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Maturity mismatch, interest-bearing leverage, and short-term financial vulnerability: Evidence from Vietnam's listed electricity firms

Pham Thi Hong Nhung[1]
Nguyen Anh Tu[2+]
Bui Thi Ngoc[3]
Le Thanh Phuong[4]
Mai Tuan Anh[5]

[1,3,4]*Thuyloi University, Vietnam.*
[1]*Email: nhungpth_kt@tlu.edu.vn*
[3]*Email: ngocbt_kt@tlu.edu.vn*
[4]*Email: phuonglt_kt@tlu.edu.vn*
[2,5]*Hanoi Open University, Vietnam.*
[2]*Email: tuna@hou.edu.vn*
[5]*Email: mtanh@hou.edu.vn*


(+ Corresponding author)

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ABSTRACT

Listed electricity firms in Vietnam often face a timing problem in financing. The assets they build and operate last for many years, but part of the debt used to finance them may mature much earlier. This study examines whether that maturity gap, together with interest-bearing leverage and operating cash flow, is associated with short-term financial vulnerability. The analysis uses 31 electricity firms listed on HOSE and HNX during 2016–2025, giving an unbalanced panel of 295 firm-year observations. Model estimation relies on firm fixed effects, year controls, and clustered standard errors. The dependent variable for short-term vulnerability is the current ratio; accordingly, a lower ratio explicitly indicates greater vulnerability. Market-based and book-based Z-scores are applied for robustness checks. The estimates show that higher maturity mismatch is associated with a lower current ratio. The interaction with operating cash flow is not statistically supported. Interest-bearing leverage appears more clearly in the two Z-score robustness models, rather than in the current-ratio models. The lagged specification does not show that these effects persist beyond the current period. Therefore, assessing financial vulnerability in the electricity sector requires analytical separation of debt maturity timing from the aggregate debt stock.

Contribution/Originality: This study isolates the maturity-timing problem from the aggregate debt burden to explain short-term financial vulnerability in Vietnam's electricity sector. The findings indicate that maturity mismatch is mainly associated with immediate liquidity constraints, whereas interest-bearing leverage is more closely associated with broader Z-score-based financial weakness.

1. INTRODUCTION

Electricity firms do not finance ordinary production cycles. Their balance sheets are tied to power plants, grids, turbines, substations, and other assets that absorb capital long before they generate stable cash inflows. This creates a financing problem that is sharper than a simple question of how much debt a firm uses. In capital-intensive energy industries, debt maturity matters because repayment dates may arrive while the underlying projects are still in the recovery phase. A firm may therefore look solvent on paper but still face pressure when short-term obligations cluster ahead of operating cash inflows (Franc-Dąbrowska, Mądra-Sawicka, & Milewska, 2021; Jaworski & Czerwonka, 2021).

Vietnam provides a suitable setting for examining this issue. The revised Law on Electricity and the adjusted National Power Development Plan VIII point to continued investment demand in power generation and transmission (National Assembly of Vietnam, 2024; Prime Minister of Vietnam, 2025). The funding side is less settled. Long-term capital markets remain relatively thin, and listed firms still rely heavily on bank credit, including credit with shorter maturities than the assets being financed (Do & Phan, 2022; Ngo & Le, 2021). The result is a familiar but under-examined tension: electricity assets are long-lived, while the liabilities used to support them may require earlier refinancing.

Total debt is not enough to explain this financing problem. A firm's risk also depends on when its debt must be repaid and whether that repayment schedule fits the life of the assets being financed (He & Xiong, 2012; Rajan & Zingales, 1995). Short-term borrowing used for long-horizon investment creates a refinancing exposure that differs from the usual leverage channel. If rollover conditions tighten, liquidity pressure may arise before broader distress indicators become visible (Almeida, Campello, Laranjeira, & Weisbenner, 2012; He & Xiong, 2012). The analysis therefore treats maturity mismatch as a timing problem in its own right, not as a relabeling of short-term debt.

The paper also separates maturity mismatch from interest-bearing leverage. The two may occur together, but they do not describe the same exposure. Interest-bearing leverage refers to the stock of debt that creates contractual interest and principal obligations. Maturity mismatch captures the timing channel: when obligations mature relative to the cash-generating horizon of assets (Habib, Costa, Huang, Bhuiyan, & Sun, 2020; Rajan & Zingales, 1995). Financial vulnerability can arise because debt levels become excessive, because repayment schedules are concentrated too heavily in the short term, or because both conditions occur simultaneously. Analytical separation therefore matters. Without distinguishing debt burden from debt timing, the sources of financial weakness in electricity firms may be interpreted imprecisely.

Operating cash flow adds another layer to the analysis. Cash generated from operations can help firms absorb funding shocks when external finance becomes more expensive or less available (Almeida, Campello, & Weisbach, 2004). Vietnamese evidence also links stronger operating cash flow with better financial health and lower distress risk (Phan, Hoang, & Tran, 2022). Even so, cash flow cannot be assumed to solve a maturity-timing problem. A firm may still face liquidity pressure when short-term obligations fall due before infrastructure assets generate enough cash.

The gap in the literature is specific. Existing Vietnamese studies have examined debt maturity, financing structure, and investment behavior, but they have not directly tested how maturity mismatch, interest-bearing leverage, and operating cash flow jointly relate to financial vulnerability in listed electricity firms (Do & Phan, 2022; Ngo & Le, 2021; Phan, 2020). In addition, much of the broader financial-distress literature relies either on aggregate leverage measures or on pooled cross-industry samples that do not isolate sectors characterized by long-lived infrastructure assets and persistent refinancing requirements (Habib et al., 2020). Existing studies therefore provide only partial guidance for understanding financing vulnerability in Vietnam's listed electricity sector.

This study addresses that gap by examining listed electricity firms in Vietnam during 2016–2025. The sample includes 31 firms listed on HOSE and HNX, forming an unbalanced panel of 295 firm-year observations. The 2025 observations are based on finalized, audited financial statements available at the time of data collection. The main dependent variable is the current ratio, used to capture short-term financial vulnerability; a lower ratio indicates greater vulnerability. Market-based and book-based Z-scores are used as robustness measures. The empirical models apply firm fixed effects, year controls, and firm-clustered robust standard errors.

The findings point to two different financing channels. Maturity mismatch is negatively associated with the current ratio, which means that greater mismatch is linked to weaker short-term liquidity. The cash-flow interaction is not strong enough to show a reliable moderating effect. Interest-bearing leverage behaves differently: it becomes clearer in the Z-score specifications, where financial weakness is measured more broadly. For listed electricity firms, debt that matures too early and debt that is large in size therefore need to be interpreted separately.

The study still has boundaries. Firm fixed effects account for stable differences across companies, but causal interpretation remains outside the design. Time-varying omitted factors and reverse causality may still enter the estimates. The dataset also follows listed firms with usable disclosures, so survivorship bias is possible. The one-year lag is also modest for this setting; power-sector projects usually take longer to show their financing effects.

2. LITERATURE REVIEW AND HYPOTHESES

2.1. Debt Maturity, Mismatch, and Rollover Exposure

Debt maturity is better understood as part of the borrowing contract, not as a balance-sheet label. When firms borrow, they choose not only the amount of debt but also the time over which that debt must be repaid. Classic debt-maturity arguments link this choice to information asymmetry, asset maturity, agency concerns, and the trade-off between flexibility and refinancing exposure (Diamond, 1991; Flannery, 1986; Stohs & Mauer, 1996). A firm's maturity structure should therefore be read as one component of corporate financing policy, not as a secondary balance-sheet detail.

Short-term debt is not necessarily a poor financing choice. In some cases, it disciplines managers, permits quicker adjustment of borrowing costs, and gives firms more flexibility when credit markets are favorable. The difficulty starts when this form of debt has to be renewed again and again. If lenders become cautious, interest rates move unfavorably, or firm-specific information deteriorates, a once-convenient debt structure can turn into a source of liquidity pressure (Diamond, 1991; Johnson, 2003). The relevant issue is therefore maturity fit: the due date of liabilities should not be far ahead of the period in which assets and projects produce cash.

The maturity-matching principle addresses this issue directly. Firms are expected to match the maturity of financing with the economic life of the assets being financed, so that repayment schedules are broadly aligned with cash-generation capacity (Stohs & Mauer, 1996). Once long-lived assets are financed by short-term liabilities, this alignment weakens. The firm may then face repayment before the financed asset has generated enough operating cash. That gap is not merely a technical accounting mismatch. It can become a source of liquidity pressure.

Maturity mismatch works mainly through rollover risk. The risk appears at the refinancing date. Firms using short-term debt have to return to lenders more often. In calm credit markets, this may not look problematic. Once credit tightens, however, the same debt structure can bring higher refinancing costs, failed rollover, or a temporary funding gap. He and Xiong (2012) explain this channel by showing how rollover risk turns debt maturity into financial fragility. Almeida et al. (2012) provide related evidence that firms with large amounts of debt coming due during credit tightening reduce investment, which means that debt maturity has real effects beyond the balance sheet. In more severe cases, firms may restructure obligations not as routine financial management, but as a response to deeper financial strain (Dudley & Yin, 2018).

This logic is especially relevant for electricity firms. Their main assets are large, durable, and slow to produce full cash returns. Power plants, transmission systems, and related infrastructure do not match well with financing that must be renewed over short intervals. In this sector, maturity mismatch should therefore be understood as the use of short-term financing for long-horizon operating and investment needs, not simply as a high share of short-term debt. This study uses maturity mismatch in that narrower, sector-specific sense.

2.2. Interest-Bearing Debt Burden and Financial Vulnerability

Debt maturity and debt burden belong to the same financing decision, but they answer different questions. One firm may face pressure because it has borrowed too heavily; another may face pressure because its repayment calendar is too short for the assets it owns. The former is a leverage problem. The latter is a maturity-structure problem. Mixing the two would obscure the financing channel under analysis.

Interest-bearing leverage captures the part of debt that requires explicit interest payments and scheduled repayment. These claims take priority over many other uses of cash and continue across business cycles (Rajan &

Zingales, 1995). A weak year does not release the firm from paying lenders. When revenue falls, margins narrow, or operating cash flow becomes unstable, the same leverage ratio begins to represent payment pressure rather than a simple financing position.

The link between leverage and financial vulnerability is therefore straightforward, although its effects can appear through several routes. Heavy interest-bearing debt may raise the chance of covenant violations, technical default, legal default, or more general loss of financial flexibility when debt-servicing capacity deteriorates (Habib et al., 2020). The effect is not limited to an immediate shortage of cash. Leverage can also reduce room for new borrowing, damage creditor confidence, and increase the indirect costs of distress. For capital-intensive firms, this matters because maintaining investment and operations usually requires continued access to external funds.

For this reason, interest-bearing leverage must be separated from maturity mismatch in the empirical analysis. Leverage describes the size of debt-related financial commitments. Maturity mismatch describes the timing at which refinancing pressure appears. A firm may have high debt but a manageable maturity profile. Another firm may have a lower debt stock but a repayment schedule that is poorly aligned with its assets. The two firms would not be exposed to the same type of weakness, particularly when the outcome being examined is short-term liquidity.

2.3. Operating Cash Flow as a Buffer of Internal Liquidity

Operating cash flow enters the argument from another side. Unlike leverage or debt maturity, it measures the firm's own capacity to generate liquid funds from operations. This point matters most where external finance is not always available on favorable terms. In the presence of financing frictions, internally generated cash gives firms room to continue operations, meet obligations, and avoid costly external financing (Almeida et al., 2004). It is therefore more than an accounting line item.

For short-term vulnerability, the practical role of operating cash flow is easy to see. A firm with steadier cash inflows has more room to pay suppliers, service debt, and keep production running when external funding becomes less available (Huang, Lin, & Huang, 2022). It can wait longer before raising new debt or equity. This is why operating cash flow is particularly relevant here: the main outcome is liquidity pressure, not long-term valuation.

Evidence from Vietnam is consistent with this view. Phan et al. (2022) find that stronger operating cash flow is linked with lower financial distress. This supports the use of operating cash flow as a substantive explanatory variable in the present setting, rather than as a routine accounting control.

This buffer, however, has limits. A positive operating cash flow figure does not automatically solve a maturity-timing problem. A firm may still be pushed into liquidity pressure when short-term debt falls due before large infrastructure assets begin to generate adequate returns. The effect of operating cash flow is therefore examined in two ways in this study. First, it is treated as a direct indicator of internal liquidity. Second, it is tested as a possible moderator of the relationship between maturity mismatch and financial vulnerability.

2.4. Sector Characteristics and Control Variables

For electricity companies, financing cannot be separated from the physical nature of the business. Their main assets are plants, grids, machinery, and construction projects; many of these assets lock capital in place before they begin generating steady revenue. Standard corporate finance arguments still apply, but the sector adds a timing problem that is harder to ignore. Investment costs arise early, while operating cash inflows arrive slowly (Franc-Dąbrowska et al., 2021; Jaworski & Czerwonka, 2021). Financing structure in this setting must therefore be examined together with project intensity, asset duration, and the speed of capital recovery.

The same sector setting guides the control variables. Firm size is included because larger electricity firms usually have stronger lending relationships and lower information frictions. This matters in Vietnam's bank-based financing environment, where access to longer-tenor credit is uneven across firms (Ngo & Le, 2021; Phan, 2020). Sales growth is retained because expansion can use up working capital before new cash inflows are realized. Asset tangibility is controlled for because fixed assets affect collateral value and borrowing capacity in capital-intensive firms (Jaworski & Czerwonka, 2021; Phan, 2020).

Construction in progress is treated separately because it has a direct link with the financing problem studied here. Electricity firms may commit large amounts of capital to unfinished infrastructure projects for several years before those assets begin operation. During that period, cash is tied up, but loan repayment and interest obligations may already be due. Although construction in progress is not always modeled as a separate variable in prior studies, its economic role is clear in the electricity sector (Franc-Dąbrowska et al., 2021). A higher construction-in-progress ratio may therefore capture part of the pressure created by unfinished projects and delayed cash generation.

Cash holdings enter the model because they affect near-term payment capacity. Cash on hand allows a firm to bridge loan instalments, supplier payments, and working-capital needs without immediately negotiating new borrowing. This does not mean that every large cash balance signals strength. Some firms may hold short-term assets because capital has not been deployed efficiently, not because liquidity management is stronger (Do & Phan, 2022). For a study centered on current liquidity, however, cash holdings cannot be omitted from the control set.

2.5. Development of Hypotheses

The reviewed studies point to one central implication: financial vulnerability cannot be explained well by a single debt variable. Financing pressure can arise from debt timing, from the size of interest-bearing obligations, and from the availability of internal cash. These channels are related, but they do not represent the same economic mechanism. Maturity mismatch places repayment pressure on assets that recover cash slowly. Interest-bearing leverage increases fixed financial commitments. Operating cash flow reflects the firm's own liquidity-generating capacity.

The first hypothesis follows from the maturity-mismatch argument. Short-term debt is not assumed to be harmful in every case. The risk appears when short-term financing supports long-horizon assets and projects. In that situation, rollover pressure can weaken the firm's short-term liquidity position, especially in capital-intensive sectors.

H_1: A higher degree of maturity mismatch is associated with higher short-term financial vulnerability.

The leverage channel gives the next expectation. Interest-bearing debt creates claims that have to be paid regardless of short-term movements in revenue or cash flow. When that debt stock is large, a decline in operating performance or tighter refinancing conditions can place the firm under additional strain. This is a debt-burden effect rather than a maturity-timing effect, but both are relevant in electricity firms.

H_2: Interest-bearing leverage is positively associated with short-term financial vulnerability.

The third hypothesis concerns internal liquidity. Operating cash flow gives firms a source of funds that does not depend immediately on external capital markets or new bank borrowing. Stronger cash flow should therefore reduce financial vulnerability.

H_3: Operating cash flow is negatively associated with short-term financial vulnerability.

The fourth hypothesis concerns the moderating role of operating cash flow. An interaction term should be interpreted as a conditional effect, not as a claim that the moderator determines the outcome by itself. As Brambor, Clark, and Golder (2006) note, moderation means that the marginal effect of one variable changes at different values of another variable. In the present setting, the question is whether maturity mismatch becomes less damaging when firms have stronger internal cash generation.

H_4: Operating cash flow weakens the positive relationship between maturity mismatch and short-term financial vulnerability.

Because the empirical models use the current ratio as an inverse measure of short-term financial vulnerability, the expected regression signs are reversed when the current ratio is the dependent variable. Under this setup, variables that worsen vulnerability are expected to reduce CURRENT, whereas variables that ease vulnerability are expected to raise it.

3. METHODOLOGY

3.1. Sample Construction

The empirical sample is built from Vietnamese electricity companies listed during 2016–2025. It includes 31 companies classified by FiinPro in the L5 electricity generation and distribution group and traded on either HOSE or HNX, giving 295 firm-year observations. No firm in this industry group is removed from the sample, and no sampled firm was delisted during the study period. Financial variables are taken from audited annual financial statements available through FiinPro; the 2025 observations are also based on final audited reports available at the time of analysis. Stock price data used for market-based measures are collected from Vietstock. Observations are retained only from the years after a firm had been listed. The panel is left unbalanced because firms entered the market at different times, and forcing balance would discard valid observations without clear econometric gain (Wooldridge, 2010).

3.2. Measurement of Variables

Financial vulnerability is treated in this study as a short-term liquidity condition rather than as a single bankruptcy signal. Table 1 reports the definitions, measurements, and empirical roles of all variables used in the regressions.

Table 1. Variable Definitions.

Variables	Symbol	Measurement	Role
Current Ratio	CURRENT	Current assets divided by current liabilities	Main dependent variable
Market-Based Z-Score	Z_MARKET	Altman-type Z-score using the market value of equity	Robustness dependent variable
Book-Based Z-Score	Z_BOOK	Altman-type Z-score using the book value of equity	Robustness dependent variable
Interest-Bearing Leverage	LEV_IBD	Interest-bearing debt divided by total assets	Main explanatory variable
Maturity Mismatch	MM1	Short-term interest-bearing debt divided by net tangible fixed assets plus construction in progress	Main explanatory variable
Operating Cash Flow	CFO_TA	Operating cash flow divided by total assets	Main explanatory variable
Maturity Mismatch × Operating Cash Flow	MM1 × CFO_TA	Interaction between maturity mismatch and operating cash flow	Moderation variable
Alternative Maturity Mismatch Proxy	MM2	Short-term interest-bearing debt divided by net tangible fixed assets	Alternative explanatory variable
Firm Size	SIZE	Natural logarithm of total assets	Control variable
Sales Growth	GROWTH	Annual percentage change in net sales	Control variable
Asset Tangibility	TANG	Net tangible fixed assets divided by total assets	Control variable
Construction in Progress Intensity	CIP_TA	Construction in progress divided by total assets	Control variable
Cash Holdings	CASH_TA	Cash and cash equivalents divided by total assets	Control variable

Note: CURRENT is used as an inverse indicator of short-term financial vulnerability rather than as a conventional distress measure. Z_MARKET and Z_BOOK are used only in robustness analyses. Interest-bearing debt is defined as the sum of short-term and long-term borrowings and finance lease liabilities.

CURRENT is the main dependent variable. It is calculated as current assets divided by current liabilities and is used as an inverse measure of short-term financial vulnerability. A lower value of CURRENT, therefore, indicates weaker short-term liquidity and greater vulnerability. The Z-score variables are not the main outcomes. They are retained for robustness because they offer broader signals of financial weakness.

The market-based Z-score (Z_MARKET) and the book-based Z-score (Z_BOOK) are included only in additional tests. These two variables capture composite aspects of financial weakness and allow the analysis to check whether the main findings remain visible when vulnerability is measured beyond the current ratio. The study does not treat them as substitutes for CURRENT because the empirical focus is narrower: the concern is the ability of electricity firms to meet near-term obligations and avoid immediate liquidity pressure. This treatment is consistent with the financial distress literature on Z-score measures, but it keeps the paper's main emphasis on the short-term liquidity channel (Altman, 1968; Altman, Iwanicz-Drozdowska, Laitinen, & Suvas, 2017; Huang et al., 2022; Phan et al., 2022).

The explanatory variables are grouped around three financing channels. The first is the debt burden. It is measured by interest-bearing leverage (LEV_IBD), calculated as interest-bearing debt over total assets. Interest-bearing debt includes short-term borrowings, long-term borrowings, and finance lease liabilities. LEV_IBD therefore reflects the size of fixed debt-related obligations that the firm must service over time (Habib et al., 2020; Rajan & Zingales, 1995).

Maturity mismatch is captured by two measures. The main measure, MM1, is calculated as short-term interest-bearing debt divided by the sum of net tangible fixed assets and construction in progress. This specification is chosen because electricity firms hold long-lived fixed assets and often carry unfinished infrastructure projects that require capital before producing operating cash flows. When short-term debt is used against such a long-horizon asset base, refinancing pressure becomes economically meaningful rather than merely mechanical (Dudley & Yin, 2018; Franc-Dąbrowska et al., 2021; He & Xiong, 2012; Jaworski & Czerwonka, 2021). The second measure, MM2, divides short-term interest-bearing debt by net tangible fixed assets. It is used to test whether the results depend on the inclusion of construction in progress in the denominator.

Operating cash flow (CFO_TA) is measured as cash flow from operating activities divided by total assets. This variable captures the ability of a firm to generate liquidity internally when external finance is costly or uncertain (Almeida et al., 2004). It is included both as a direct explanatory variable and as a moderating variable. To test the moderation channel, the model includes an interaction term between maturity mismatch and operating cash flow. Following Brambor et al. (2006), the component variables are mean-centered before constructing the interaction term. This makes the lower-order coefficients easier to interpret and helps avoid unnecessary collinearity between the interaction term and its components.

Five firm-level controls are included. Firm size (SIZE) is measured as the natural logarithm of total assets. Sales growth (GROWTH) captures business expansion. Asset tangibility (TANG) is measured as net tangible fixed assets divided by total assets and reflects the collateral base available to the firm, a relevant feature in capital-intensive industries (Do & Phan, 2022; Ngo & Le, 2021; Phan, 2020). Construction in progress intensity (CIP_TA) equals construction in progress divided by total assets. This variable captures the scale of unfinished investment projects, which is important for electricity firms because infrastructure projects usually have long construction and recovery periods (Franc-Dąbrowska et al., 2021; Jaworski & Czerwonka, 2021). Cash holdings (CASH_TA) are measured as cash and cash equivalents divided by total assets and represent the stock of liquid reserves available to ease near-term financing pressure (Almeida et al., 2004). All variables are measured annually.

3.3. Model Specification

The baseline model estimates the relationship between financing structure and short-term financial vulnerability as follows:

$$\mathrm{CURRENT}_{it} = \alpha + \beta_1 \mathrm{LEV\_IBD}_{it} + \beta_2 \mathrm{MM1}_{it} + \beta_3 \mathrm{CFO\_TA}_{it} + \gamma' \mathrm{Controls}_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (1)$$

In Equation 1, $\mathrm{CURRENT}_{it}$ is the current ratio of firm i in year t. Since CURRENT moves in the opposite direction to vulnerability, a negative coefficient should be read as evidence of greater short-term financial vulnerability. The firm effect, μ_i, absorbs stable differences across companies. The year effect, λ_t, accounts for shocks or conditions shared by firms in the same year.

Equation 2 then asks whether the maturity-mismatch effect varies with operating cash flow:

$$\mathrm{CURRENT}_{it} = \begin{array}{l} \alpha + \beta_1 \mathrm{LEV\_IBD}_{it} + \beta_2 \mathrm{MM1}_{it} + \beta_3 \mathrm{CFO\_TA}_{it} \\ + \beta_4 (\mathrm{MM1}_{it} \times \mathrm{CFO\_TA}_{it}) + \gamma' \mathrm{Controls}_{it} + \mu_i + \lambda_t + \varepsilon_{it} \end{array} \quad (2)$$

The interaction term is used to check whether internal cash generation changes the slope attached to maturity mismatch. Interpretation requires care because the dependent variable is the current ratio, not a direct distress score. A factor that increases financial vulnerability is expected to reduce the current ratio, while a factor that reduces vulnerability is expected to increase it.

Robustness is examined through three additional approaches. First, the dependent variable is replaced by the market-based Z-score and the book-based Z-score. This checks whether the financing variables are also related to broader distress indicators. Second, MM1 is replaced by MM2 to test whether the results are sensitive to the construction of the maturity-mismatch variable. Third, a one-period-lagged specification is estimated to examine whether the observed relationships persist over time.

$$\mathrm{CURRENT}_{it} = \begin{array}{l} \alpha + \beta_1 \mathrm{LEV\_IBD}_{i,t-1} + \beta_2 \mathrm{MM1}_{i,t-1} + \beta_3 \mathrm{CFO\_TA}_{i,t-1} \\ + \gamma' \mathrm{Controls}_{i,t-1} + \mu_i + \lambda_t + \varepsilon_{it} \end{array} \quad (3)$$

All specifications include year effects and use firm-clustered standard errors.

3.4. Data Treatment, Estimation Strategy, and Diagnostic Tests

Before estimation, variables with visibly skewed tails are winsorized at the 1st and 99th percentiles. This treatment is applied to CURRENT, Z_MARKET, Z_BOOK, MM1, MM2, GROWTH, CIP_TA, and CASH_TA. The remaining continuous variables are not winsorized. This treatment limits the effect of unusually large or small observations without removing usable firm-year records.

Variance inflation factors are used to check whether the regressors create a serious collinearity problem. In the baseline specification, the mean VIF is 1.70 and the highest VIF is 2.61. After the interaction term is added, the mean VIF rises slightly to 1.76, while the highest value remains 2.61. These figures are low enough to rule out serious multicollinearity concerns. They are still interpreted as diagnostic evidence, not as a mechanical pass-or-fail rule.

The choice of estimator begins with the panel diagnostics. The Hausman test favors firm fixed effects over random effects ($p = 0.0000$). This result suggests that unobserved firm-level characteristics are not independent of the explanatory variables, making the fixed-effects specification more appropriate (Hausman, 1978). Groupwise heteroskedasticity is then tested using the modified Wald test for the fixed-effects model (Greene, 2003). The test result indicates heteroskedasticity across firms ($p = 0.0000$), so conventional standard errors would not be appropriate. The Wooldridge test does not show strong evidence of first-order serial correlation at the 5% level ($p = 0.0883$), although the result points to weak serial dependence at the 10% level (Drukker, 2003; Wooldridge, 2010). The Pesaran CD test does not indicate cross-sectional dependence in the final specification ($p = 0.3258$) (Pesaran, 2004).

These diagnostics support the use of firm fixed effects, year effects, and firm-clustered robust standard errors as the main basis for inference. Firm clustering is used because observations from the same firm may share error dependence over time; ignoring this dependence can lead to misleading inference (Arellano, 1987; Cameron & Miller, 2015). Fixed effects help control for time-invariant firm heterogeneity, but they are not treated as a complete remedy for endogeneity. Reverse causality and omitted time-varying factors may remain.

Driscoll-Kraay standard errors are considered only as a robustness option, not as the primary inference method. This choice follows from the structure of the dataset. Driscoll-Kraay errors are more useful when the time dimension is sufficiently long and cross-sectional dependence is a central concern. The present panel is short, and the final specification does not show evidence of cross-sectional dependence (Driscoll & Kraay, 1998; Hoechle, 2007). All data processing, variable construction, diagnostic testing, and model estimation are conducted in Stata 17.

4. RESULTS

4.1. Descriptive Statistics and Correlations Among Variables

Table 2 reports descriptive statistics for the variables used in the empirical analysis.

Table 2. Descriptive Statistics.

Variables	N	Mean	SD	Min.	Max.
Current Ratio	295	2.326	2.174	0.097	16.019
Market-Based Z-Score	295	4.270	4.946	0.132	25.507
Book-Based Z-Score	295	3.410	2.856	0.162	21.598
Interest-Bearing Leverage	295	0.266	0.195	0.000	0.787
Maturity Mismatch	295	0.133	0.218	0.000	2.014
Alternative Maturity Mismatch Proxy	295	0.163	0.297	0.000	2.678
Operating Cash Flow	295	0.133	0.096	-0.192	0.474
Firm Size	295	14.464	1.577	11.253	18.300
Sales Growth	295	0.082	0.337	-0.695	3.731
Asset Tangibility	295	0.573	0.277	0.027	0.963
Construction in Progress Intensity	295	0.034	0.114	0.000	0.909
Cash Holdings	295	0.066	0.081	0.000	0.590

Note: The sample consists of 295 firm-year observations for 31 listed electricity firms in Vietnam over 2016–2025. Selected continuous variables with pronounced right-skewness and heavy tails were winsorized at the 1st and 99th percentiles before regression estimation.

The current ratio has a mean of 2.326 and a standard deviation of 2.174, indicating substantial variation in short-term liquidity across firms and over time. The two supplementary indicators also show considerable dispersion: the market-based Z-score has a mean of 4.270, while the book-based Z-score averages 3.410. Among the main explanatory variables, interest-bearing leverage has a mean of 0.266, maturity mismatch 0.133, and the alternative maturity-mismatch measure 0.163. Operating cash flow has a mean of 0.133. Several variables, particularly the current ratio, the Z-score measures, the maturity-mismatch variables, sales growth, construction-in-progress intensity, and cash holdings, display pronounced right tails. These long tails explain why the regression analysis uses winsorized values for the affected variables.

Table 3 gives the pairwise correlation matrix. The signs already provide a useful preview of the regression evidence. CURRENT moves positively with the two Z-score variables and cash holdings. It moves negatively with interest-bearing leverage, maturity mismatch, and asset tangibility. The largest correlation in the matrix is between MM1 and MM2 (0.888), indicating that the two measures should not be included in the same model.

Table 3. Pairwise Correlation Matrix.

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. CURRENT	1.000											
2. Z_MARKET	0.550***	1.000										
3. Z_BOOK	0.628***	0.882***	1.000									
4. LEV_IBD	-0.518***	-0.644***	-0.771***	1.000								
5. MM1	-0.195***	-0.154***	-0.058	-0.004	1.000							
6. MM2	-0.172***	-0.157***	-0.079	0.022	0.888***	1.000						
7. CFO_TA	0.249***	0.589***	0.457***	-0.422***	-0.202***	-0.239***	1.000					
8. SIZE	-0.246***	-0.468***	-0.499***	0.448***	0.193***	0.219***	-0.465***	1.000				
9. GROWTH	-0.040	-0.018	0.004	0.034	0.017	0.006	0.058	0.039	1.000			
10. TANG	-0.485***	-0.204***	-0.384***	0.492***	-0.322***	-0.409***	0.122**	0.022	0.030	1.000		
11. CIP_TA	-0.091	-0.134**	-0.152***	0.181***	-0.041	0.217***	-0.142**	0.099*	0.003	-0.267***	1.000	
12. CASH_TA	0.413***	0.339***	0.418***	-0.373***	-0.047	-0.037	0.396***	-0.278***	0.032	-0.296***	-0.082	1.000

Note: Pairwise correlation coefficients are reported. *, **, and *** indicate statistical significance at the 10%, 5%, and 1% levels, respectively.

4.2. Main Results: Short-Term Financial Vulnerability

Table 4 presents the main results from the firm fixed-effects models with year effects and firm-clustered robust standard errors. In the baseline model, maturity mismatch carries a negative and statistically significant coefficient on the current ratio (β = -1.719; p = 0.015). This is the central finding of the study. The greater the use of short-term funding for long-term operating assets, the weaker the firm's short-term liquidity position. Put differently, firms with a higher degree of maturity mismatch tend to face greater short-term financial vulnerability.

Table 4. Main Fixed-Effects Results for Short-Term Financial Vulnerability.

Variables	(1) Baseline	(2) Moderation
Interest-Bearing Leverage	-0.489	-0.480
	(1.943)	(2.011)
Maturity Mismatch	-1.719**	-1.737**
	(0.663)	(0.828)
Operating Cash Flow	-0.923	-0.930
	(1.330)	(1.315)
Maturity Mismatch × Operating Cash Flow		-0.302
		(5.643)
Firm Size	-0.616	-0.618
	(0.739)	(0.752)
Sales Growth	-0.265	-0.264
	(0.177)	(0.177)
Asset Tangibility	-4.529**	-4.526**
	(1.735)	(1.757)
Construction in Progress Intensity	-5.782**	-5.776**
	(2.107)	(2.149)
Cash Holdings	3.428*	3.428*
	(1.922)	(1.927)
Constant	14.490	14.166
	(10.552)	(10.689)
Year fixed effects	Yes	Yes
Firm fixed effects	Yes	Yes
Standard errors	Firm-clustered	Firm-clustered
Observations	295	295
Number of firms	31	31
Within R^2	0.335	0.335
F-statistic	11.740***	11.610***

Note: CURRENT denotes the current ratio. Standard errors clustered at the firm level are shown in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Interest-bearing leverage does not carry statistical significance in the baseline model (β = -0.489; p = 0.803). The same applies to operating cash flow (β = -0.923; p = 0.493). For the control variables, asset tangibility and construction-in-progress intensity both enter with negative and statistically significant coefficients (β = -4.529; p = 0.014; β = -5.782; p = 0.010). Cash holdings move in the opposite direction and are positively related to the current ratio at the 10% level (β = 3.428; p = 0.085). The baseline specification reports a within R-squared of 0.335, and the F-statistic is significant at the 1% level.

Column (2) leaves the main result largely unchanged. With the interaction term included, maturity mismatch still has a negative and statistically significant coefficient on CURRENT (β = -1.737; p = 0.044). The interaction between maturity mismatch and operating cash flow is close to zero and statistically insignificant (β = -0.302; p = 0.958). Thus, the evidence supports the direct maturity-mismatch channel, but it does not show that operating cash flow changes that channel in a systematic way. The liquidity-buffer argument is therefore not supported in this specification.

4.3. Robustness Checks using Z-Scores and MM2

Table 5 extends the analysis in three directions. The first two models replace the current ratio with the two Z-score measures. Here, the pattern of results changes somewhat. In the model using the market-based Z-score, interest-bearing leverage has a large negative coefficient and is strongly significant (β = -18.635; p = 0.001), whereas maturity mismatch remains significant only at the 10% level (β = -2.143; p = 0.063). In the model using the book-based Z-score, the role of interest-bearing leverage is even clearer: the coefficient remains strongly negative (β = -11.822; p < 0.001), while maturity mismatch once again survives only at the 10% level (β = -1.002; p = 0.085).

Table 5. Robustness Results and Alternative Maturity Mismatch Proxy.

Variables	(3) Market-Based Z-Score	(4) Book-Based Z-Score	(5) Alternative Proxy
Interest-Bearing Leverage	-18.635***	-11.822***	-0.457
	(5.115)	(2.628)	(1.928)
Maturity Mismatch	-2.143*	-1.002*	
	(1.109)	(0.562)	
Alternative Maturity Mismatch Proxy			-1.400***
			(0.477)
Operating Cash Flow	2.914	-1.725	-0.994
	(2.428)	(1.491)	(1.308)
Firm Size	1.549	0.573	-0.630
	(1.048)	(0.693)	(0.726)
Sales Growth	0.006	0.085	-0.299*
	(0.451)	(0.180)	(0.171)
Asset Tangibility	-3.043*	-0.327	-4.701***
	(1.763)	(1.468)	(1.632)
Construction in Progress Intensity	-2.427	-0.832	-5.155**
	(2.277)	(1.918)	(1.936)
Cash Holdings	-7.444*	2.091	3.503*
	(4.222)	(2.253)	(1.848)
Constant	-10.935	-0.925	14.800
	(13.822)	(9.612)	(10.276)
Year fixed effects	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes
Standard errors	Firm-clustered	Firm-clustered	Firm-clustered
Observations	295	295	295
Number of firms	31	31	31
Within R^2	0.478	0.516	0.348
F-statistic	4.570***	13.910***	15.700***

Note: The dependent variables are Z_MARKET in column (3), Z_BOOK in column (4), and CURRENT in column (5). Firm-clustered standard errors are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

The change in the dependent variable changes the emphasis. With CURRENT, the maturity-timing variable carries the sharper signal. With Z_MARKET and Z_BOOK, the debt-burden variable becomes clearer. The two debt measures therefore appear to reflect different forms of financial weakness. MM1 is more informative when the outcome is immediate liquidity. LEV_IBD becomes more informative when the outcome is a broader composite measure of financial condition.

The third check uses MM2 in place of MM1 and keeps the current ratio as the dependent variable. The coefficient on MM2 is again negative and statistically significant (β = -1.400; p = 0.006). This result is consistent with the baseline model and shows that the main finding is not driven solely by the first maturity-mismatch measure. Still, MM2 is best read as a supporting proxy. MM1 remains the preferred measure because it incorporates construction in progress, which is central to the financing structure of electricity firms.

4.4. Results from the Lagged Model

Table 6 turns to the one-period-lagged model. After the explanatory variables are lagged by one year and year effects are retained, the earlier relationships become weaker. Lagged maturity mismatch is not statistically significant (β = -0.838; p = 0.170). Lagged interest-bearing leverage also falls outside conventional significance levels (β = -3.378; p = 0.102). Lagged operating cash flow, firm size, sales growth, asset tangibility, and cash holdings are insignificant as well. Construction-in-progress intensity is the only lagged variable that remains significant, with a negative coefficient (β = -3.377; p = 0.032).

Table 6. One-Year Lagged Fixed-Effects Estimates.

Variables	(6) Lagged model
Interest-Bearing Leverage (t−1)	-3.378
	(2.000)
Maturity Mismatch (t−1)	-0.838
	(0.596)
Operating Cash Flow (t−1)	-1.132
	(1.056)
Firm Size (t−1)	0.371
	(0.661)
Sales Growth (t−1)	0.259
	(0.268)
Asset Tangibility (t−1)	-1.965
	(1.383)
Construction in Progress Intensity (t−1)	-3.377**
	(1.506)
Cash Holdings (t−1)	2.649
	(1.740)
Constant	-0.440
	(9.389)
Year fixed effects	Yes
Firm fixed effects	Yes
Standard errors	Firm-clustered
Observations	264
Number of firms	31
Within R^2	0.276
F-statistic	5.520***

Note: CURRENT is the current ratio. All explanatory variables are lagged by one year. Firm-clustered standard errors are shown in parentheses. **, and *** indicate statistical significance at the 5%, and 1% levels, respectively.

The lagged estimates are weaker than the contemporaneous results. MM1 loses statistical significance once the explanatory variables are shifted back by one year. This means the model does not provide evidence of a stable carry-over effect from maturity mismatch into the following period. In this sample, the liquidity channel appears mainly within the same year.

4.5. Main Empirical Patterns

The results can be read in four steps. First, MM1 is consistently related to weaker short-term liquidity when CURRENT is the dependent variable. Second, the interaction term with operating cash flow does not provide evidence of moderation. Third, LEV_IBD becomes more stable in the models using Z_MARKET and Z_BOOK. Fourth, the lagged specification does not preserve the maturity-mismatch result. The evidence, therefore, separates two channels: maturity timing is more relevant for current liquidity, while debt burden is more visible in the broader Z-score measures.

5. DISCUSSION

5.1. Maturity Mismatch and Short-Term Financial Vulnerability

The main result points to a liquidity-based interpretation of maturity mismatch. In the baseline model, maturity mismatch has a negative and statistically significant coefficient when the current ratio is used as the dependent variable (β = -1.719; p = 0.015). The result remains after the interaction term is introduced (β = -1.737; p = 0.044). Since the current ratio moves inversely with short-term financial vulnerability, these estimates mean that firms with a larger gap between short-term debt and long-horizon assets tend to show weaker immediate liquidity.

This finding fits the basic argument in the debt maturity literature. The issue is not that short-term debt is always damaging. Short-term financing can be useful when cash flows and repayment schedules are aligned. The problem appears when liabilities mature before the financed assets have produced enough cash. This interpretation is consistent with the maturity-matching view of Stohs and Mauer (1996), the liquidity-risk argument in Diamond (1991), and the rollover-risk mechanism in He and Xiong (2012). It also accords with Almeida et al. (2012), who show that refinancing pressure can affect real corporate decisions when credit conditions tighten.

The contribution of the result lies in its sectoral focus. The main dependent variable is not a broad distress score but the current ratio, which captures short-term liquidity. That choice matters. For listed electricity firms, refinancing pressure may not first appear as broad financial deterioration. It may show up earlier as a decline in the ability to meet near-term obligations. This is plausible in a sector where assets last for many years, investment recovery is slow, and large amounts of capital can remain locked in unfinished or recently completed infrastructure projects.

The robustness tests support the same reading. Using MM2 instead of MM1 leads to the same sign and statistical conclusion. The coefficient is negative and significant (β = -1.400; p = 0.006), so the baseline result is not tied only to the first proxy. With the Z-score outcomes, the MM1 coefficient remains negative, although the significance falls to the 10% level (β = -2.143; p = 0.063; β = -1.002; p = 0.085).

The lagged specification gives a more cautious message. Once the regressors are lagged by one year, maturity mismatch is no longer statistically significant (β = -0.838; p = 0.170). This does not overturn the contemporaneous result, but it limits any claim of persistence. A one-year lag may also be short for electricity projects, where construction, refinancing, and capital recovery often move over longer cycles. The evidence should therefore be read as showing a current or near-term liquidity channel, not a settled long-term effect.

5.2. Debt Burden and Broader Financial Weakness

Interest-bearing leverage follows a different pattern. In the current-ratio models, its coefficient is negative but statistically insignificant (β = -0.489; p = 0.803 in the baseline model; β = -0.480; p = 0.813 in the interaction model). The result changes when the dependent variable is replaced by the two Z-score measures. The coefficient becomes large and statistically significant for both the market-based Z-score (β = -18.635; p = 0.001) and the book-based Z-score (β = -11.822; p = 0.000).

This difference helps separate debt burden from debt timing. In Rajan and Zingales (1995) leverage represents a stock of debt that gives rise to fixed financial claims. Habib et al. (2020) make a related point in the distress literature: debt service, covenant pressure, and weaker financing capacity can transmit high leverage into financial weakness. The estimates here are consistent with that view. LEV_IBD is not the main signal in the current-ratio model, but it becomes more informative once the outcome is measured by Z-scores.

The distinction matters because the two debt variables answer different questions. Interest-bearing leverage asks how large the debt burden is. Maturity mismatch asks whether the timing of that debt fits the assets being financed. Both risks can exist in the same firm, but they need not show up in the same empirical outcome. In this sample, the timing channel appears in current liquidity, while the debt-burden channel appears more clearly in the broader financial-condition measures.

This result also clarifies how the paper relates to existing Vietnamese evidence. Do and Phan (2022), Ngo and Le (2021), and Phan (2020) examine debt maturity, financing structure, and investment-related issues in Vietnam. The present analysis adds a narrower distinction: when financial vulnerability is the outcome, debt burden and maturity timing do not behave in the same way. This distinction is especially relevant for electricity firms, where high debt use is common, but the implication of that debt depends on whether the concern is immediate liquidity pressure or broader financial weakness.

The lagged coefficient on interest-bearing leverage is not statistically significant ($\beta = -3.378$; $p = 0.102$). This means the lagged estimates do not justify a strong persistence claim. The more defensible reading is narrower: within this sample, LEV_IBD is linked more consistently to Z-score–based financial weakness than to the current-ratio measure of liquidity.

5.3. Operating Cash Flow and the Absence of a Robust Moderation Effect

The operating cash flow results should be read with some restraint. Prior studies provide good reasons to expect internal cash generation to matter. Almeida et al. (2004) emphasize internally generated cash as a source of financial flexibility when firms face financing constraints. Huang et al. (2022) link stronger operating cash flow to resilience and survival. Phan et al. (2022) also report that operating cash flow is associated with lower financial distress among listed firms in Vietnam. The expectation that operating cash flow may protect firms from financial pressure is therefore reasonable.

The evidence in this study is weaker. Operating cash flow is not statistically significant in the baseline current-ratio model ($\beta = -0.923$; $p = 0.493$), the interaction model ($\beta = -0.930$; $p = 0.485$), or the lagged model ($\beta = -1.132$; $p = 0.292$). It is also insignificant in the two Z-score models. More importantly, the interaction between maturity mismatch and operating cash flow is essentially zero and statistically insignificant ($\beta = -0.302$; $p = 0.958$).

The insignificant interaction should not be read as evidence that internal liquidity has no value. It indicates a narrower point. Cash generated from operations may help firms meet payments, but it cannot by itself realign a debt schedule that is too short for the asset base. The difference from Phan et al. (2022) lies in the way debt timing is modeled here. Once maturity mismatch is introduced explicitly, operating cash flow no longer shows a strong buffering effect. Cash from operations can ease near-term payments, but it cannot rewrite a debt schedule that falls due too early for infrastructure assets.

Brambor et al. (2006) are useful for reading this result. The issue is not whether operating cash flow has a favorable average role. The issue is whether CFO_TA changes the marginal effect of maturity mismatch on CURRENT. The estimates do not show that conditional pattern. Operating cash flow is therefore relevant to liquidity, but not a reliable moderator in this model.

5.4. Control Variables in the Electricity-Sector Setting

The control variables also carry economic information. Asset tangibility is negative and statistically significant in the main specifications ($\beta = -4.529$; $p = 0.014$; $\beta = -4.526$; $p = 0.015$). Construction-in-progress intensity is also negative and significant ($\beta = -5.782$; $p = 0.010$; $\beta = -5.776$; $p = 0.012$). In the lagged model, construction-in-progress intensity remains significant as well ($\beta = -3.377$; $p = 0.032$).

These estimates add nuance to the usual collateral argument. Jaworski and Czerwonka (2021) and Phan (2020) emphasize that tangible assets can support borrowing capacity. The present result does not reject that view. It shows another side of the same issue. In electricity firms, a large fixed-asset base may support credit access, but it may also reduce short-term flexibility because those assets cannot be quickly converted into cash. This distinction matters when the dependent variable is the current ratio rather than a measure of long-term firm value.

The construction-in-progress result is even closer to the sector's operating reality. Franc-Dąbrowska et al. (2021) and Jaworski and Czerwonka (2021) describe energy firms as having long-horizon infrastructure commitments and substantial investment needs. Construction in progress reflects that condition at the firm level. A high ratio means that capital is tied up in unfinished projects. These projects may have economic value, but they do not yet generate operating cash. It is therefore reasonable that construction in progress is associated with weaker short-term liquidity and remains relevant in the lagged model.

Cash and cash equivalents move in the opposite direction. Their coefficient is positive and weakly significant in the current-ratio specifications ($\beta = 3.428$; $p = 0.085$; $\beta = 3.428$; $p = 0.085$; $\beta = 3.503$; $p = 0.068$ in the alternative-measure model). This suggests that liquid reserves provide some cushion against near-term pressure. The effect, however, is not large enough to change the main interpretation. Cash holdings may ease payment pressure, but they do not remove the influence of maturity mismatch, debt burden, or capital tied up in long-horizon projects.

5.5. Overall Interpretation

The findings support a differentiated interpretation of financial vulnerability among listed electricity firms in Vietnam. Maturity mismatch is most closely associated with short-term liquidity weakness. Interest-bearing leverage is more strongly linked to broader financial weakness captured by Z-score measures. Operating cash flow remains part of the story, although the estimates do not show a reliable moderating effect.

The main implication follows from this separation. Financial vulnerability in electricity firms should not be explained only by the amount of debt, nor by a simple split between short-term and long-term liabilities. The timing of debt, the burden of interest-bearing obligations, and internally generated liquidity each describe a different part of financing risk. Reading them separately gives a more precise account of why vulnerability appears in a sector with large fixed assets, long investment cycles, and slow cash recovery.

6. CONCLUSION

This paper examines financial vulnerability in Vietnam's listed electricity firms through three financing dimensions: maturity mismatch, interest-bearing leverage, and operating cash flow. The setting is not incidental. Electricity firms hold assets with long service lives, require heavy investment, and recover capital slowly, while Vietnam's supply of long-term finance is still limited. In such a setting, the size of debt tells only part of the story. Repayment timing can matter just as much. The analysis therefore focuses on maturity mismatch and treats leverage and operating cash flow as related but separate financing channels.

The empirical analysis uses an unbalanced panel of 31 listed electricity firms from 2016 to 2025, with 295 firm-year observations. Firm fixed-effects models are estimated with year effects and firm-clustered robust standard errors. The evidence shows a clear pattern. Maturity mismatch is most strongly associated with short-term financial vulnerability when the current ratio is used as the main dependent variable. The interaction between maturity mismatch and operating cash flow is not statistically robust, so the results do not support the view that internal liquidity systematically reduces the effect of an unfavorable maturity structure. Interest-bearing leverage behaves differently. It is more stable in the robustness tests that use market-based and book-based Z-score measures. This suggests that debt burden and debt maturity timing work through different dimensions of financial weakness. The lagged model gives little support for persistence; in these data, the maturity-mismatch effect is mainly a same-year association.

These results speak first to financing decisions inside electricity firms. Managers should look beyond the headline debt ratio and ask whether repayment dates fit the cash-flow cycle of plants and projects still under construction. When a large amount of capital is tied up in construction in progress, liquidity can tighten before broad distress indicators become visible. For policy design, the point is more institutional. Electricity investment needs funding with a longer tenor and more stable refinancing conditions. Without that, rising investment demand can turn maturity mismatch into a recurring sector constraint, not just a weakness in a few firm balance sheets.

The sample covers only listed electricity firms in Vietnam, so the number of firms is modest by design. Financial vulnerability is also measured through accounting indicators and Z-score proxies rather than observed default events. The study should not be read as establishing causality. Firm fixed effects account for time-invariant, unobserved firm characteristics, but reverse causality and omitted, time-varying factors may still affect the estimates. These limitations define the range of the claims made here. Future studies could move beyond listed electricity firms, add market-based measures of refinancing pressure where data are available, or separate firms by ownership and project stage.

The central implication is narrower. For listed electricity firms, maturity mismatch and interest-bearing leverage should not be treated as the same risk. One concerns timing; the other concerns debt burden. Operating cash flow belongs in the analysis, but the estimates do not show that it reliably offsets the maturity-timing problem.

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REFERENCES

Almeida, H., Campello, M., Laranjeira, B., & Weisbenner, S. (2012). Corporate debt maturity and the real effects of the 2007 credit crisis. *Critical Finance Review, 1*(1), 3-58. https://doi.org/10.1561/104.00000001

Almeida, H., Campello, M., & Weisbach, M. S. (2004). The cash flow sensitivity of cash. *The Journal of Finance, 59*(4), 1777-1804. https://doi.org/10.1111/j.1540-6261.2004.00679.x

Altman, E. I. (1968). Financial ratios, discriminant analysis and the prediction of corporate bankruptcy. *The Journal of Finance, 23*(4), 589-609. https://doi.org/10.1111/j.1540-6261.1968.tb00843.x

Altman, E. I., Iwanicz-Drozdowska, M., Laitinen, E. K., & Suvas, A. (2017). Financial distress prediction in an international context: A review and empirical analysis of Altman's Z-score model. *Journal of International Financial Management & Accounting, 28*(2), 131-171. https://doi.org/10.1111/jifm.12053

Arellano, M. (1987). Practitioners' corner: Computing robust standard errors for within-groups estimators. *Oxford Bulletin of Economics and Statistics, 49*(4), 431–434. https://doi.org/10.1111/j.1468-0084.1987.mp49004006.x

Brambor, T., Clark, W. R., & Golder, M. (2006). Understanding interaction models: Improving empirical analyses. *Political Analysis, 14*(1), 63-82. https://doi.org/10.1093/pan/mpi014

Cameron, A. C., & Miller, D. L. (2015). A practitioner's guide to cluster-robust inference. *Journal of Human Resources, 50*(2), 317-372. https://doi.org/10.3368/jhr.50.2.317

Diamond, D. W. (1991). Debt maturity structure and liquidity risk. *The Quarterly Journal of Economics, 106*(3), 709-737. https://doi.org/10.2307/2937924

Do, T. V. T., & Phan, D. T. (2022). Debt maturity structure and investment decisions: Evidence of listed companies on Vietnam's stock market. *Cogent Economics & Finance, 10*(1), 2024358. https://doi.org/10.1080/23322039.2021.2024358

Driscoll, J. C., & Kraay, A. C. (1998). Consistent covariance matrix estimation with spatially dependent panel data. *The Review of Economics and Statistics, 80*(4), 549-560. https://doi.org/10.1162/003465398557825

Drukker, D. M. (2003). Testing for serial correlation in linear panel-data models. *The Stata Journal: Promoting Communications on Statistics and Stata, 3*(2), 168-177. https://doi.org/10.1177/1536867X0300300206

Dudley, E., & Yin, Q. E. (2018). Financial distress, refinancing, and debt structure. *Journal of Banking & Finance, 94*, 185-207. https://doi.org/10.1016/j.jbankfin.2018.07.004

Flannery, M. J. (1986). Asymmetric information and risky debt maturity choice. *The Journal of Finance, 41*(1), 19-37. https://doi.org/10.1111/j.1540-6261.1986.tb04489.x

Franc-Dąbrowska, J., Mądra-Sawicka, M., & Milewska, A. (2021). Energy sector risk and cost of capital assessment—Companies and investors perspective. *Energies, 14*(6), 1613. https://doi.org/10.3390/en14061613

Greene, W. H. (2003). *Econometric analysis* (5th ed.). Upper Saddle River, NJ: Prentice Hall.

Habib, A., Costa, M. D., Huang, H. J., Bhuiyan, M. B. U., & Sun, L. (2020). Determinants and consequences of financial distress: Review of the empirical literature. *Accounting & Finance, 60*(S1), 1023–1075. https://doi.org/10.1111/acfi.12400

Hausman, J. A. (1978). Specification tests in econometrics. *Econometrica, 46*(6), 1251-1271. https://doi.org/10.2307/1913827

He, Z., & Xiong, W. (2012). Rollover risk and credit risk. *The Journal of Finance, 67*(2), 391-430. https://doi.org/10.1111/j.1540-6261.2012.01721.x

Hoechle, D. (2007). Robust standard errors for panel regressions with cross-sectional dependence. *The Stata Journal: Promoting Communications on Statistics and Stata, 7*(3), 281-312. https://doi.org/10.1177/1536867X0700700301

Huang, J.-C., Lin, H.-C., & Huang, D. (2022). The effect of operating cash flow on the likelihood and duration of survival for marginally distressed firms in Taiwan. *Sustainability, 14*(24), 17024. https://doi.org/10.3390/su142417024

Jaworski, J., & Czerwonka, L. (2021). Determinants of enterprises' capital structure in energy industry: Evidence from European Union. *Energies, 14*(7), 1871. https://doi.org/10.3390/en14071871

Johnson, S. A. (2003). Debt maturity and the effects of growth opportunities and liquidity risk on leverage. *The Review of Financial Studies, 16*(1), 209-236. https://doi.org/10.1093/rfs/16.1.0209

National Assembly of Vietnam. (2024). *Law No. 61/2024/QH15 on electricity*. Vietnam: Vietnam Government Portal.

Ngo, V. T., & Le, T. L. (2021). Factors influencing corporate debt maturity: An empirical study of listed companies in Vietnam. *The Journal of Asian Finance, Economics and Business, 8*(5), 551-559.

Pesaran, M. H. (2004). *General diagnostic tests for cross section dependence in panels*. IZA Discussion Paper No. 1240. Bonn, Germany: Institute for the Study of Labor (IZA).

Phan, T. D. (2020). Factors affecting debt maturity structure: Evidence from listed enterprises in Vietnam. *The Journal of Asian Finance, Economics and Business, 7*(10), 141-148.

Phan, T. D., Hoang, T. T., & Tran, N. M. (2022). Cash flow and financial distress of private listed enterprises on the Vietnam stock market: A quantile regression approach. *Cogent Business & Management, 9*(1), 2121237. https://doi.org/10.1080/23311975.2022.2121237

Prime Minister of Vietnam. (2025). *Decision No. 768/QĐ-TTg approving the adjustment of the National Power Development Plan for 2021–2030, with a vision to 2050*. Vietnam: Vietnam Government Portal.

Rajan, R. G., & Zingales, L. (1995). What do we know about capital structure? Some evidence from international data. *The Journal of Finance, 50*(5), 1421–1460. https://doi.org/10.1111/j.1540-6261.1995.tb05184.x

Stohs, M. H., & Mauer, D. C. (1996). The determinants of corporate debt maturity structure. *The Journal of Business, 69*(3), 279–312. https://doi.org/10.1086/209692

Wooldridge, J. M. (2010). *Econometric analysis of cross section and panel data* (2nd ed.). Cambridge, MA: MIT Press.