# Firm-Specific Determinants of Capital Structure: Empirical Evidence from Selected Indian Renewable Power Energy Companies (2015-2024)

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**Abstract**
This study examines the determinants of the capital structure in selected Indian renewable power energy companies. This study is carried out using the panel data covering the period from 2015 to 2024. The analysis of this study focuses on the impact of the firm-specific factors, namely: profitability, asset tangibility, firm size, liquidity, interest coverage ratio, growth rate, and non-debt tax shields, on leverage, which is measured by the debt-to-equity ratio. This study uses a fixed effects panel regression to evaluate the differences between the firms. The top 5 companies are selected based on their market capitalization listed in the Indian stock market as of September 2025 for this study. The empirical results of the study reveal that asset tangibility and firm size influence the capital structure significantly. Profitability, interest coverage ratio, liquidity, growth rate, and non-debt tax shields don't show a significant relationship with leverage. These findings indicate that the capital structure decisions in the Indian renewable power energy sector are primarily driven by long-term structural characteristics rather than short-term financial performance indicators. The results of the study show strong support for the trade-off theory of the capital structure, while there is limited evidence in favor of the pecking order theory. This study contributes to the existing literature by presenting sector-specific insights into the capital structure of renewable energy companies. The findings of the study will help policymakers and corporate managers design financial strategies and regulatory frameworks for Indian renewable energy companies.

***Keywords:*** Indian Renewable power companies, capital Structure, debt-equity ratio, panel data analysis, film-specific determinants

## 1. Introduction

Capital structure is an important element of corporate finance that determines the proportion of debt to equity used to finance the firm's operations and growth in the long term (Modigliani & Miller, 1958). An optimum mix of debt and equity is central to the firm value, its financial stability, and long-term sustainability (Myers, 1984; Jensen & Meckling, 1976). In a developing economy like India, the renewable power sector plays a vital role in ensuring energy security, promoting sustainable development, and supporting industrial growth (Dubey et al., 2023). Over the period of 10 years, India has witnessed significant growth in the renewable energy sector. This growth is driven by government initiatives, rising environmental concerns, and technological advancements (Bhattacharyya, 2019). This sector is characterized by substantial regulatory oversight, longer project gestation periods, high capital investment, and complex strategic financial decisions (Handoo & Sharma, 2014).

The capital structure of renewable power energy companies is largely influenced by various internal and external factors such as asset tangibility, profitability, firm size, growth rate, liquidity, business risk, and tax shields (Titman & Wessels, 1988; Rajan & Zingales, 1995). These determinants are important for corporate managers and policymakers to effectively design financial strategies, to reduce the cost of capital and to sustainably expand in this sector. The unique institutional framework and the regulatory environment in India provide an excellent opportunity to analyze the capital structure behavior in an emerging market context (Booth et al., 2001; Frank &

Goyal, 2009).

## 2. Literature Review

The choice of capital structure in a firm depends upon how firms finance their assets through debt and equity. This has been a central theme in corporate finance research. The irrelevance proposition given in the classical theory proposed by Modigliani and Miller laid the groundwork, which was then followed by competing explanations given in trade-off theory, pecking order theory, and agency theory (Jensen & Meckling, 1976; Modigliani & Miller, 1958; Myers, 1984). Empirical research has investigated the impact of firm-specific factors such as profitability, size, tangibility, liquidity, tax shields, and growth rate on leverage decisions in different industries across different contexts (Rajan & Zingales, 1995; Titman & Wessels, 1988). This section reviews the theoretical as well as the empirical literature relevant to the capital structure determinants.

### Theoretical perspectives on capital structure

Further evidence is provided by Bistuer-Talavera et al. (2024), who analyzed capital structure decisions in the renewable energy sector during the energy transition. Their findings showed that long-term debt and project financing are primary sources of funding for renewable energy projects. The study also underscored the significance of stable regulatory frameworks and diversified financing mechanisms in facilitating access to the capital.

Chakrabarti and Chakrabarti (2023) investigated the determinants of capital structure in the Indian energy sector using panel data from 141 energy companies. Their findings revealed that firm size, liquidity, age and asset turnover significantly influence Leverage, whereas profitability, growth opportunities, non-debt tax shields, and asset tangibility do not significantly affect financing decisions. The study suggests that larger and more established firms enjoy better access to debt markets and can secure financing at lower costs.

Focusing specifically on renewable energy companies, Vidhyadevi and Swarupa (2023) examined the capital structure practices of selected Indian renewable energy firms. Their analysis highlighted the capital-intensive nature of renewable energy projects and the consequent dependance on the long-term debt financing. The study emphasized the importance of maintaining the optimal Debt-Equity balance to ensure financial sustainability and support future expansion.

(Frank & Goyal, 2003) The trade-off theory suggests that firms balance the tax advantage of debt against the costs of financial distress and bankruptcy. Firms that are burdened with higher taxes may prefer debt to exploit the interest tax shield. But excessive debt increases the risk of financial distress. Trade-off theory is widely used in empirical studies in leverage determinants.

The pecking order theory argues that firms prefer internal sources of financing first, and then debt, and lastly issue equity as a last resort to minimize the cost of asymmetric information (Myers & Majluf, 1984). Empirical research on this theory has yielded mixed evidence, as the firms often diverge from the strict hierarchy in practice (Shyam-Sunder & C. Myers, 1999).

(Modigliani & Miller, 1958) proposed that in a frictionless market, the capital structure is irrelevant to the firm value. This theory serves as a benchmark for the subsequently developed theories of capital structure. However, real-world frictions like bankruptcy costs, taxes, and information asymmetry led researchers to refine and further extend the theory to incorporate the practical determinants of leverage.

### Empirical determinants of capital structure

**Profitability** – Since profitable firms rely on internal funds and hence require less external debt, profitability is considered to influence the leverage negatively under the pecking order theory. Empirical evidence is mixed. Some studies find a significant negative relationship, while other studies suggest less significant or weak effects. For example, studies on Indian firms show that profitability is significant in certain models, but may vary as the debt matures. (Handoo & Sharma, 2014)

**Assets Tangibility** – Assets tangibility is the ratio of fixed assets to total assets. It is often positively related to leverage because tangible assets serve as collateral that reduces lenders' risk of repayment defaults. This relationship is supported in many empirical research studies. (Stoiljković et al., 2022)

**Firm size –** Bigger firms usually have better access to capital markets and also diversified risk profiles. This can lead to higher leverage under the trade-off theory. This positive relationship has been documented for different industries across different countries. (Stoiljković et al., 2022)

**Liquidity** – This reflects the short-term financial health of the firm. Under the pecking order theory, firms with more liquidity may rely less on debt. The results of the empirical research that studies the impact of liquidity on leverage are mixed. Some studies find a significant negative relationship, while other studies find it insignificant or context-specific. (Mazanec, 2023)

**Growth opportunities** – Growth opportunities capture the future investment potential. Trade-off theory suggests that while growing firms may take on more debt to finance their expansion, higher growth may also indicate risk, leading to lower leverage. The availability of empirical evidence is inconsistent, while some studies show insignificant or weak effects in emerging markets. (Shaik et al., 2022)

**Non-debt Tax Shields** –Non-debt tax shields such as depreciation can substitute for the interest tax shields, thereby reducing the incentives to use debt. Empirical findings on the role of non-debt tax shields are also mixed. Some studies report negative associations with leverage, while others often show low significance levels. (Khémiri & Noubbigh, 2018)

**Empirical evidence from Indian and emerging markets**

Studies that focused on Indian firms usually find that growth, profitability, asset tangibility, tax rate, size, and debt servicing capacity influence the debt structure, though the significance levels vary by debt tenure (like short-term, medium-term, or long-term debt) and by model specifications (Handoo & Sharma, 2014). Evidence from the manufacturing and financial sector in India reinforces the importance of these determinants but also underscores that these results are context-specific due to market differences and institutional and regulatory frameworks (Shaik et al., 2022).

Empirical research from emerging markets (like Pakistan, Gulf, Africa) also shows that traditional determinants like profitability, tangibility, size, and liquidity impact leverage, while the magnitude and the directions of the effects differ across institutional environments (Khémiri & Noubbigh, 2018).

**Research Gap and Novelty of Study**

Despite extensive body of literature o Capital Structure determinants, sector-specific studies focusing on the renewable power energy industry, particularly in the context, remain limited. A systematic keyword search using "Capital Structure" AND "renewable energy" OR "green energy" through Publish or Perish Software and Google Scholar for the period 2015-2025 yielded only a small number of relevant studies. This indicate that empirical research examining capital structure determinants in the renewable power energy sector is still underdeveloped, thereby highlighting a significant research gap.

Furthermore, existing studies provide inconclusive of e evidence regarding the relative importance of certain firm-specific factors, particularly growth opportunities and non-debt tax shields, in influencing Capital Structure Decisions. With these variables have been widely examined in general corporate finance literature, their role within renewable power energy companies has not been adequately explored. The Present Study addresses these gaps by focusing exclusively on selected Indian renewable power energy companies over the period 2015-2024. Using Panel regression analysis, the study evaluates the impact of firm-specific determinants, Such as asset structure, firm Size, Profitability, liquidity, growth, and non-debt tax shields on the capital structure.

**Novelty of the Study:**

1) The study is among the few empirical investigations dedicated exclusively to the Indian renewable power energy sector, a strategically important and capital-intensive industry.

2) It provides updated evidence using recent data covering the period 2015-24, reflected the rapid expansion and policy driven transformation of India's renewable energy market.

3) The Study specifically examines the relative influence of growth opportunities and non-debt tax shields; variables whose significance remains unclear in the existing literature.

4) By employing panel regression techniques, the research captures both cross-sectional and time-series variations in firm's financing decisions, thereby improving the robustness of findings.

5) The Study contributes sector-specific insights that can assist policymakers, investors, lenders, and corporate managers in designing effective financing strategies for renewable power energy companies.

## 3. Objectives of the study

1) To empirically examine the impact of firm-specific financial characteristics on the capital structure of selected Indian renewable power energy companies during the period 2015–2024.

2) To analyze the relationship between profitability and capital structure of selected Indian renewable power energy companies.

3) To examine the effect of asset tangibility and firm size on the capital structure of selected Indian renewable power energy companies.

4) To assess the influence of liquidity and interest coverage ratio on the capital structure decisions of selected firms.

5) To evaluate the impact of business risk and non-debt tax shields on capital structure in the Indian renewable power energy sector.

## 4. Hypotheses of the study

1) ($H_{01}$): Profitability has no significant impact on the capital structure (debt–equity ratio) of selected Indian renewable power energy companies.

2) ($H_{02}$): Asset tangibility and firm size have no

significant impact on the capital structure of selected Indian renewable power energy companies.

3) ($H_{03}$): Liquidity and interest coverage ratio have no significant impact on the capital structure of selected Indian renewable power energy companies.

4) ($H_{04}$): Growth rate and non-debt tax shields have no significant impact on the capital structure of selected Indian renewable power energy companies.

## 5. Research Methodology

1) **Research design** – Quantitative and explanatory research design

2) **Sample selection** – The sample comprises five major renewable power energy companies, namely: JSW Energy Limited, Tata Power Solar Systems, Suzlon Energy Limited, NTPC Limited, Adani Green Energy Limited. These firms were selected on the basis of the size of their market capitalization. The top 5 firms as of January 2026 with the highest market capitalization were selected for this research study. Further, the selection was finalized based on data availability and sectoral relevance.

3) **Sources of data collection** – This study uses secondary data collected from annual reports for a period of 10 years from 2015 to 2024, resulting in a balanced panel data-set consisting of 50 firm-year observations.

4) **Panel structure of data –** The balanced panel is n = 5, T = 10. Here, n represents the number of firms, which is 5 in this research study, and T is the time period, which is 10 years, i.e., from 2015 to 2024.

Hence total observations = 5 * 10 = 50

This study employs a balanced panel data-set. This data-set consists of 5 firms observed for a period of 10 years, resulting in 50 firm-year observations. The balanced panel data-set used for analysis is presented in the Appendix.

5**) Variables and measurement** – The capital structure is measured using the debt – equity (DE) ratio, which is a dependable variable for this research study. The independent variables are selected on the basis of classical and established capital structure theories and prior empirical literature. The operational definitions of the dependent variables are as follows:

a) Profitability (PF) = EBITDA / Total Assets

b) Tangibility (TG) = Total Fixed Assets / Total Assets

c) Firm Size (FS) = Natural Logarithm of

d) Liquidity (LQ) = Current Assets / Current Liabilities

e) Non-Debt Tax Shields (NDTS) = Annual Depreciation / Total Assets

f) Growth Rate (GR) = Annual Growth Measure

g) Coverage Ratio (CR) = EBITDA / Interest Expenses

The above-mentioned variables capture profitability, asset structure, scale, liquidity position, tax benefits, growth opportunities, and debt-serving abilities of the selected firms.

**6) Estimation technique and model used** – Since the nature of the data is a panel data-set in nature, this study employs panel data regression analysis. Fixed effects within regression models are estimated to control for unobserved, time-invariant, and firm-specific heterogeneity like managerial practices, firm-specific risk profiles, and ownership structures. Separate regression models are estimated corresponding to each of the hypotheses. This is done to avoid multi-collinearity and to ensure clarity in interpretation.

$$DE_{\{it\}} = \alpha_i + \beta X_{\{it\}} + \varepsilon_{\{it\}}$$

Where represents the debt–equity ratio of firm *i* in year *t*,

$\alpha_i$ captures firm-specific fixed effects,

$X_{\{it\}}$ is a vector of firm-specific explanatory variables,

$\beta$ denotes the corresponding coefficient vector,

And $\varepsilon_{\{it\}}$ is the error term

7) **Hypothesis testing procedure** – Hypotheses are tested using t-statistic values for individual coefficients and F-statistics for overall model significance at conventional significance levels of 1%, 5% and 10%. The null hypothesis is rejected if the corresponding p-value is found to be less

than 0.05.

**8) Statistical software used** – All the estimations are carried out in R statistical software.

## 6) Data Analysis & Interpretation

**1) From the Data of Hypothesis Testing number-1**

**Empirical Results:**

The fixed-effects regression results show that profitability has a positive effect, but still, it is not statistically significant (p-value = 0.966). Also, the value of R-Squared is very low, meaning that profitability explains almost no changes in the debt-equity ratio within the firms.

**Interpretation**

In the renewable power energy sector, if the profitability is not significant, it means that the short-term earnings do not affect the debt decisions. This is exactly against the Pecking order Theory, which expects more profitable firms to use less Debt. Instead, the firms in this sector don't use their internal cash flow but are completely dependent on planned financing arrangements. This makes sense because most financing decisions are long-term and project-focused, and also the industry is more capital-intensive and regulated.

**2) From the Data of Hypothesis Testing number-2**

**Empirical Results:**

The test results show that a negative and significant effect is created by asset tangibility on debt, meaning that when a firm useless debt ($p< 0.05$) with more fixed assets. On the other hand, firm size has a positive and significant impact on the debt-equity ratio, thereby meaning larger firms tend to take on more debt ($p<0.01$). It is explained in the overall model that about 15% of the changes in leverage within the firms.

**Interpretation**

The firms with more fixed assets tend to use less debt because of the negative link between asset tangibility and debt. This happens because of regulations, long-lasting assets, and cautious financing strategies. On the other hand, the positive effect of firm size means that larger firms can now easily borrow more, face lower borrowing costs, and have stronger credit ratings. The above results strongly support trade-off theory, showing that a firm's structure and size are immensely important in deciding how much debt to use.

3) **From the Data of Hypothesis Testing number-3**

**Empirical Results:**

As the p-values are much higher than usual significance levels, both the liquidity and the interest coverage ratios have no significant impact on debt. The model also explains very little about the variation in the leverage.

**Interpretation**

The fact that liquidity is not significant means that a firm's short-term ability to pay its bills does not affect long-term debt decisions in this sector. Likewise, the interest coverage ratio is also not significant, showing that firms do not change their debt levels based on short-term ability to pay interest. This is because the sector relies on long-term loans, government guarantees, and project-based financing rather than short-term cash flow.

4) **From the Data of Hypothesis Testing number-4**

**Empirical Results:**

Both the non-debt tax shields and growth rate do not have a significant effect on debt levels. This relationship is not statistically significant even though non-debt tax shields show a negative effect.

**Interpretation**

Some of the results show that the changes in the debt levels are not because of company growth. This because of the reason that growth in this sector is usually funded through government support, new equity, or long-term project loans, which are separate from the firm's overall debt structure. Depreciation Tax benefits do not replace interest tax benefits is because of that that the non-debt tax shields are not significant, showing that the financing decisions are hardly impacted by the tax considerations.

**Hypothesis Testing**

Below is the model adequacy check common for all the hypotheses.

Balanced panel:

Firms (n) = 5 Time periods (T) = 10

Total observations (N) = 50

This satisfies the basic requirements for firm-level panel estimation.

**$H_{01}$: Profitability has no significant impact on the capital structure (debt–equity ratio) of selected Indian renewable power energy companies.**

**Model type:**

- One-way Fixed Effects (within) model
- Controls for unobserved, time-invariant firm-specific heterogeneity

**Coefficient-wise Interpretation:**

| Profitability (PF) | |
|---|---|
| Statistic | Value |
| Coefficient ($\beta_1$) | 0.16586 |
| t-value | 0.0428 |
| p-value | 0.9661 |

**Interpretation of the above output table:**

- The coefficient of profitability is positive, but:
- The p-value = 0.9661, which is far greater than 0.05
- The t-statistic is extremely small, indicating no explanatory power.

Profitability does not have a statistically significant effect on the debt–equity ratio.

**Model Fit Indicators** Within $R^2$: 0.0000416

Profitability explains virtually none of the within-firm variation in capital structure.

F-statistic: F = 0.001832, p-value = 0.96605

This confirms that the model as a whole is statistically insignificant.

**Statistical Decision on Hypothesis 1**

Decision Rule: Reject $H_{01}$ if p-value < 0.05. Otherwise, fail to reject $H_{01}$.

**Decision: Fail to reject the null hypothesis ($H_{01}$)**

**Result Statement**

The results of fixed panel regression show that profitability has no statistically significant impact on the capital structure of the selected Indian renewable power energy companies. Although the coefficient of profitability is positive, it is not statistically significant (β = 0.1659 and p = 0.966). This means that changes in profitability do not significantly explain changes in the debt-equity ratio within the firms. Hence, null hypothesis ($H_{01}$) is not rejected.

**$H_{02}$: Asset tangibility and firm size have no significant impact on the capital structure (debt–equity ratio) of selected Indian renewable power energy companies.**

**Model type:**

- One-way fixed effects (within) model
- Controls for unobserved firm-specific heterogeneity

**Coefficient-wise Interpretation for Tangibility**

| Tangibility (TG) | |
|---|---|
| Statistic | Value |
| Coefficient | −14.1239 |
| t-value | −2.1566 |
| p-value | 0.0367 |

**Interpretation of the above output table:**

- Tangibility has a negative and statistically significant effect on the debt–equity ratio.
- A higher proportion of fixed assets is associated with lower leverage within firms over time.

This is statistically significant at the 5% level.

**Coefficient-wise Interpretation for Firm Size**

| Firm Size (SF) | |
|---|---|
| Statistic | Value |
| Coefficient | 1.3455 |
| t-value | 2.7789 |
| p-value | 0.0081 |

**Interpretation of the above output table:**

- Firm size has a positive and statistically significant effect on capital structure.
- Larger firms tend to employ higher debt relative to equity.

This is statistically significant at the 1% level, which is very strong.

**Overall Model Fit Within $R^2$ = 0.1523**

- Tangibility and firm size together explain about 15.2% of the within-firm variation in leverage.
- F-statistic = 3.8634 (p = 0.0286). The mode is jointly Significant.

**Statistical Decision on Hypothesis 2**

- Decision Rule: Reject $H_{02}$ if at least one explanatory variable is statistically significant.

Hence, both asset tangibility and firm size significantly influence capital structure.

**Result Statement**

The empirical results confirmed that asset tangibility and firm size play a statistically significant role in shaping the capital structure of the selected Indian renewable power energy companies. The results indicate that asset tangibility negatively and significantly affects the debt-equity ratio ($\beta$ = -14.12, $p < 0.05$), whereas firm size positively influences leverage at a high level of significance ($\beta = 1.35$, $p < 0.01$). Hence, the null hypothesis ($H_{02}$) is rejected.

**$H_{03}$: Liquidity and interest coverage ratio have no significant impact on the capital structure (debt–equity ratio) of selected Indian renewable power energy companies.**

**Model specification:**

- One-way fixed effects (within) model
- Controls for time-invariant firm-specific effects

The model is econometrically appropriate

**Coefficient-wise Interpretation for Liquidity**

| Liquidity (LQ) | |
|---|---|
| Statistic | Value |
| Coefficient | 0.2605 |
| t-value | 0.2317 |
| p-value | 0.8179 |

**Interpretation of the above output table:**

- Liquidity has a positive but statistically insignificant effect on leverage.
- The very high p-value indicates no meaningful relationship.

**Coefficient-wise Interpretation for Coverage Ratio**

| Growth Rate (GR) | |
|---|---|
| Statistic | Value |
| Coefficient | $-3.11 \times 10^{-5}$ |
| t-value | −0.4380 |
| p-value | 0.6636 |

**Interpretation of the above output table:**

- Interest coverage has a negative but statistically insignificant effect.
- Firms' debt-servicing ability does not-significantly alter leverage decisions.

**Overall Model Fit:** Within $R^2 = 0.0041$

Liquidity and coverage ratio explain less than 1% of within-firm variation in capital structure.

F-statistic = 0.0894 (p = 0.9147)

The model is jointly insignificant.

This confirms the absence of explanatory power.

**Statistical Decision on Hypothesis 3**

Decision Rule: Reject $H_{03}$ if any coefficient is statistically significant.

**Decision: Fail to reject the null hypothesis ($H_{03}$)**

Hence, liquidity and interest coverage ratio do not significantly influence capital structure.

**Result Statement**

Findings from the fixed effects panel regression suggest that variation in the liquidity and interest coverage ratio does not significantly explain changes in the capital structure of the sampled Indian renewable power energy companies. The variables exhibit high p-values, indicating insignificance, and the model fails to adequately explain variations in the dependent variables. Consequently, the null hypothesis ($H_{03}$) cannot be rejected.

**$H_{04}$: Growth rate and non-debt tax shields have no significant impact on the capital structure (debt–equity ratio) of selected Indian renewable power energy companies.**

**Model specification:**

- One-way fixed effects (within) model
- Controls for firm-specific unobserved heterogeneity

**Coefficient-wise Interpretation**

| Coverage Ratio (CR) | |
|---|---|
| Statistic | Value |
| Coefficient | −0.0745 |
| t-value | −0.4205 |
| p-value | 0.6762 |

**Interpretation of the above output table:**

- Growth rate has a negative but statistically insignificant

effect on leverage.

- Changes in firm growth do not systematically influence debt–equity decisions.

| Non-Debt Tax Shields (NDTS) | |
|---|---|
| Statistic | Value |
| Coefficient | −53.51 |
| t-value | −1.3313 |

| Non-Debt Tax Shields (NDTS) | |
|---|---|
| Statistic | Value |
| p-value | 0.1901 |

**Interpretation of the above output table:**

- NDTS shows a negative relationship with capital structure, consistent with theory.
- However, the effect is not statistically significant at conventional levels.

**Overall Model Fit Within $R^2 = 0.0438$**

Growth and NDTS explain about 4.4% of within-firm variation in leverage. F-statistic = 0.9843 (p = 0.3820). The model is jointly insignificant.

**Statistical Decision on Hypothesis 4**

Decision Rule: Reject $H_{04}$ if at least one coefficient is statistically significant.

**Decision: Fail to reject the null hypothesis ($H_{04}$)**

Hence, growth rate and non-debt tax shields do not significantly affect capital structure.

**Result Statement**

Evidence from the fixed effects panel regression suggests that variations in the firm growth and non-debt tax shields do not significantly explain differences in capital structure across the sampled Indian renewable power energy companies. Both the variables display negative coefficients but lack statistical significance. Accordingly, the null hypothesis ($H_{04}$) is not rejected.

## 7) Discussion

The present study examined the determinants of capital structure in selected Indian renewable power energy companies during 2015-24 using balanced panel data analysis. The findings reveal that capital structure decisions in the renewable energy sector are primarily influenced by long-term structural characteristics rather than short-term financial performance indicators. The results provide important insights into applicability of capital structure theories in a highly regulated capital-intensive industry.

The findings indicate that profitability has no statistically significant impact on the Debt-to-Equity ratio, leading to the acceptance of $H_{01.}$ This result is inconsistent with Pecking Order Theory, which argues that profitable firms prefer internal funds and therefore rely less on the external debt. Similar findings have been reported by Rajan and Zingales (1995) and Frank and Goyal (2009), who observed that profitability often exhibits a weak or inconsistent relationship with leverage in industries characterized by stable cash flows and long-term investment commitments. In the renewable energy sector, financing decisions are largely project-based and depend on long-term funding arrangements rather than annual earnings performance. Consequently, internal cash generation appears to play a limited role in determining leverage levels.

The Study further reveals that firm size has a positive and highly significant effect on leverage, while asset tangibility shows a significant negative relationship with debt. These findings strongly support the Trade-off Theory of capital structure. The positive influence of firm size is consistent with the studies of Titman and Wessels (1988), Rajan and Zingales (1995), and Booth et al. (2001), which found that large firms enjoy easier access to Debt markets due to lower bankruptcy risk, greater diversification, and stronger creditworthiness. The negative relationship between asset tangibility and leverage differs from many traditional studies that report a positive association because tangible asset can serve as collateral. However, similar observations have been noted in regulated infrastructure sectors where firms have access to alternative financing sources such as government support, equity financing, and concessional loans. In the renewable power sector, high asset ownership may reduce the dependence on the external debt financing.

The results also show that liquidity and interest coverage ratio do not significantly influence leverage decisions. The finding suggests that short-term financial strength and debt-servicing capacity are not major determinants of Capital Structure in renewable energy companies. Similar conclusions were reported by Antoniou et al. (2008) and Deesomsak et al (2004), who found that liquidity affects on leverage are often weak in industries with long-term financing structures. Renewable energy projects typically operate under long-term power purchase agreements, predetermined Tariffs, and fixed repayment schedules, making Leverage less sensitive to short-term fluctuations in earnings or liquidity.

Furthermore, the study finds that growth rate and non-debt tax shield have no significant effect on capital structure. Traditional theories often suggest that growing firms require more external financing, while non-debt tax shields can substitute for the tax benefits of debt, However, the present findings are consistent with studies by Huang and Song (2006) and Frank and Goyal (2009), which reported

limited explanatory power of these variables in certain industries. In the renewable energy sector, expansion is generally financed through project-specific funding, fresh equity issues, government incentives, and policy support rather than through increased corporate leverage. Similarly, depreciation-related tax benefits are relatively predictable and therefore do not substantially influence financing decisions.

Overall, the findings demonstrate that capital structure decisions in Indian renewable power energy companies are shaped predominantly by firm size and asset structure, while profitability, liquidity, growth opportunities, interest coverage, and non-debt tax shields play relatively minor roles. These results provide strong support for the Trade-off Theory and limited support for the Pecking Order Theory. The study highlights the importance of Industry-specific factors such as regulatory frameworks, project financing mechanisms, government support, and capital intensity in determining optimal capital structure. The findings offer valuable implications for investors, policymakers, lenders, and financial managers involved in the renewable energy sector and other regulated infrastructure industries.

## 8) Conclusion

This study has examined the factors that influence the capital structure in selected companies using the panel data analysis. It has analyzed how the debt-equity ratio is affected by profitability, asset tangibility, firm size, liquidity, interest coverage ratio, growth rate, non-debt tax shields. How firms decide the level of debt in a capital-intensive regulated sector, this industry specific evidence is explained by industry-specific evidence.

The results of this study show that capital structure decisions are not strongly affected by profitability, asset tangibility, firm size, liquidity, interest coverage ratio, growth rate, non-debt tax shields. But firm size and asset tangibility are the crucial factors that significantly affect the leverage. This means that, instead of short-term financial performance, what matters most is the basic firm size when deciding the level of debt. In this study of the Indian renewable power energy sector, the overall findings strongly support the trade-off theory of capital structure, extending very little support to pecking order theory.

In general, the evidence shows that financing decisions in the Indian renewable power energy sector are mainly influenced by long-term investment needs, firm size, asset structure, and institutional factors rather than short-term liquidity and profitability. It also adds to the existing research by giving strong sector-specific insights into capital structure decisions in the setting of emerging markets.

### Policy and Managerial Implications

1) **Stable Regulations:** Ensure Clear and predictable policies to facilitate long term debt financing for renewable energy projects.
2) **Support for Small firms:** Provide easier loans, guarantees, and special financing schemes to improve debt access for smaller companies.
3) **Renew Tax Incentives:** Reassess depreciation-based tax benefits to better align with the firms financing and investment needs.
4) **Promote Long-Term Financing:** Encourage Instruments such as Green Bonds and Infrastructure bonds to meet sector specific firms' requirements.
5) **Focus on Scale and Assets:** Strengthen asset quality and expand firm size to improve debt and capacity and reduce financing costs.
6) **Adapt a Long-Term Perspective:** Base financing decisions on project viability and capital requirements rather than short-term profitability or liquidity.
7) **Diversify Funding Sources:** Use a mix of equity, project financing, and government supported funds instead of relying solely on debt for growth.
8) **Maintain Financial Stability:** Monitor Liquidity and interest coverage ratios to ensure financial discipline, investor confidence, and long-term sustainability.

## References


- Bhattacharyya, S. C. (2019). Energy Economics: Concepts, Issues, Markets and Governance. Springer London. https://doi.org/10.1007/978-1-4471-7468-4
- Booth, L., Aivazian, V., Demirguc-Kunt, A., & Maksimovic, V. (2001). Capital Structures in Developing Countries. The Journal of Finance, 56(1), 87–130. https://doi.org/10.1111/0022-1082.00320
- (Charabarti, 2023). The capital Structure Puzzle- Evidence from Indian Energy Sector. SSRN
- (Cristobal 2024). Capital Structure Decisions in the Energy Transition: Insights from Spain. Journal of Urban Planning and Development.
- Dubey, B., Agrawal, S., & Sharma, A. K. (2023). India's Renewable Energy Portfolio: An Investigation of the Untapped Potential of RE, Policies, and Incentives Favoring Energy Security in the Country. Energies, 16(14), 5491. https://doi.org/10.3390/en16145491
- Frank, M. Z., & Goyal, V. K. (2003). Testing the pecking order theory of capital structure. Journal of Financial Economics, 67(2), 217–248. https://doi.org/10.1016/S0304-405X(02)00252-0
- 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
- Handoo, A., & Sharma, K. (2014). A study on determinants

of capital structure in India. IIMB Management Review, 26(3), 170–182. https://doi.org/10.1016/j.iimb.2014.07.009

- 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
- Khémiri, W., & Noubbigh, H. (2018). Determinants of capital structure: Evidence from sub-Saharan African firms. The Quarterly Review of Economics and Finance, 70, 150–159. https://doi.org/10.1016/j.qref.2018.04.010
- Mazanec, J. (2023). Capital Structure Theory in the Transport Sector: Evidence from Visegrad Group. Mathematics, 11(6), 1343. https://doi.org/10.3390/math11061343
- Modigliani, F., & Miller, M. H. (1958). The Cost of Capital, Corporation Finance and the Theory of Investment. The American Economic Review, 48(3), 261–297.
- Myers, S. C. (1984). The Capital Structure Puzzle. The 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. The Journal of Finance, 50(5), 1421–1460. https://doi.org/10.1111/j.1540-6261.1995.tb05184.x

- Shaik, M. B., Kethan, M., Rani, I., Mahesh, U., Harsha, C. S., Navya, M. K., & Sravani, D. (2022). WHICH DETERMINANTS MATTER FOR CAPITAL STRUCTURE? AN EMPIRICAL STUDY ON NBFC'S IN. 26(1).

- Shyam-Sunder, L., & C. Myers, S. (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

- Stoiljković, A., Tomić, S., Leković, B., & Matić, M. (2022). Determinants of Capital Structure: Empirical Evidence of Manufacturing Companies in the Republic of Serbia. Sustainability, 15(1), 778. https://doi.org/10.3390/su15010778

- (Swarupa, 2023). Analyzing the Capital Structure Tactics used by the chosen Indian Renewable Energy Firms. The International Journal of Electronic Finance.

- Titman, S., & Wessels, R. (1988). The Determinants of Capital Structure Choice. The Journal of Finance, 43(1), 1–19. https://doi.org/10.1111/j.1540-6261.1988.tb02585.x