

Financial performance and capital structure of select hydropower companies in India: An Empirical Analysis

Asif Maqbool Dendru¹, Bashir Ahmad Joo²

¹Research Scholar, Department of Management Studies, University of Kashmir

²Professor, Department of Management Studies, University of Kashmir

Corresponding Author: - Asif Maqbool Dendru, email Id: asifscholarphd@gmail.com

Abstract

This research paper attempts to analyse the relationship between the capital structure and financial performance of two hydropower generation public sector undertakings in India. Secondary data sourced from the financial statements of the corresponding generating companies for the period from 2010-11 to 2016 is analysed using multi-correlation analysis. Results indicate that the capital structure negatively impacts profitability, consistent with the extant research on the subject matter as well as the underlying financial principle - more debt, more interest expenses, and hence lesser profitability. Moreover, in consonance with the MM hypothesis, the present research has revealed that the interaction of tax and capital structure results in the negative impact of tax on the capital structure.

Keywords: Capital structure, operating performance, hydropower.

Introduction

The financial and operational performance of power sector companies, including hydropower, is crucial for the country's economic development is highlighted in [1],[2], [3] and [4]. The operating performance of hydropower companies in India is evaluated using multi-criteria decision-making techniques like AHP, TOPSIS, and VIKOR, as discussed in [5]. To rank the main hydropower projects in India a technical-performance-evaluation analysis of ten major projects using TOPSIS and VIKOR methodologies found Kyona (Maharashtra) and Bakhra Nangal (Punjab) as the most environment friendly [5]. An investigation on the major power sector companies in India on operating and financial performance found that the sector wholistically needs to review and trim down its dependence on fossil fuel like coal in pursuance to produce quality and reliable power to augment the future growth of the country [6]

A comparative analysis of power-generating companies in the public and private sectors using various ratios led to the finding that in terms of financial performance, the government-owned power-generating companies performed better than the private sector companies in India [7]. Contrarily, using the ANOVA method analysed six listed power generation companies another study concluded that private-sector power generation companies performed relatively better [8]. From efficiency and productivity points of view, research has led to the finding that the financial and operational performance of different segments in the power sector value chain of India is significantly impacted by the power purchase costs and as such significantly contribute to the deterioration of the finances of the utility companies [9].

Capital Structure is vital to the performance of primary sector businesses [(Oyedokun et al., n.d.)]. The operating and financial performance in relation to capital structure of select hydropower companies exhibit notable trends and patterns. Research indicates that the financial stability of hydroelectric giants in countries like Brazil and Russia remains high, despite low profitability ratios [10]. The mix of debt and equity i.e. the capital structure of hydropower companies is crucial for their capacity to invest in new projects and technologies and numerous factors influence the capital structure decisions of these companies such as profitability, tangibility, liquidity, and interest coverage ratio. Moreover, the financial leverage has an effect on profitability and the firm's overall value in the power sector [11].

Objectives Of the study

The main objective of the study is to investigate the relationship between the financial performance and the capital structure of two hydro-power generation public sector undertakings in the context of India.

Theoretical Framework

Every empirical investigation is based on a theoretical framework and a set of preliminary hypotheses that the data is intended to either confirm or refute [14]. The Theoretical framework is like a 'blueprint' of a house with the researcher acting like an architect, identifying the concepts and principles to be used to establish the ideas and approaches to the dissertation. many experts emphasise that as a home that cannot be built in the absence of a plan, in the same manner, a research study's structure and goals remain unclear in the absence of a composite theoretical framework [15].

Traditionally, three theories attempt to explain the choice of the capital structure:

- (a) Irrelevance Theory
- (b) The Trade-off Theory
- (c) The Pecking Order Theory

Until the middle of the 1950's the majority of study of finance was devoted to outlining the procedures and structures of the financial system. It was the theorem propounded by France Modigliani and Merton Miller (1958) - the Irrelevance Theory also known as Modigliani-Miller Theorem (M&M Theorem) - that laid the foundational structural framework for understanding the relationship between the Value of a firm and its capital structure. Another well-known theory in corporate finance is the Trade-off hypothesis, which states that corporations fix their ideal capital structure by comparing the tax advantages of debt against the costs of financial hardship. Optimal capital structure optimizes a firm's value is what the Trade-off Theory postulates. Corporations attempt to find a balance between the expenses of financial crisis and the tax benefits of debt (interest tax shield). The Pecking Order Theory propounded in 1984 in the seminal paper titled "Corporate Financing and Investment Decisions When Firms have information that investors do not have" [16]. Basic tenet of the Pecking Order Theory is that management are more knowledgeable than outside investors about the underlying value of the company's assets and investment prospects. This information asymmetry—referring to the information about a firm's prospects, risks and values as possessed

by its managers which is not available to outside investors – impacts the decision to choose between internal and external financing and between issues of debt and equity securities. The information asymmetry ultimately leads to a pecking order – the order in which investment is financed first with internal funds, reinvested earnings primarily followed by new issue of debt; new issue of equity being the last choice. While the Trade-off Theory is based on an intuitive sense, the Pecking Order Theory is premised on differences in the cost of different varieties and the combinations of capital leading to a pecking order in the financing choices that managers make. Market Timing Theory propounds that given the fact that corporate executives perceive their risky securities are mispriced by the market, firms prefer external equity only in situations when the cost of equity is low; otherwise, debt is preferred [17].

The above-mentioned theories essentially set the necessary structural framework for the present study.

Review of Literature

The financial and operational performance of power sector companies, including hydropower, is crucial for the country's economic development, as highlighted in [1], [2], [3] and [4]. Rai & Prakash (2019) [7] conducted a comparative analysis of power-generating companies in the public and private sectors using the ratio analysis and found out that in terms of financial performance, the government-owned power-generating companies performed better than the private sector companies in India. Ashutoshbhai (2018) [8] using the ANOVA method analysed six listed power generation companies and concluded that private-sector power generation companies performed relatively better. Khurana & Banerjee (2015) [9] reviewed the financial and operational performance of different segments in the power sector value chain of India with a focus on efficiency and productivity and concluded that the power purchase costs are primarily responsible for the deterioration of the finances of the utility companies. Vyas (2015) [6] investigated major power sector companies in India on operating and financial performance and found that the sector wholistically needs to review and trim down its dependence on fossil fuel like coal in pursuance to produce quality and reliable power to augment the future growth of the country.

Research has for long also explored on firm's financial performance and its relationship with the sources of finance firms expressed in terms of the capital structure of the firm. The capital structure of hydropower companies is crucial for their capacity to invest in new projects and technologies and numerous factors influence the capital structure decisions of these companies such as profitability, tangibility, liquidity, and interest coverage ratio [1]. Moreover, the composition of capital structure can significantly impact the cost of capital and the firm's overall value in the power industry [2]. Appropriate capital structure besides providing adequate funds for the project also assures its long-term operation as well as creating positive effects for the industry, region, and society. Given that the decisions of a firm regarding the source and mix of debt and equity to fund its projects determines the success or failure of the company, hence these decisions are considered to be one of the most important decisions of a company (Shalini & Biswas, 2016) [20].

Mafunbate et al (2017) [19] endeavoured to analyse the influence of capital structure on financial performance in the power industry to show a negative but significant relationship between capital structure and financial performance extending support of the pecking order theory. Moreover, size and financial performance emerged as negatively related. Similarly, Liu and Ning (2009) [22] analysed various micro factors and their influence on hydropower firm's capital structure in China and concluded that company scale, non-debt tax shield and asset structure were not significantly correlated with the capital structure, while the profitability was found to be significantly negatively correlated with the capital structure. Moreover, the fluidity of the assets emerged to be negatively correlated with the capital structure. With a focus on construction companies, Perri and Cela (2022) [23] investigated the relationship between capital structure and profitability of the firms in Albania. The results of the research indicated that while on the one hand, there is no significant impact of capital structure on the firm's profitability, on the other, capital structure and return on equity were found to possess a significant relationship. Shalini and Biswas (2016) [20] in an endeavour to analyse the impact of capital structure decisions of power sector companies on their operating performance found positive correlation between liquidity and capital structure and negative correlation between profitability and capital structure by and large.

Research has also established that an inappropriate capital structure cannot guarantee adequate funds for the projects, which eventually leads to project failures. Towards analysing the capital structure from the sustainability angle, appropriate capital structure and achievement of objectives in Public-Private-Partnership projects (PPP), Du et al (2018) [13] have found several critical factors – both economic as well as social factors - influencing the capital structure of PPP projects including benefit, cost, risk government support, external situation etc. The operating performance and capital structure of select hydropower companies exhibit notable trends and patterns. Some researchers have found that the financial stability of hydroelectric giants in countries like Brazil and Russia remains high, despite low profitability ratios [1]. Additionally, diversification and enterprise performance in listed hydropower companies are negatively related, suggest that a simply structured and efficient operation mode is crucial for enhancing performance [2]. Furthermore, optimizing the capital structure is vital for power companies, with a focus on long-term debt and equity ratios to manage financial risk effectively [3]. These findings emphasize the importance of financial analysis, operational efficiency, and strategic capital structuring in enhancing the overall performance of hydropower companies.

To study the optimal debt ratio for hydropower projects, Chen et al (2017) [26] while applying a two-party game model and simulating data related to a Turkish power project concluded that the optimality of the capital structure of the power project is dependent on the bargaining capacity of participants in the projects' debt syndication. In another study, Desai (2020) [(Desai, 2020)] applied a panel regression model to study 25 listed companies to validate the applicability of capital structure theories in India and found that power and energy companies follow the propositions of the pecking order theory as well as trade-off theory. Another study conducted by Zhu and Wang (2012) [25] studied capital requirements for hydropower development in the context of China and emphasised the essence of public-private-partnership

for expeditious development of hydropower projects in China. Savchina et al (2022) [10] examined Brazilian and Russian hydropower companies to evaluate their financial stability using the bankruptcy likelihood prediction model, finding that the financial stability of the biggest hydroelectricity companies in these countries is at a high level; albeit profitability ratios are significantly low.

Some major factors that impact the capital structure of hydropower companies include the size of the firm, its profitability, liquidity, and the non-debt tax shields enjoyed by it [1], [2], [3]. These companies tend to rely on a mix of debt and equity to finance their operations, with profitability showing a significant negative correlation with the capital structure [4]. The preference between debt and equity and the proportion of its mix is influenced by factors like profitability, tangibility, liquidity, non-debt tax shields, and interest coverage ratio [5]. In terms of operating performance, capital structure has been found to impact some indicators of financial performance viz. Return on Assets (ROA) and Return on Equity (ROE). The relationship between capital structure and profitability is complex to the extent that different ratios of liabilities to assets and equity exhibit varying impacts on the financial performance of hydropower companies.

Research on theoretical framework for understanding the relationship between firm performance and the underlying funding mechanism has also remained an importance area for a long time now. The impact of a nation's institutional framework on a firm's capital structure is becoming more widely acknowledged Rajan & Zingales [24]. Graham et al (2001) [27] did not find consistent support in favour of capital structure theories expect for moderate support in favour of the Pecking Order Theory. Onaolapo et al (2015) [28], extending support to the Pecking Order Theory, found that profitability, size, and asset tangibility are important determinants of corporate capital structure while analysing 35 listed firms in Nigeria. Deesomsak et al (2009) [30] found that capital structure decision is the product of both firm-specific characteristics including firm size, growth opportunities, non-tax debt shield and liquidity as well as country-specific characteristics including corporate governance, legal framework and institutional environment. Mishra C. (2011) [31] studied capital structure of manufacturing sector public sector undertakings in India and found leverage and profitability negatively related in resonance with the pecking order theory, while as tax and leverage were found to be negatively related in contrast to this theory. Donohoe S. (2016) [32] studied the impact of countries' lending infrastructure on SME capital structure in the European context and found that debt- both long-term and short-term - is higher in countries with less stringent regulatory environments in terms of lower capital regulatory requirements for banks. Akhter et al (2023) [33], in consonance with agency cost theory found that short-term debt positively effects accounting-based performance measures but have a negative impact on market-based performance measures. Moreover, the study also found long-term and short-term debt inversely relate with both accounting and market-based performance measures in support of the pecking order theory.

Incidentally, Vaaler et al (2007) [34] studied the factors influencing credit risk and capital structure in project finance and found significant effects of factors such as country-level institutional and macro-economic conditions, syndicate structure, lead sponsor experience and

project size on capital structure in Asian project finance companies. Bakatjan et al (2015) [35] investigated the optimal capital structure for BOT projects in Turkey and found that total project cost is negatively impacted by equity, thus more preference for equity capital. Moreover, the major constraint to optimal capital structure is the debt-service-coverage ratio.

While existing literature provides good insight into the financial performance and its relationship with a firms' capital structure, having identified some major factors that impact the capital structure of hydropower companies include the size of the firm, its profitability, liquidity, and the non-debt tax shields enjoyed by it, not much has been researched about the relationship in the context of Indian hydropower sector as a whole or hydropower companies located in a remote place like the union territory of Jammu and Kashmir. Hence, this study aims to fill the identified research gap by performing empirical analysis of two hydropower generation public sector undertakings operating hydropower plants in the union territory of Jammu and Kashmir.

Methodology

Based on the theoretical framework as well as the measurable variables identified in course of the review of literature, the present study is designed as an empirical type. A group of two hydro-power generation public sector undertakings form the sample of the present study and the following variables with corresponding proxies have been identified and worked upon in course of the analysis:

Variable Type	Variable Name	Proxy
Independent	Capital Structure	Debt/Equity Ratio
	Profitability	Return of Assets
	Efficiency	Generation/Total Assets
Dependent	Solvency	Debt Service Coverage Ratio
	Tax	(1-PBT/PAT)

Secondary raw data corresponding to the reference period from the financial years (2010-11 to 2015-16) extracted from the annual reports/financial statements and audit reports of the selected hydropower generation public sector undertakings – JKPDC and NHPC- has been compiled into the measurable variables corresponding to the constructs identified from the literature review and the underlying theoretical framework. Annual reports have been collected from www.nhpcindia.com and www.cag.gov.in. Stata-14 software has been used for analysis. Multi-correlation Analysis is used to analyse the relationship between the dependent variable and the independent variables.

Analysis

The results of the multiple correlation analysis of the underlying independent variable and the dependent variables, in the form of a pairwise correlation matrix, are presented in table 1.1:

Table 1.1: Pairwise correlation: JKPCDC

Variable	Capital Structure	Profitability	Financial Risk	Efficiency	Solvency	Tax-Capital Interaction
<i>Capital Structure</i>	1.000					
<i>Profitability</i>	-0.490	1.000				
<i>Financial Risk</i>	0.626	-0.210	1.000			
<i>Efficiency</i>	-0.215	-0.271	0.296	1.000		
<i>Solvency</i>	-0.446	0.067	0.216	0.680	1.000	
<i>Tax-Capital Interaction</i>	-0.319	0.665	-0.194	-0.334	0.003	1.000

Source: Authors' compilation extracted from Stata-14.

Table 1.2: Pairwise Correlation-NHPC

Variable	Capital Structure	Profitability	Efficiency	Solvency	Financial Risk	Tax-Capital Interaction
<i>Capital Structure</i>	1.0000					
<i>Profitability</i>	-0.1916	1.0000				
<i>Efficiency</i>	0.3370	0.5122	1.0000			
<i>Solvency</i>	0.3370	0.5122	0.618	1.0000		
<i>Financial Risk</i>	0.6368	0.2502	-0.4027	-0.4027	1.0000	
<i>Tax-Capital Interaction</i>	-0.5971	0.4800	0.2481	0.2481	0.1338	1.0000

Source: Authors' compilation extracted from Stata-14

Results also depict that the profitability is negatively impacted by the capital structure with a negative correlation coefficient consistent with the theory that debt leads to more interest cost and hence, lesser profitability. The results presented above depict a strong positive correlation coefficient between the financial risk and the capital structure, consistent with the general financial principle that the more the debt more is the financial risk of bankruptcy. Similarly, the value of the correlation coefficient between solvency and efficiency is an indicator of a strong positive correlation between solvency and efficiency. Results also depict that more debt in capital structure negatively impacts profitability with the coefficient of correlation between capital structure and profitability, yet again consistent with the theory that debt leads to more

interest cost and hence, lesser profitability. Moreover, it is revealed that the interaction of tax and capital structure has a negative impact on the capital structure, which is in consonance with MM-hypothesis.

Conclusion

Applying multi-correlation analysis technique on the secondary data sourced from the financial statements of the corresponding generating companies for the period from 2010-11 to 2016, instant study focused to analyse the relationship between the capital structure and financial performance of two hydropower generation public sector undertakings in India. Results of the study indicate that the operating performance measured in terms of profitability is negatively impacted by the debt present in the capital structure. Moreover, the interaction of tax and capital structure has a negative impact on the capital structure. These results corroborate with extant research on the subject matter as well as the underlying theory i.e. MM Hypothesis.

Future Scope: The study analysed secondary data of two hydropower generation companies for the period of five years from 2011-2016. Studying data of more than two companies for extended period of time could help draw more robust conclusions on the subject matter of instant research.

References

1. Manoj, V., Rathnala, P., Sura, S. R., Sai, S. N., & Murthy, M. V. R. (2022). Performance evaluation of hydro power projects in India using multi criteria decision making methods. *Ecological Engineering & Environmental Technology*, 23.
2. Yüsek, Ö., Kankal, M., Kömürcü, M. İ., Önsoy, H., Akpınar, A., & Filiz, M. H. (2007). The importance of hydropower plants in Turkey's energy planning. *General Directorate of State Hydraulic Works*.
3. Bartle, A. (2002). Hydropower potential and development activities. *Energy policy*, 30(14), 1231-1239.
4. Tshering, S., & Tamang, B. (2004, October). Hydropower-Key to sustainable, socio-economic development of Bhutan. In *United Nations Symposium on Hydropower and Sustainable Development* (pp. 27-29).
5. De Faria, F. A., Davis, A., Severnini, E., & Jaramillo, P. (2017). The local socio-economic impacts of large hydropower plant development in a developing country. *Energy Economics*, 67, 533-544.
6. Vijay, H. V. (2015). Financial performance analysis of selected companies of power sector in India. *International Journal of Applied Research*, 1, 212-219.
7. Rai, A., & Prakash, A. R. (2019). A comparative study on financial performance of power generating companies in India. *Journal of Commerce and Accounting Research*, 8(4), 12-27.
8. Krishna, V. (2018). AN EMPIRICAL STUDY OF FINANCIAL PERFORMANCE OF SELECTED POWER GENERATION COMPANIES OF INDIA. *Vidhyayana-An International Multidisciplinary Peer-Reviewed E-Journal-ISSN 2454-8596*, 4(2).
9. Khurana, M., & Banerjee, S. G. (2014). *Beyond crisis: the financial performance of India's power sector*. World Bank Publications.

10. Savchina, O. V., Pavlinov, D. A., Bobkov, A. L., & Konovalova, N. (2022). Comparative analysis of the financial stability of renewable-based electricity companies: The case for hydroelectric organizations. *International Journal of Energy Economics and Policy*, 12(5), 392-408.
11. Wieczorek-Kosmala, M., Błach, J., & Gorzeń-Mitka, I. (2021). Does capital structure drive profitability in the energy sector?. *Energies*, 14(16), 4803.
12. Oyedokun, G. E., Job-Olatuji, K. A., & Sanyaolu, W. A. (2018). Capital structure and firm financial performance. *Accounting and taxation review*, 2(1), 56-71.
13. Du, J., Wu, H., & Zhao, X. (2018). Critical factors on the capital structure of public-private partnership projects: A sustainability perspective. *Sustainability*, 10(6), 2066.
14. Friedman, B. M. (1985). The substitutability of debt and equity securities. In *Corporate capital structures in the United States* (pp. 197-238). University of Chicago Press.
15. Grant, C., & Osanloo, A. (2014). Understanding, selecting, and integrating a theoretical framework in dissertation research: Creating the blueprint for your “house”. *Administrative issues journal*, 4(2), 4.
16. Desai, R. (2020). Factors affecting financing decision of Indian power & energy sector and testing of capital structure theories: panel data analysis. *Indonesian Management and Accounting Research*, 19(1), 71-90.
17. Stewart, M., & Nicholas, M. (1984). Corporate financing and investment decisions when firms have information that investors do not have. *Journal of Financial Economics*, 13(2), 187-221.
18. Why are dividends disappearing? An empirical analysis.
19. Mafumbate, J., Ndlovu, U., Mafuka, A., & Gavhure, P. J. J. O. E. (2017). The influence of firm specific determinants on financial performance in the power industry. *Journal of Economics and Behavioral Studies*, 9(5 (J)), 18-28.
20. Biswas, M. Impact of Capital Structure Decisions on the Operating Performance of Select Companies in Power Sector of India—A Correlation Analysis.
21. Mafumbate, J., Ndlovu, U., Mafuka, A., & Gavhure, P. J. J. O. E. (2017). The influence of firm specific determinants on financial performance in the power industry. *Journal of Economics and Behavioral Studies*, 9(5 (J)), 18-28.
22. Liu, Y., & Ning, X. (2009). Empirical research of the capital structure influencing factors of electric power listed companies. *International Journal of Marketing Studies*, 1(1), 43.
23. Perri, R. S., & Cela, S. (2022). The impact of the capital structure on the performance of companies—Evidence from Albania. *Universal Journal of Accounting and Finance*, 10(1), 10-16.
24. 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.
25. Zhu, M., & Wang, S. J. (2012). Study on Public-Private Partnerships Financing Structure in Hydropower Project. *Advanced Materials Research*, 524, 3172-3176.
26. Chen, B., & Liou, F. M. (2017). Optimal capital structure of power plant projects with various bargaining powers in project negotiations. *Journal of energy engineering*, 143(2), 04016051.
27. Graham, J. R., & Harvey, C. R. (2001). The theory and practice of corporate finance: Evidence from the field. *Journal of financial economics*, 60(2-3), 187-243.

28. Onaolapo, A. A., Kajola, S. O., & Nwidobie, M. B. (2015). Determinants of capital structure: A study of Nigerian quoted companies. *methodology*, 7(23).
29. Niu, X. (2008). Theoretical and practical review of capital structure and its determinants. *International Journal of Business and Management*, 3(3), 133-139.
30. Deesomsak, R., Paudyal, K., & Pescetto, G. (2004). The determinants of capital structure: evidence from the Asia Pacific region. *Journal of multinational financial management*, 14(4-5), 387-405.
31. Mishra, C. S. (2011). Determinants of capital structure—a study of manufacturing sector PSUs in India. In *Proceedings of 2011 International Conference on Financial Management and Economics, IPEDR* (Vol. 11, pp. 247-52).
32. Mc Namara, A., Murro, P., & O'Donohoe, S. (2017). Countries lending infrastructure and capital structure determination: The case of European SMEs. *Journal of Corporate Finance*, 43, 122-138.
33. Akhter, T., Sultana, S., & Azad, A. K. (2023). Capital Structure, Firm Performance and Risk Exposure: New Evidence from oecd Countries. *Managing Global Transitions*, 21(4).