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THE IMPACT OF CAPITAL STRUCTURE ON THE PROFITABILITY OF POWER INDUSTRY COMPANIES

Dong Thi Van Hong^{1*}

^{1*}Phenikaa University, Hanoi, Vietnam. e-mail: hong.dongthivan@phenikaa-uni.edu.vn,
orcid: <https://orcid.org/0009-0003-6162-5469>

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SUMMARY

The first aim of the article is to examine the effect of capital structure on the profitability of the power firms in Vietnam. This research utilizes secondary data in the form of financial reports by the power providers in the years 2010-24. The article has an approximate dynamic panel data model of systematic generalized linear model (GMM) estimate. The capital structure measures are DEBT, DE, and LTT that have the following meanings: debt-to-asset, debt-to-equity, and long-term debt-to-asset respectively. The dependent variables are the return on equity (ROE) and the return on assets (ROA) that indicates the profitability of the business. Other control variables that were used in the study are corporation operational time (t) and firm size (SIZE). According to the experimental findings, the first-order lag coefficient of ROA is positive (0.4907) and statistically significant in the 1% level in the regression equation in which ROA is the dependent variable. It means that the profits of the enterprise have a positive contribution of the previous performance that defines the profit sustainability. On the other hand, the variables of capital structure are not statistically relevant in ROE model and indicates that capital structure has not yet proven itself to be significantly relevant to the profitability as indicated by ROE. According to the research findings, this paper will make some recommendations to integrate the operational efficiency of power enterprises, the main ones being: identifying the optimal financial leverage level appropriate to the cash flow nature of power projects; maximizing production costs and reduction of power losses to ensure greater efficiency in the operations of enterprises; reorganizing the portfolio of power sources towards higher rates of renewable energy; and encouraging the digital transformation to increase the management capacity and business efficiency of enterprises.

Key words: *power industry, renewable energy, capital structure, profitability, financial leverage, retained earnings.*

INTRODUCTION

Electricity industry is a basic element in socio-economic development particularly in the developing economies such as Vietnam. Electricity is a crucial input to industrial production, industrial services and everyday living, and plays a vital role promoting industrialization, modernization, and international economic integration. In the last 20 years, the electricity demand in Vietnam has increased at an alarming rate, and always faster than its Gross Domestic Product growth. This is a trend of the economy becoming more and more reliant on a steady and uninterrupted supply of electricity. Thus, the increase in power

production-capacity and the development of the transmission systems, as well as the national energy security, have become pressing demands of the long-term strategy of the economy development.

In addition to the fast growth of electricity demand, the electricity sector in Vietnam is also experiencing massive reform and restructuring. The electricity industry was previously a vertically integrated monopoly system where the State played the leading role in the entire value chain where it generated and transmitted to the distribution. In recent years, however, Vietnam has been slowly moving towards the model of a competitive electricity market with state regulation. Under this new model, the State continues to take a lead role in transmission and distribution of electricity but the power generation sector has grown to involve the participation of the private sector and foreign investors. This has changed radically the process of pricing of electricity, approaches of raising investment capital as well as allocated financial risks amongst businesses within the industry.

One of the major features of the power industry is the capital intensity and the long period of its existence. Power generation projects such as hydro power, thermal power as well as renewable energy are usually characterized by huge initial investments as well as a payback period of many years. Thus, power companies tend to use rather high amount of financial leverage and heavily dependent on long-term borrowing by credit institutions or capital markets. In this regard, the judgements of capital structure i. e. debt and equity mix become a decisive element in the efficiency and profitability of the operations of the company. The debt financing has a financial advantage in that it offers tax shields over interest cost and also a financial discipline mechanism among the managers. Nevertheless, when the financial leverage ratio is excessive, the enterprise can be subjected to the risk of financial distress and pressure to cover debt as the situation in the market or the changes in the regulation policies.

Moreover, the power generation system of Vietnam has changed dramatically over the last several years towards the growing percentage of renewable energy, particularly, solar and wind power. This shift towards sustainable development and reduction of greenhouses gas has offered numerous new business opportunities in the power sector. Nonetheless, there are also several challenges in this shift such as decreasing and increasing revenue as a result of fluctuation in electricity pricing systems, grid infrastructure constraints to accommodate renewable energy generation, and the increased use of imported fuels like coal and natural gas. These aspects expose a company to financial risks, and they may directly affect the profitability of power companies.

In practice, it is observed that the profitability of Vietnamese power companies differs significantly in accordance with the form of power generation and over time. Certain hydropower industry companies are likely to have high and rather stable profit margins because of the benefits in low production costs and optimal hydrological factors. On the other hand, given the effect of fuel price, financing cost, and market factors, many thermal power companies or new energy companies record extremely volatile profit margins. Such difference demonstrates that the efficiency of operations of power companies is determined not only by the technological factors or natural conditions but also by financial decisions, in particular, by the decisions connected with capital structure.

The issue of capital structure and operational effectiveness has been a topic of research throughout decades in the sphere of corporate finance. Traditional research on capital structure demonstrates that the utilization of debt may be beneficial in the form of tax breaks, lower agency costs, and favorable market signals. Nevertheless, current empirical research on the topic has produced inconclusive findings, and the effect that capital structure has on firm profitability might be different in relation to the industry specificity and the institutional environment of a specific country.

The aim of the paper is to understand the nature of the relationship of capital structure and profitability of the power industry in Vietnam that is the electricity companies with reference to the year 2010 to 2024. The sector of power industry where the fixed assets are large, the turnover of cash flows is low

and the industry is highly regulated by the state may be an exceptionally good candidate to determine the correlation between capital structure and profitability. The proposed research can fill the existing gap in the empirical literature on the influence of capital structure on the profitability of the electricity companies of Vietnam, as the industry is capital-intensive and heavily controlled by the government.

Research objectives of the paper are to examine the corporate profitability features of these companies, to experiment with the impact of capital structure on the profitability, and to evaluate the impact of financial leverage in the power sector. Through this relationship, the study will seek to offer information on how electricity companies in Vietnam can maximize their capital structure to enhance their efficiency. The results will be added to the capital structure literature in the power industry in developing economies and will have an impact on policymakers and business managers.

The paper is structured in the following manner: it starts with a review of the available literature on capital structure and profitability, followed by a discussion of the research methodology and the empirical model. Empirical analysis findings are then presented and discussed to result in policy implications and governance recommendations. The conclusions and recommendations of the paper are presented in the form of ideas for further research directions, providing the full picture of the impacts of the capital structure on the profitability of the electricity companies in Vietnam.

A LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

Modern theories of capital structure have their roots in the classical writings by two authors [10]. The authors established that the value of capital structure does not depend on the structure of a company in an ideal market where there is perfect symmetric information, zero transaction costs, zero bankruptcy costs, and zero taxes. According to this debate, whether a business finances with debt or equity does not change its total value. This is regarded as the foundation of the modern capital structure assumption. However, in a subsequent study in 1963, [9] corporate income tax was included in the analysis, indicating that tax-deductible interest expense creates a "tax shield," as a result of which, increasing the value of the business [11].

Under tax circumstances, businesses using debt financing benefit from reduced tax obligations, rising the present value of cash flows. This perspective indicates that debt can offer a financial advantage over equity. Based on [8], the M&M propositions have become a fundamental standard in capital structure research. As stated in [15], rationalize these strategies, particularly the agency cost theory.

The theory of agency cost, as used by [12], is based on the suggestions made by [17]. According to this argument, a company is likely to have a conflict of interest when its ownership and management are not unified. Agency costs can emerge when managers are left to pursue their own self-interests and not the best interests of their shareholders. Debt, in this regard, is regarded as a financial discipline. Financial leverage compels managers to spend the cash flow more prudently when the company is obligated to pay periodic interest resulting in less wastage of the free cash flow as argued by [13]. In a power industry company with a relatively stable cash stream through electricity generation and distribution, debt may be used to optimize the capital structure and improvement of the efficiency of resource allocation [1].

According to some metaphysical studies, leverage is said to positively impact firm value in some circumstances, [14] argues leverage can serve as a quality signal of firms. [16] state that debt structure can be constructed in a manner that investment incentives are maximized. In the case of power companies that have good credit records, large fixed assets and can forecast their cash flows, the take-on loan cost is usually low leading to heightened benefits of the tax shield.

Also, [18] emphasize the importance of the corporate image and pledging provisions in debt agreements. The power industry is greatly regulated; such provisions can assist in reducing the risk of investment, as

well as ensuring financial stability in the long terms. However, the cons of taking up more debt must be taken into consideration as well. At relatively high leverage ratios, the cost of financial distress and the risk of bankruptcy rise, [16] postulate that high leverage ratios are associated with higher likelihood of default.

In the power industry, where capital investment is required to meet the infrastructure and long term projects, too much debt may pose financial constraints when interest rates rise or when the electricity pricing decisions change. Theo [5] Over leveraged yet inefficient firms can be acquired as a target of restructuring or mergers.

The ownership is an extremely important aspect. According to [4], concentrated ownership can be used to minimize the agency cost and enhance efficiency. In power companies, particularly those with dominant state ownership, the monitoring mechanism and information transparency play a decisive role in the capability of capital utilization [2]. Furthermore, power companies are normally large in scale, with a high proportion of fixed assets and long investment cycles. Based on [3], large-scale companies have the advantage of accessing capital but need to optimize capital costs to maintain effectiveness. Nevertheless, research by [6] shows that high leverage in capital-intensive industries can expand financial risk if costs and cash flow are not well controlled.

Hypothesis H1: The debt ratio (DEBT) has a positive effect on the profitability of power companies.

Hypothesis H2: The debt-to-equity ratio (DE) has a positive effect on the profitability of power companies.

Hypothesis H3: The long-term debt to total assets ratio (LTD) has a positive effect on the profitability of power companies.

In conclusion, the capital structure of power industry companies needs to be considered in a balanced relationship between the benefits of tax shields, agency costs, financial distress costs and the specific characteristics of the highly regulated industry. All power companies have no optimal debt ratio. Alternatively, the capital structure is to be planned to be consistent with investment strategy, the ability to generate cash flows and policy environment. The choice of the right leverage will help to the better business performance and ensure the long-term sustainable development of the enterprise.

Enterprise size is believed to be one of the significant variables that affect capital structure decision and efficiency of a business. Within the theory of corporate finance, size is typically used to denote financial capacity, capital markets, and capital accessibility and stability of business operations. The bigger businesses normally possess more assets, good credit record, and increased information transparency thus making borrowing process cheaper and the external financing easier to mobilize. Thus, the size of the enterprise may be regarded as one of the factors, which make a considerable contribution to the selection of the capital structure and enterprise profitability.

Enterprise size was placed among the meaningful characteristic variables to explain the variation in the decision of enterprise financing as part of the factors that determine the capital structure of listed companies in China. The findings indicate that most businesses which have higher size have greater access to external capital particularly the long-term loans provided by the banking system. This enables the large businesses to have greater financial leverage than the small businesses. But another theme highlighted by the study is that institutional issues and market financial terms may shift the priority of a business in selecting sources of funding. In transitional economies, the tendency of the business is to utilize retained earnings before the equity capital and then the long-term debt.

Further, in as empirical study on Pakistani listed manufacturing enterprises as in [21], firm size has a

high correlation with the debt ratio in the capital structure. The greater the market capitalization, the more likely companies can diversify its risks, its cash flow has some stability and is creditworthy in the market. This implies that they are able to access loan capital at lower rates as opposed to smaller businesses. This finding supports the predictions of the capital structure theories which include agency theory and trade-off theory where large firms have the ability to cope with the risk of financial distress and exploit the tax savings of debt.

The correlation between the size of a company and its operational effectiveness and profitability is high as well as its influence in the capital structure. Portuguese researchers discovered that the bigger power firms had superior financial ratios such as return on equity and cash flow on total assets, which enabled them to invest more in fixed assets as well as raise their operation efficiency [7]. The research claims that an effective financial leverage can help a company to improve its bottom line. Two significant methods through which the failing businesses can increase profits and better utilize their resources are the reorganization of their investments and the capital structures adjustments [18] [3].

Hypothesis H4: Company size (SIZE) has a positive affect the profitability of power companies.

Hypothesis H5: Business operating time (t) has a positive impact on the profitability of power companies.

Research Methodology and Research Hypotheses

In order to estimate the moment, this paper uses the systematic GMM method. On the whole, the GMM can be described as a suitable approach to the estimation when elaborating a model based on a dynamic approach [20]. GMM has the ability to help in estimating the model in cases where there exist factors that cannot be observed [19]. The article offers clarity in theoretical and methodological terms in the application of systematic GMM model in the literature of the power sector that are trying to explain the link between capital structure and profitability.

Firstly, corporate profits are typically dynamic, which suggests current profit levels are substantially affected by past profits. This characteristic indicates the inertia in production and business operations, the potential to maintain a competitive advantage, and the comparatively stable cost structure of the power industry. When introducing a lagged dependent variable into the model, traditional OLS, FEM, REM, or GLS methods will yield biased and inconsistent estimates due to the lagged dependent variable's correlation with the error term.

Secondly, there is an endogeneity between capital structure and returns. The endogeneity issue arises due to the two-way relationship between financial leverage and returns, and estimations based on regular methods are not reliable.

Third, research data have frequently been tabulated, and the number of businesses (N) is large and the number of observation years (T) is usually small. In this framework, the systematic GMM method is appropriate [19]. It is applicable because it combines both the difference equation and the level equation simultaneously, using lagged variables as internal tools, which results in improved efficiency and robustness of the estimate.

The system GMM provides model consistency with the incorporation of instrumental validation with Hansen/Sargan test and AR(1), AR(2) tests.

Arellano-Bond test (1991) [20] for autocorrelation. Check for first-order autocorrelation of the error after differentiating. AR (1) – First-order autocorrelation, in GMM models, having AR (1) is usually normal. Desired condition: $p < 0.05$, indicates first-order autocorrelation (this is not a problem). AR (2)

– Second-order autocorrelation, this is the most important test. Desired condition: $p > 0.05$, no second-order autocorrelation exists, the model is considered valid.

The GMM system model is considered an appropriate method of estimation that should be used to assess the effect of capital structure on the profitability of energy businesses due to the reasons mentioned above. The model used in this study is as follows:

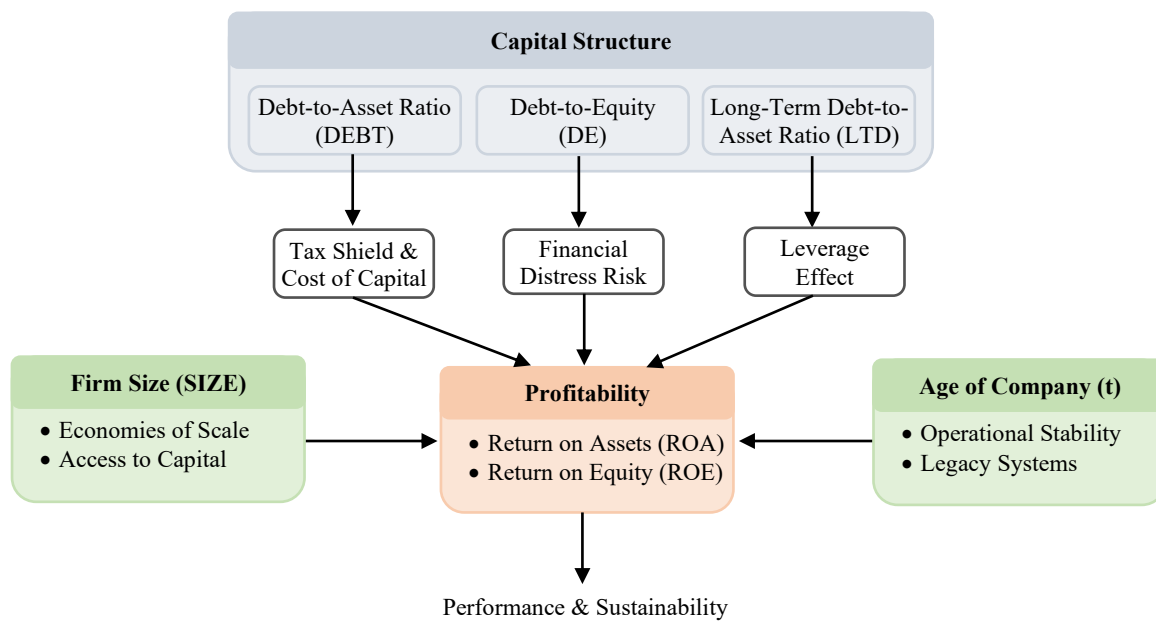


Figure 1. A power industry profitability and capital structure analytical framework

The interrelations among the control (firm size and age), profitability (ROA and ROE), and capital structure (debt-to-asset, debt-to-equity, and long-term debt-to total assets ratios) are observed in figure 1 in businesses in the electricity industry. Profitability is dependent on the financial leverage of a company, tax shelters, and risk profile of the company. The age and size of corporations are some of the factors that affect financial performance and sustainability of corporations.

The equation takes the subsequent form:

$$Y_{it} = \alpha Y_{i(t-1)} + \beta'(L)x_{it} + C_{it} + \lambda_t + \eta_i + \varepsilon_{it} \tag{1}$$

In this equation 1, $t = 1, \dots, T$ và $i = 1, \dots, T$. T and N represent time and company. Y_{it} is the dependent variable (ROA, ROE), $Y_{i(t-1)}$ are lagged dependent variables. $\beta'(L)x_{it}$ represents all independent variables and their lags (DEBT, DE, LTD). C_{it} is the control variable (SIZE, AGE). λ_t is the unobservable effect over time (time effect). η_i is the unobservable specific effect of each company. ε_{it} is the random error. Specifically, the variables included in the model are:

* Profitability of Company: The profitability is commonly measured in Return of Assets (ROA) and Return of Equity (ROE). These indicators inform the creditors much about the financial status of a company and its growth prospects. With a lesser degree of creditor risk, those businesses with good returns on the assets would find it easier to obtain debt financing which may translate into lower interests. Therefore, businesses with high ROA tend to borrow more. On the other hand, increased debt financing by businesses with high ROA helps them take advantage of the tax shield of interest expense. However, some argue that businesses with high ROA use less debt due to large internal capital sources and a preference for using equity capital over debt. In addition, empirical evidence shows that the impact of ROA on debt depends on the characteristics of the financial market and institutions of each country.

In the majority of empirical work, capital structure is analyzed in relation to the debt components of total financing of the company. The following major ratios are commonly used:

Debt: The DEBT represents the relationship between a company's total debt and total assets. The DEBT can also be used to determine how much a company uses debt as opposed to equity to finance its operations. In other words, the DEBT allows one to measure a company's reliance on debt for financing its operations, which in turn will impact its level of financial risk. Therefore, the greater the DEBT ratio when all other things are equal, the greater a company's reliance is on debt capital and, as a result, will lead to a higher level of return and a higher level of financial risk [8][15][12][10].

DE: The Debt Equity Ratios (DE) measure an organization's financial risk and leverage based upon what percentage of total assets are financed with borrowed funds. As the company's DE rises beyond the acceptable level, it becomes increasingly difficult for the company to sustain itself financially [17][14][13][16].

Long-Term Debt to Total Assets Ratio (LTD): The LTD ratio shows the amount of long-term debt of the company compared to its total assets. This measure is important for evaluating the company's permanent financial commitments and their implications on the financing mix for the company's future heavy (or high) capex projects/investments. An increased LTD ratio indicates that a greater proportion of long-term debt is used to fund the financing of the assets, which may be positive for initiatives with elongated payback periods; however, it increases the structural additional long-term financial risk [18][5][3][27].

Additionally, the study uses the control variables Company size (SIZE) and Operating hours of the power industry company (t). The control variable t denotes the company's age, operationalized as the natural logarithm of the subtraction of the years of data collection and company founding (equation 2):

$$t = \ln(\text{Data Year} - \text{Establishment Year}) \quad (2)$$

This would also prevent ambiguity from terms like 'operating time' or 'age of securities company.' Employing the natural logarithm, accounting for the company's age effect on profitability in a non-linear fashion, the natural logarithm addresses the diminishing effect of company age on profitability as the company matures. This method attempts to reflect the firm's corporate lifecycle more accurately in the regression model.

Firm size serves as an important control variable in this analysis as the increasing size of firms correlates with improved access to capital markets and greater operational and cash flow stability. These attributes can have a resounding effect on the firm's profitability and may influence its capital structure. Larger firms have greater operational stability, which in turn lowers financing costs and diminishes the perceived risk attributed by investors and creditors. Firm size (SIZE) is captured in this study by the natural log of a firm's total assets, a standard practice in corporate finance. The natural log is used to normalize the size-financial performance relationship, where the effect of size on profitability diminishes with larger firms.

This research is based on data collected from the Vietstock.vn website, the annual reports published by companies in the power industry, and the General Statistics Office (Gso.gov.vn) of Vietnam. Financial statements for companies in the power sector who are listed on the stock exchange from 2010 to 2024 have been obtained to serve as data for the analysis. Newly established or merged companies have been excluded from the research because they do not have historical financial data that can be compared to the financial data of other firms in the industry. Furthermore, any company that does not have a sufficient amount of publicly available data to support the research has also been excluded. Sample size calculations are completed using the formulas of Bollen (1989) and Tabachnick

& Fidell (2007). The sample size for Bollen's linearly structured model formula is: $n = 5 * 2^i$ (i = observed variable in the model). The formula of Tabachnick & Fidell used to calculate sample sizes for multiple linear regression analysis is $n = 50 + 8q$ (q = number of predictor variables in the model).

Variables included in this research model can be summarized with their name, symbol, and calculation formula, with descriptive statistics provided in table 1. Descriptive statistics created from the data give a summary of the data (e.g., mean, standard deviation, minimum, maximum) to provide an overview of the data included in the analysis, as well as the characteristics of the variables included in the analysis.

Table 1. Statistical information of regression of capital structure and profitability among companies in power industry

No	Variable names and symbols	Calculation formula	Citation basis
Dependent variables: ROA (Return on Assets), ROE (Return on Equity)			
Independent variable:			
01	The debt ratio (DEBT)	Liabilities/Total Assets	[10] [8] [15] [12] [17] [13] [14] [16] [18] [5] [3] [6]
02	The debt-to-equity ratio (DE)	Liabilities/Equity	
03	The long-term debt to total assets ratio (LTD)	Long-term Liabilities/Total Assets	
Control variables			
04	Company size (SIZE)	Ln (Total capital)	[18] [3] [21] [7]
05	Age of securities company (t)	Ln (Data collection year – Establishment year)	

(Source: Collected by the author)

REGRESSION RESULTS

The results substantiate the hypotheses H1–H3, which predicted a positive correlation between the components of capital structure and the profitability metrics of the firm. More specifically, the empirical assessment identified positive impacts for the DEBT, DE, and LTD variables on profitability (both ROA and ROE) and for the coefficients that signify leveraged profitability in a positive context within the power industry. This is consistent with the theory, which posits that the profitability of the power industry improves with increased levels of debt.

The paper analyzes power sector firms listed on the Vietnam stock market, which is available on vietstock.vn. The analysis period will range from 2010 to 2024. The analysis will capture 57 firms, equating to 705 data points. The logic surrounding the sample, however, necessitates some explanation. The analysis will exclude new firms, specifically those incorporated after 2020. That said, this is contradictory to the reported maximum value of $t = 4.09$, which would indicate a range of 14 years. The value occurs because the firms in the data set possess complete data from the beginning of the time period, which is 2010, to the cusp of 2024. In simpler terms, to exclude newer firms is to ensure that all data points observed are from firms that have long operational histories. Therefore, the sample of the analysis truly consists of 57 firms that have been financially recorded from 2010-2024. The explanation on the age of the observations clarifies the sample logic on the t value, and the age of the firms in the present. The paper does not consider firms that were established after 2020. Also, some observations contain data that is not available in the period spanning 2010-2024. Furthermore, some firms that were observed to have data gaps were populated by data from the firms' annual reports which were accessed manually. More on this can be found in table 2 below:

The table 2 presents the statistical results of the variables in the paper. The results illustrate the dataset consists of 705 observations for each variable, reflecting a relatively good sample size for empirical analysis.

Table 2. Statistical findings on how the capital structure influences the profitability of the power industry companies

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	705	0.0796	0.0805	-0.0768	0.4648
ROE	705	0.1334	0.2138	-1.3989	4.4181
DEBT	705	0.4578	0.2368	0.0000	1.1409
DE	705	1.2051	3.9151	-76.7500	2.1636
LTD	705	0.2735	0.2146	0.0000	0.9146
SIZE	705	2.7963	1.5268	22.63295	32.0805
t	705	2.5627	0.7127	0.0000	4.0943

(Source: Statistics from Stata 14 software)

For the profit variable, the ROA has a mean value of 0.0796 (equivalent to 7.96%), indicating that the businesses in the sample generally have positive profitability. However, the smallest value of -0.0768 proposes that some businesses still incurred losses during the study period. The standard deviation of ROA (0.0805) is close to the mean value, reflecting a relatively substantial dispersion among the businesses.

ROE has an average value of 0.1334 (13.34%), higher than ROA, which is consistent with financial theory that ROE is influenced by financial leverage. However, ROE has a large standard deviation (0.2138), along with the smallest (-1.3989) and largest (4.4181) values, indicating significant differences in profitability among businesses and the possibility of outliers in the sample.

Regarding capital structure, the debt ratio (DEBT) averaged 0.4578, indicating an average financial leverage of approximately 45.8% for businesses, reflecting a moderate level of debt utilization. However, the highest value exceeded 1 (1.1409), proposing that some businesses had total debt exceeding total assets, posing a high financial risk.

A lower long-term debt-to-assets ratio than long-term debt ratio (0.2735) means a large portion of a company's debts may be owed on short-term loans. Many smaller businesses also have very low levels of equity as shown by the DE variable which shows this measure has an extremely high peak of 2.1636 and a large standard deviation of 3.915.

The size variable (SIZE) has a lot of differences between the companies in the study; however, the average size is 2.7963 and has a large amount of variability. The construction of the size variable needs to be checked again to ensure the reliability of the regression model is maintained because of the unusual peak value and significant variability of the time variable (t).

The results of the descriptive statistics clearly show there are large differences between the companies in the sample, especially with regard to profitability and measures of capital structure. Refer to table 3 for the details:

The correlation coefficients among model variables can be shown in table 3 in order to examine the variables for multicollinearity. This is an important correlation examine as it assists in determining the stability of the estimates and gives a general sense of the linearity of the relationships between the variables.

In terms of the variables themselves, the data indicate that DE has a negative correlation with ROA (-0.1344), while LTD and DEBT exhibit positive correlations with ROA (0.5704 and 0.6353, respectively). These correlations suggest that a firm with a high level of financial leverage will experience a decrease in their level of profitability.

Table 3. Capital structure and profitability in power industry companies pearson correlation

	ROA	DEBT	DE	LTD	SIZE	t
ROA	1.0000					
DEBT	-0.6353*	1.0000				
	0.0000					
DE	-0.1344*	0.2088*	1.0000			
	0.0003	0.0000				
LTD	-0.5704*	0.8326*	0.1553*	1.0000		
	0.0000	0.0000	0.0000			
SIZE	-0.3379*	0.3420*	0.1191*	0.4023*	1.0000	
	0.0000	0.0000	0.0015	0.0000		
t	0.2846*	-0.3213*	-0.0759*	-0.4292*	0.0572	1.0000
	0.0000	0.0000	0.0441	0.0000	0.1292	

Note: (***), (**), (*) p-value statistical significance levels are 1%, 5%, 10%

(Source: Statistics from STATA 14 Software)

Nevertheless, this relationship may be bidirectional. Companies with low operating efficiency may have to increase borrowing to maintain operations, while high debt levels can also reduce efficiency due to increased interest expenses. This suggests the potential for endogeneity and inverse causality, reinforcing the need to use dynamic panel data models and sys - GMM methods to address endogeneity.

The correlation between DEBT and LTD is 0.8326 that is relatively large. This is theoretically correct since LTD is a component of total debt. According to a correlation that is greater than 0.8, there is the possibility of multicollinearity that increases the variance of the estimate when these two variables are contained in the same model at the same time.

The discovery makes the author to infer that, to control the long-term sustainability of the returns and the time-lag in the panel data, there is a need to integrate the lagged value of a dependent variable into the dynamic model (Table 4).

Table 4. Test of multicollinearity of the influence of capital structure on profitability in companies of the power industry

Variable	VIF	1/VIF
LTD	3.98	0.251458
DEBT	3.33	0.299853
t	1.34	0.746195
SIZE	1.31	0.763951
DE	1.05	0.950636
Mean VIF	2.20	

(Source: Statistics from STATA 14 Software)

The multicollinearity test was conducted using Variance Inflation Factors (VIF) and Tolerance Factors (1/VIF) between independent variables in the model as shown in table 4. The average VIF for all

independent variables was 2.20, with all independent variables being below 10. Therefore, we do not have major issues with multicollinearity within this model based upon these VIF results as they demonstrate there is little overlap of information between independent variables, thus creating little to no bias in the estimates despite the fact that the correlation coefficients between DEBT and LTD were relatively high (0.8326) in the previous correlation matrix.

Both the findings from the VIF and from the previous correlation matrix confirm that the technical requirements for performing tests for endogeneity using GMM and dynamic panel are met.

The table 5 shows the results of the dynamic panel data model estimation using the GMM system estimation methods. It also addresses the results of the estimates of the regression model. Based upon these findings, conclude how different capital structures and control variables impact a firm’s return on assets (ROA) and the direction of impact.

Although Hypotheses H1 through H3 claim that capital structure variables (DEBT, DE, LTD) positively influence profitability (ROA and ROE), the analysis depicts a clear contradiction. The DEBT variable, for instance, has a negative impact on ROA that is statistically significant (coef: -0.0547, p = 0.010), implying that the more debt a company has, the lower its profitability. This is in direct contradiction with the hypotheses, which assume a positive effect.

Table 5. Analysis of the power industry's companies' capital structures and their effects on profitability using a generalized linear model (GMM) with a return on investment (ROI) dependent

Time variable: YEAR			Number of groups = 57	
Group variable: MCK01			Number of obs = 643	
Wald chi2(6) = 209.63			max = 14	
Prob > chi2 = 0.000			Obs per group: min = 2	
Number of instruments = 65			avg = 11.28	
Variables	Coef.	Corrected Std. Err.	z-statistic	p-value
ROA(t-1)	0.4907***	0.1015	4.83	0.000
DEBT	-0.0547**	0.0211	-2.59	0.010
DE	-0.0004	0.0006	-0.70	0.482
LTD	-0.0195	0.0287	-0.68	0.496
SIZE	-0.0062***	0.0019	-3.19	0.001
T	0.0061	0.0061	1.00	0.317
Constant	0.2324***	0.0614	3.78	0.000
AR (1) in first differences: z = -3.16 Pr > z = 0.002				
AR (2) in first differences: z = -0.55 Pr > z = 0.581				
Hansen test of overid. restrictions: chi2(58) = 50.30 Prob > chi2 = 0.754				

(Source: Statistics from STATA 14 Software)

In the regression for ROA, DEBT has a negative coefficient (-0.0547, p = 0.010). This means that with an increase in debt, there is a decrease in profitability, which is the opposite of the hypothesis that suggests a positive correlation between debt and profitability. It seems that for companies in the power industry the expense of their debt is more than the benefit of leverage.

In figure 2, the regression coefficient plot of the GMM model helps visualize the extent and direction of the impact of independent variables on ROA. The horizontal axis represents the regression coefficient values, while the vertical axis represents the variables in the model. If the coefficient is to the right of 0, the variable has a positive impact; conversely, if it is to the left of 0, it has a negative impact on ROA. The horizontal bars represent the confidence intervals of the estimates. The variable is said to be statistically significant when the confidence interval does not intersect with 0. The findings indicate

positive and significant effect of ROA(t-1) indicating the dynamism of profitability. DEBT variable is found to be negative and significant, which means that high leverage can lower profitability. The SIZE variable also has a negative and statistically significant impact. Meanwhile, DE, LTD, and T is not statistically significant. The plot helps readers easily compare the level of influence of the variables in the model. This is a visual tool commonly used to illustrate regression results in experimental studies.

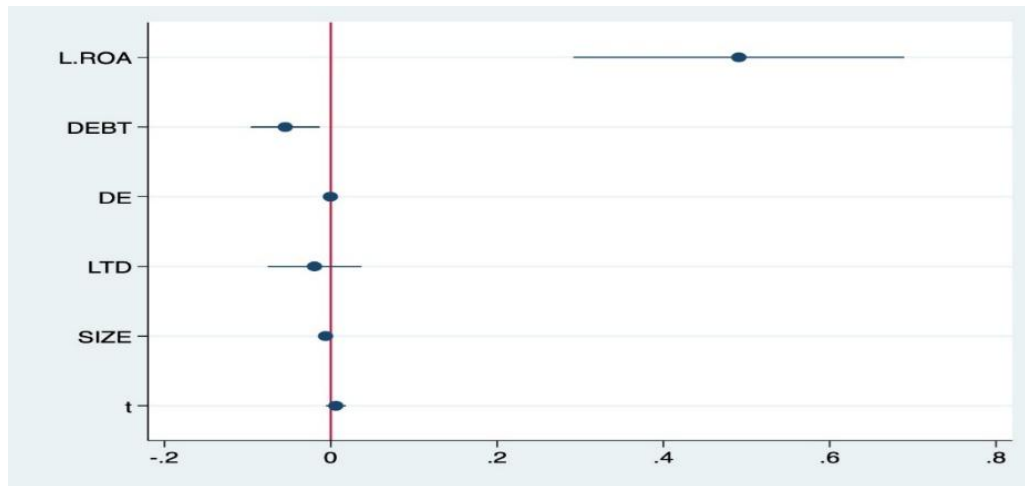


Figure 2. Graph showing the regression results of the GMM model with the dependent variable ROA. (source: construction report using stata 14 software)

According to the results obtained through the System GMM method, the model has been found to be statistically significant and meets the primary econometric requirements for the analysis of Dynamic Panel Data. The AR(1) result of 0.002 indicates first-order autocorrelation from the AR(1) residual error term in the analysis of the first-difference estimator of this GMM model and is within bounds of what is expected in a GMM model; whereas, the AR(2) result of 0.581 indicates that there was not second-order autocorrelation in the first difference residual errors. The Hansen test result ($p = 0.754$) confirms the validity of the instrumental variables used; and, the Wald χ^2 value of 209.63 with a significant p-value of 0.000 indicates that the explanatory variables significantly affect ROA and provides support to this model.

The up-to-date operation efficiency and the lagged ROA variable (L1.ROA) are positively correlated (coef = 0.4907) which supports the argument touched on the top. This implies that efficiency of operation of the past influences the present performance. The negative coefficient (-0.0547) is significant (at 0.00005) in the case of capital structure to operate (the Debt Ratio). This implies a negative correlation between the performance of operational efficiency of a firm and its level of indebtedness. In addition, the SIZE variable is significant at the level of 0.01 and its coefficient is negative indicating that larger companies are less efficient in their tire operations. This is likely due to the management issues and challenges of serving too many service providers and customers, respectively. Finally, the time trend is not statistically significant, indicating that there is no apparent time trend effect on tire operational efficiency, after controlling for other factors.

On the whole, the System GMM model effectively addressed common econometric shortcomings in dynamic panel data such as endogeneity, unobservable fixed effects, and autocorrelation. The results obtained are statistically significant and consistent with theoretical reasoning, thereby providing reliable empirical evidence for the relationship between capital structure and operational efficiency (Table 6).

The GMM model's regression analysis with ROE as the dependent variable is presented in table 6. Included are the ROE(t-1), DEBT, DE, LTD, SIZE, T, and the Constant coefficients, standard errors, z-statistics, and respective p-values. The ROE(t-1) variable is statistically significant at 0.015, while

DEBT, DE, LTD, and T are statistically insignificant, which, in turn, means they are likely to have a low impact on profitability. The SIZE variable is statistically significant at 0.073, meaning a low negative impact on profitability is plausible. The Hansen test indicates that the model's estimates are reliable, and the Arellano-Bond test indicates there is no second-order autocorrelation.

Examining the regression coefficient plot (refer to figure 3) with ROE as the dependent variable provides an understanding of how PTI's ROE was influenced by each of the independent variables and to what degree the influence was positive or negative. Plotted vertically are the independent variables and plotted horizontally are the regression coefficient values (the greater the positive or negative coefficient value will indicate a greater magnitude of the effect).

Table 6. GMM regression outcomes regarding the effects of capital structure on the profitability (ROE) of power company

Time variable: YEAR			Number of groups = 57	
Group variable: MCK01			Number of obs = 643	
Wald chi2(6) = 139.15			max = 14	
Prob > chi2 = 0.000			Obs per group: min = 2	
Number of instruments = 65			avg = 11.28	
Variables	Coef.	Corrected Std. Err.	z-statistic	p-value
ROE(t-1)	-0.3136**	0.1285	-2.44	0.015
DEBT	-0.2585	0.1758	-1.47	0.142
DE	0.0264	0.0168	1.57	0.116
LTD	0.1656	0.1846	0.90	0.370
SIZE	-0.0344*	0.0192	-1.79	0.073
T	0.0481	0.0308	1.56	0.119
Constant	1.0577**	0.4763	2.22	0.026
AR(1) in first differences: z = 0.85 Pr > z = 0.396				
AR(2) in first differences: z = 0.22 Pr > z = 0.823				
Hansen test of overid. restrictions: chi2(58) = 53.99 Prob > chi2 = 0.625				

(Source: Statistics from STATA 14 Software)

All independent variables that are positively correlated with the ROE will yield a positive coefficient, while all independent variables that are negatively correlated with the ROE will yield a negative coefficient.

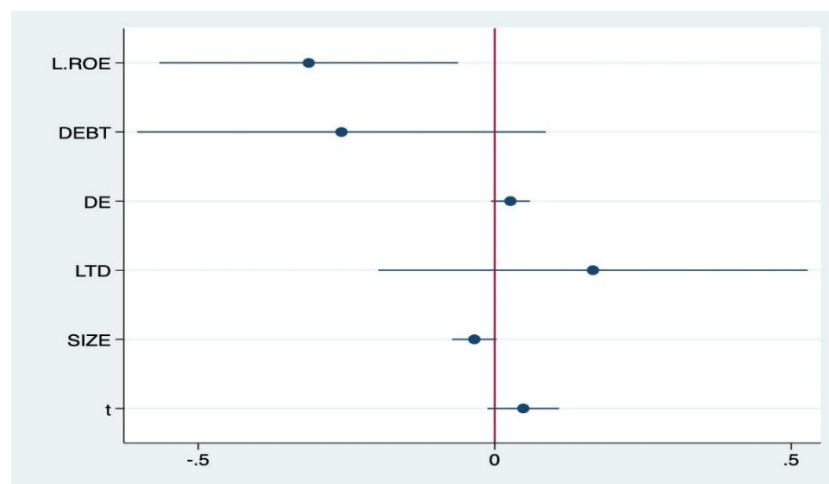


Figure 3. Graph showing the regression results of the GMM model with the dependent variable ROE. (source: construction report using stata 14 software)

One of the statistically significant independent variables in the GMM model results was ROE (t-1) with a coefficient that was negative. ROE (t-1) indicates that prior year profit is a predictor of current year profit and, therefore, serves as a basis for evaluating the capacity of current year profit to offset the amount of prior year profit. Because the aforementioned independent variables (DEBT, DE, & LTD) all have non-zero coefficients, but are only marginally statistically significant, there is no basis to conclude that capital structure has any effect on ROE. The negative coefficient of the SIZE variable, although it is only marginally statistically significant, indicates that firms with larger capital bases may produce lower returns than firms with smaller capital bases.

The statistical significance of the System GMM model's estimation with ROE as the dependent variable can be concluded since the Wald χ^2 value is 139.15 and the p-value is 0.000. With no evidence of autocorrelation, and the absence of evidence from the Arellano-Bond test would allow for reliable estimates ($p < 0.05$) to be obtained. Furthermore, the suitability of the instrument variables according to the Hansen test ($p = 0.625$) supports this conclusion, as does the finding that there is a statistically significant mean-reversion relationship between the lagged ROE variable and ROE (L1.ROE: -0.3136) at the 5% level of significance. Additionally, it was found that the capital structure variables (DEBT, DE, LTD) did not significantly affect ROE once all endogenous variables were taken into consideration; likely due to the already high effect of leverage on ROE.

POLICY IMPLICATIONS

Power industry is described as capital intensive, lengthy investment periods, highly controlled by the state and highly affected by fuel prices, environmental concerns, and economic growth. Under the conditions of the energy transition and stress to enhance financial efficiency, the electricity companies should take a complex of solutions including financial, operational and the long-term strategic orientations.

First, regarding capital structure, power companies should decide on the optimal level of financial leverage, which is appropriate in regard to the cash flow peculiarities of power projects. Due to the large investment and long payback period, excessive reliance on borrowed capital can increase interest expenses and liquidity risk, thereby negatively impacting profitability. Therefore, businesses need to restructure debt maturities by increasing the proportion of medium and long-term debt while minimizing the use of short-term debt for long-term investment projects. In addition, diversifying capital sources through the issuance of corporate bonds, green bonds, or attracting strategic investors will help reduce financial pressure and enhance proactive investment activities.

Secondly, in terms of operational efficiency, businesses need to focus on optimizing production costs and reducing power losses. Fuel and operating costs account for a large proportion of the total costs of the electricity industry; therefore, applying modern technology, automation, and predictive maintenance can help improve equipment efficiency and reduce downtime. At the same time, investing in upgrading the transmission system, applying smart grids, and strengthening monitoring of power losses will contribute to improving asset utilization efficiency, thereby increasing ROA.

Thirdly, in the context of the global energy transition, power companies need to proactively restructure their power source portfolios towards increasing the proportion of renewable energy. By investing in wind and solar energy, not only do we satisfy the needs of emission reduction but also enable the green capital to be accessed cheaply. At the same time, companies should devise a balanced approach to both conventional and renewable sources of energy to make the systems in question stable and cost-effective.

Fourth, one should perceive digital transformation as the basis of improving governance capabilities. The use of artificial intelligence in load forecasting, the automation of asset management and the implementation of electronic metering platforms will assist business to enhance transparency, efficiency

in their decision making and minimize costs in the management domain. Digital transformation does not only result in an increase in operational efficiency, but it also increases the level of competitiveness in the long term.

Lastly, it is of special concern when it comes to the corporate governance and risk management systems. Any changes in the fuel prices, exchange rates, and regulatory policy significantly affect the power industry; consequently, companies should develop mechanisms that will help them avoid the financial risks and improve the information transparency and quality of the internal controls. Not only that this will help lead to stability of profits but also increase the trust of investors and stakeholders.

Overall, the solutions described above demonstrate that the enhancement of the operational efficiency of power companies cannot be built on one factor but on the combination of the capabilities to optimize the capital structure, enhance the operational efficiency, and digital transformation as well as sustainable development orientation. Coordinated execution of these solutions will establish a strong ground to more profitability and financial stability in the long-term.

CONCLUSION

There are some interesting findings from the research regarding Vietnam's power firms and their capital structure and profitability. Considering the model, with Return on Assets (ROA) being the dependent variable, the research found that the net present value of time (lag value) of the time horizon of profits (0.4907) is positive and is statistically significant ($p < 0.01$), therefore, past performance is important to the current profits. However, the capital structure variables (DEBT, DE, and LTD) are statistically insignificant in the model where Return on Equity (ROE) is the dependent variable. Thus, it can be concluded that the relationship between capital structure and profitability is indirect, with ROE framing and defining profitability. Through regression analysis, and leveraging on the extremes of profitability, we find that DEBT, with a p-value of 0.010, is deflating the values of ROA by 0.0547. This means that, indeed, the greater the debt, the less the profits, and as the financial burden of debt increases, so do the associated risks, and consequently the ROA declines. The significant negative impact of firm size (SIZE = -0.0062 ($p < 0.01$)) indicates that larger firms tend to underperform for whatever reason. The Arellano-Bond test for autocorrelation confirms the validity of the dynamic panel data model. In AR (1), correlation is expected and there is first-order autocorrelation with a $p = 0.002$ ($p < 0.05$), and AR (2) confirms no second-order autocorrelation with $p = 0.581$ (> 0.05), so the estimates are valid. Considering the various aspects, future research can take multiple directions to analyze the capital structure of the power sector and its profitability. The capital structure of the sector under consideration and its relationship with the ownership structure, particularly the State's ownership, is worthy of investigation. Another significant research problem is the assessment of the profitability of the power sector with regards to investment in renewable energy, differentiated by thermal, hydro and renewable power generation, as well as the analysis of the capital structure of these categories. Finally, the impact of the current macroeconomic conditions, such as interest rates, inflation, and volatility in energy prices, on the capital structure can demonstrate the financial stability of the power sector.

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