of leverage on profitability highlights the significance of careful financial management. Therefore, firms are expected to manage their debt carefully and efficiently, particularly in unstable economic environments experiencing high interest rates (Minnema & Andersson, 2018).

At the same time, policymakers should make efforts to create an enabling environment that is conducive to firms making long-term decisions (Chao et al., 2017). If economic managers are successful in managing economic challenges like inflation, interest rates, and currency devaluation, there will be a positive effect on firms' ability to make long-term decisions.

While our findings are inconsistent with other studies, particularly with those of Ibhagui and Olokoyo (2018), they indicate that these associations may be context-dependent. Hence, further research is needed in varied contexts to obtain an in-depth understanding of the complex triangular linkage between leverage, firm size, and corporate profitability.

5. Conclusion

This study sought to analyze the relationship between leverage and profitability from a fresh perspective with the aim of finding a possible answer to inconsistencies in earlier empirical studies. It is based on the fact that previous empirical studies did not consider firm size when measuring the association between leverage and corporate profitability. This omission could possibly have led to inconclusive results. To fill this gap, we used a

Hansen threshold model, where firm size; the threshold variable could potentially explain the inconclusive results reported in previous studies.

Our findings reveal important insights and patterns pertaining to firm size, leverage, and corporate profitability. Contrary to our assumption, the results reveal that the threshold effects of firm size are not evident in the leverage/corporate profitability linkage. Moreover, leverage negatively affects ROA and ROE across all models, thus indicating a pervasive impact on corporate profitability. This negative impact of leverage on both measures of profitability may imply that interest rates remained on the higher side, significantly impacting firms' fixed costs and decreasing profitability. Therefore, if interest rates remain high, firms will be reluctant to borrow, particularly in developing countries where economies are more sensitive to economic shocks, thereby limiting growth potential.

This study is useful for managers as it helps them understand the complex interrelationship between leverage, firm size, and profitability. Managers in developing economies should be more careful while making financing decisions because developing economies are more susceptible to external shocks, which significantly affect firms' ability to repay debt.

Moreover, when a firm achieves its optimal capital structure, its management should focus on maintaining that structure to maximize firm value. To do so, firms must adjust their debt-to-equity ratios to balance the tax shield advantages of debt against agency costs and the cost of financial distress. In addition, firms should balance other factors such as asset tangibility, firm size, profitability, and prevailing economic conditions.

Furthermore, this study encourages policymakers to develop policies that will help improve the economic environment. With proper implementation, this can lead to a decline in interest rates. In turn, this would encourage firms to borrow for expansion purposes and be influential in developing capital markets.

This study has certain limitations. First, it is limited to Pakistan. Future studies could be conducted in other countries. Second, it is limited to three industrial sectors. Future researchers could conduct comparative analyses in other sectors. Third, this study is limited in terms of control variables. Thus, other control variables could be used as threshold variables for a deeper understanding of leverage-profitability relationships.

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