# An Empirical Study on Capital Structure of Energy Sector in India

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## Abstract

The study aims to explore the impact of capital structure on the energy sector in India. Several variables were identified in order to know their effects on the capital structure of energy sector in India. The analysis comprises panel data set of 28 companies ranging from 2009 to 2020 which leads to a total of 336 sample size. Hausman test is performed to find the best fit model among the several panel data regressions. The variables firm size, interest coverage and operating expenses are significant in relation to book leverage of the firm. The findings of the study reveal that 43% of the book leverage of the firm. The firm leverage, industrial leverage, firm leverage one lag have a significant impact on the capital structure and suggested that the energy sector has comparatively less risk and has good profit. The results obtained were statistically significant.

## Key words
Book leverage, Capital Structure, Operating costs, Hausman Test and panel data.

## 1. Introduction
India 's energy sector is one of the most varied in the world. These sources range from coal, lignite, oil, natural gas and various sources like solar, wind, agriculture and waste produced by agricultural activities. The demand for electricity has increased immensely and also is expected to increase in the years to come. Hence, the demand for energy sector is increased.

Over the next 20 years, India is expected to have the highest rise in energy consumption among any nation in the world as its economy continues to grow and provide its population more affluence. The dilemma of how to effectively supply this rising demand without aggravating problems like expensive energy imports, air pollution, and greenhouse gas emissions is raised by the mix of a developing and industrialising economy and an expanding and increasingly urban population. The analysis shows that India's electrical industry is changing, making it possible for the supply of clean, cheap, and dependable power to an increasing number of families and companies. This transformation is being driven by the fast spread of solar power and smart policy-making. The industrial and transportation sectors, which include things like road freight, steel, and cement, will prove much harder to expand sustainably, as it is the case with economies all around the world.

Energy security concerns in India are many and constantly changing. According to current policy parameters, India's total import cost for fossil fuels is expected to quadruple over the next two decades, with oil making up the vast majority of this total. Domestic production of oil and gas continues to lag behind demand trends, and by 2040, net reliance on imported oil will have increased from 75% to over 90%. This ongoing reliance on imported fuels exposes us to price cycles, volatility, and potential supply interruptions. If system flexibility is not greatly strengthened, many electrical distribution businesses' financial health is not addressed, and other reform plans are not carried out, India's domestic market may also see dangers to energy security, notably in the electricity sector.The main aim of this paper is to identify the impact of capital structure in the energy sector and the analysis of the same has been done by identifying various variables.

## 2. Literature Background

The main goal of capital structure study is to boost company value by reducing risk exposure (Titman and Wessels, 1988). Analysis of the effects of internal factors and choices on capital structure at Baltic listed businesses for the years 2000 to 2005 provides statistically significant results for correlations between variables and factors including ROA, operational profit, firm size, and growth (Norvaisiene and Stankeviciene, 2007). The factors influencing the capital structure decisions made by Canadian businesses in relation to their development and profitability are examined throughout the years 1994 to 2006. To determine the link between financial leverage as a dependent variable and growth, company size, and profitability as independent factors, hypotheses are created. In Nigerian manufacturing enterprises, the link between capital structure and company performance is examined in light of the factors of the firm, including ROE, Return on Investment (ROI), debt ratio, asset turnover, and firm size. This indicates a negative relationship between capital structure and business performance and further establishes that expansion has little to no impact on firm performance (Muritala et al., 2013). Banks have a high leverage ratio and tend to reach profitability at a faster pace than non-financial enterprises, according to an analysis of the effect of capital structure on financial performance of banks (Pinto and Quadras, 2016). The study on capital structure of energy sector in India suggests that various variables like book leverage , firm size, operating expenses, interest coverage and firm leverage have a significant impact on the capital structure of the companies and are statistically significant.( Kiruthikasri et al. 2020) The study focuses on identifying the nature and determinants of capital structure in selected Indian energy sector industries and to understand the impact of leverage on the capital structure.

## 3. Research Design
The variables that have been identified to achieve the objectives are as follows:
**Book Leverag**e: The ratio of total long-term consolidated debt to total assets is referred to as book leverage. Book leverage is only calculated using a company's net value.

**Profitability:** Profitability ratios are a collection of indicators that assess a business's capacity for generating money. The effectiveness of a company's utilisation of its current assets to produce profit and value for shareholders is also demonstrated by profitability ratios.

**Firm Size:** Firm size is defined as the rate of growth that is best for a particular company, and size is influenced by a number of both internal and external factors. Natural log of the total asset is used to calculate firm size.
**Interest coverage:** Interest coverage is a metric used to assess a company's capacity to pay interest. Earnings Before Interest and Taxes (EBIT) divided by interest expenditures for a given time period—often one year—gives you the interest coverage ratio.

**Operating expenses:** Operating costs, which include rent, machinery, inventory expenditures, marketing, payroll, insurance, and R&D money, are incurred during normal business operations. For the majority of firms, operating costs are necessary and required.

 **Firm leverage 1 lag:** Unwanted biases and even auto-correlational effects, which might weaken the findings from regression, are eliminated using a one-year lag of company leverage.

**Industrial leverage:** Industrial leverage quantifies the amount of debt a business is using to fund its continuous operations. The average mean of industrial leverage is referred to as industrial leverage mean.

 **Firm leverage 3 years:** The debt a company employs to fund assets is referred to as firm leverage. Rolling mean over three years is the definition of firm leverage.

This study is mainly based on secondary data which was derived from Quandl and screener. The data of 28 companies for 12 years (2009 to 2020). There are 336 observations in total and all the companies have been listed in the Bombay Stock Exchange (BSE). Several software were used in order to obtain the results and running various regression tests. The P values obtained from the results were helpful to reject or accept the null hypothesis.

The descriptive statistics, Hausman test and fixed effect model is performed in order to identify the determinants of capital structure in Indian energy sector.

**Dependent Variable:** Book leverage
**Independent variable:** Firm size, Interest coverage, Operating Expenses

Ho: There is no relationship between book leverage and independent variables ($\beta = 0$)
Ha: There is relationship between book leverage and independent variables ($\beta \neq 0$)
Regression analysis is performed to understand the impact of the leverage on the capital structure of the companies.
**Dependent Variable:** Book leverage
**Independent variable:** Firm leverage 1 lag, Industrial leverage mean, Firm Leverage 3 year
Ho: There is no relationship between book leverage and independent variables ($\beta = 0$)
Ha: There is relationship between book leverage and independent variables ($\beta \neq 0$).

## 4. Discussion

This section represents the results and suggestions that can be drawn from the findings that have been obtained from the various tests that have been conducted. Descriptive statistics is performed the dependent and independent variables and Table 1 represents the analyses made on the capital structure of the firms it includes 336 observations of 28 companies for 12 years from 2009 to 2020. According to the descriptive statistics analysis, it is found that the mean of Book Leverage is high compared to the other variables. It shows that the mean of the book leverage is 1399.124 which indicates that the company is excessively borrowing debts to finance the growth of the company, which can result in varied earnings as a result of additional interest expenses. The book leverage and interest coverage is positively skewed which indicates that mean and median are greater than mode.

Table 1. The dependent variable is book leverage

| Dependent Variable | Book leverage |
|---|---|
| **Independent Variables** ||
| **1.** | Firm size |
| **2.** | Interest coverage |
| **3.** | Operating expenses |

Table 2 indicates the dependent variable is book leverage and the independent variables are Firm size, interest coverage and operating expenses. Using these variables descriptive analysis has been performed.

Table 2.  Descriptive statistics

| | N | Min | Max | Mean | Std. Deviation | Skewness | | Kurtosis | |
|---|---|---|---|---|---|---|---|---|---|
| | Statistic | Statistic | Statistic | Statistic | Statistic | Statistic | Std. Error | Statistic | Std. Error |
| Book leverage | 336 | 2.17638 | 6.06559 | 3.985069 | 1.0263 | -0.165 | 0.133 | -1.129 | .265 |
| Firm size | 336 | -80.0954 | 36178.94 | 188.3984 | 4221825.9 | 16.368 | 0.133 | 283.834 | .265 |
| Interest coverage | 336 | -29.0339 | 0.90745 | -0.05406 | 3.538 | -12.19 | 0.133 | 174.197 | .265 |
| Operating expenses | 336 | 0 | 9896 | 1399.125 | 4894252.5 | 2.058 | 0.133 | 3.725 | .265 |
| Valid      N (listwise) | 336 | | | | | | | | |

## Hausman Test

The Hausman test is performed to find the best-fit model among various panel data regressions.

Table 3. The Hausman test

| Hausman Test | | | |
|---|---|---|---|
| Test Summary | Chi-Square Statistics | Chi-Square d. f | Prob. |
| Cross-section Random | 6.730367 | 3 | 0.0410 |
| R-squared | 0.430972 | Adj. R-squared | 0.40243 |

From Table 3 it is evident that the book leverage ratio has R- Squared value of 0.4309 and the P value is 0.0410 which is lesser than the significant value 0.005 we reject the null hypothesis.

## Fixed Effect Model

Table 4. Fixed Effect Model

| Fixed Effect Model | | | | |
|---|---|---|---|---|
| Dependent Variable: Book leverage | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| C | -3992.592 | 378.8331 | -10.53 | 0.000 |
| Firm size | 1357.177 | 92.205790 | 14.71 | 0.000 |
| Interest coverage | -0.086840 | 0.046473 | -1.86 | 0.0326 |
| Operating expenses | 6.826675 | 50.49100 | 0.135 | 0.0425 |
| R-squared | 0.4309 | Adj. R-squared | 0.4024 | |

Table 4 projects the fixed effect model that was conducted using the firm size, interest coverage, and operational expenditure selections. These findings suggests that all factors were below the threshold for significance (P 0.05), suggesting that they had an advantageous effect on the firm's book leverage**.**

Larger businesses often have better production, which has an indirect influence on the degree of leverage, according to financial experts. One of the micro variables affecting the firm's book leverage is interest coverage. Operating expenditures imply that a lower ratio indicates a stronger capacity for businesses to turn a profit. Thus, the analysis considers the factors book leverage and company size to be important. The calculated R-squared value is 0.4309, which indicates that independent variables may account for 43.09 percent of the firm's book leverage.

Table 5. Dependent variable is book leverage

| | |
|---|---|
| **Dependent Variable** | **Book leverage** |
| **Independent Variables** | |
| **1.** | Firm leverage 1 lag |
| **2.** | Industrial leverage mean |
| **3.** | Firm leverage 3 year |

Table 5 indicates the dependent variable is book leverage and the independent variables are firm leverage 1, Industrial leverage mean, firm leverage 3 years Using these variables regression has been done.

Table 6. Model summary of the regression analysis

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate | R |
|---|---|---|---|---|---|
| 1 | .164a | 0.027 | 0.017 | 2255.282196 | .164a |

Table 6 indicates that the R value is greater than 0.4 which means that the study can be taken for future analysis and the R square value is less than 0.5 which tells us that the model is ineffective and is insufficient to determine the relationship between the variables.

*Anova Table*

Table 7. Anova table

| | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Regression | 42331833.72 | 3 | 14110611.24 | 2.774 | .042b |
| Residual | 1530975633 | 301 | 5086297.784 | | |
| Total | 1573307467 | 304 | | | |

Table 7 represents that the significance value is less than 0.05 which means that it has a significant impact on the variables. And the F value is more than 1 and it shows that it is good and an efficient model.

Table 8. Regression analysis

| Model | Unstandardized coefficients | | Standardized coefficients | t | sig |
|---|---|---|---|---|---|
| | B | Std error | Beta | | |
| | 1301.440 | 181.512 | | 7.170 | 0.00 |

| | | | | | |
|---|---|---|---|---|---|
| (Constant) | | | | | .014 |
| Industrial Leverage | 6453.428 | 2605.761 | .141 | 2.477 | |
| Firm Leverage 1 lag | .000 | .001 | .013 | .219 | .827 |
| Firm Leverage 3 years | -.002 | .001 | -0.80 | -1.366 | 0.173 |

From Table 8 the significant values have been obtained after performing the regression analysis which shows that firm leverage 1lag has a significance value less than 0.05 which means the null hypothesis is rejected. And shows that there is a significant relationship between the book leverage and Firm leverage 1 lag. The rest of the variables are above the significance level which projects that the null hypothesis is accepted and there is no significant relation between book leverage and these variables.

## 5. Conclusion
The study was mainly done to identify the various factors that affect the capital structure in the Indian energy sector. With 336 observations and panel data covering the years 2009 to 2020, the study looked into the factors that influence capital structure. The study's objective is to identify the numerous characteristics that have a significant impact on capital structure as well as to assess how capital structure affects company value in the paper sector. For identifying the best fit model, Hausman test models are used. The findings indicate that it is possible to establish the capital structure of the Indian energy sector by the independent variables that have been identified.

The descriptive statistics enabled that the companies has been aggressive in financing its growth with debt and the earnings of the companies are quite volatile. The Hausman test was conducted to know the best fit model which is the fixed effect model. The analysis considers the factors book leverage and company size to be important. The regression analysis portrayed that the variable firm leverage has a significant relationship with the book leverage and the rest of the variables does not have a significant relationship. The regression analysis suggested that only the variable firm leverage 1 lag has a significant relationship with the dependent variable and the rest of the variables does not have a significance relation with the dependent variables and is not much effective.

## 5.1 Limitations and Future Scope
The study was only limited to energy sector and for a period of 12 years for 28 companies. The variables that were identified were also limited. Further analysis can be done on various other industries and by identifying different variables that have an impact on the capital structure of the companies by using similar or more advanced methods for analysing the variables.

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