Print ISSN: 2288-4637 / Online ISSN 2288-4645
doi:10.13106/jafeb.2022.vol9.no1.0133

Leverage and Bankruptcy Risk - Evidence from Maturity Structure of Debt: An Empirical Study from Vietnam

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Received: September 30, 2021 Revised: December 05, 2021 Accepted: December 15, 2021

Abstract

This study examines the relationship between debt maturity structure and bankruptcy risk. There are various studies of leverage's effect on bankruptcy risk. Debt maturity, however, has not received the attention it deserves, especially in emerging markets with a high degree of information asymmetry. Using Vietnamese listed company data and various estimations, we find that leverage is positively associated with the likelihood of default. Importantly, short-term leverage shows a significantly positive effect on bankruptcy risk, while long-term leverage does not show significant results. The findings highlight that rollover risk firms are exposed to when using short-term debt increases bankruptcy risk. Meanwhile, firms do not cope with this risk in case of long-term debt adoption. High information asymmetry in emerging markets may be the main reason for the difference. The result is robust for subsamples of firms in different financial conditions, in concentrated and competitive industries, as well as for manufacturing and non-manufacturing companies. We also find that firms in a better financial situation and concentrated industries experience a higher short-term leverage effect than their counterparts. We, however, do not find a significant difference in the impact between manufacturing and non-manufacturing companies. This paper is among the first to examine the relation between debt maturity and bankruptcy risk in Vietnam.

Keywords: Leverage, Bankruptcy Risk, Maturity Structure of Debt

JEL Classification Code: G300, G320, G330, G390

1. Introduction

The rich literature of corporate financial policies documents that leverage is positively associated with bankruptcy risk. Modigliani-Miller's (M&M) (Miller, 1988) theorem suggests that bankruptcy risk increases when firms use higher leverage. Besides, using huge debt can lead to underinvestment since agency problems between shareholders and creditors (Hart & Moore, 1995), which in turn increase the probability of default. These predictions are supported by various empirical studies (Baxter, 1967; Castanias, 1983; Khoa & Thai, 2021; Verwijmeren & Derwall, 2010).

However, according to Hart and Moore (1995), debt maturity matters in bankruptcy risk. Short-term debt and long-term debt can affect firms' bankruptcy risk in different ways**.** Short-term debt increase debt service in the short-term, which decreases firms' internal cash flows. Cash flow constraint prevents firms from conducting new investments. Meanwhile, long-term debt creates a financial burden in firms that cannot raise external funds due to the long-term debt burden. These obstacles prevent firms from conducting new investments, which induces a higher probability of bankruptcy.

Current literature overlooks the relation between debt maturity and bankruptcy risk. Our study explores the impact of debt maturity on bankruptcy risk in emerging markets. To be specific, we examine the relationship in the context of Vietnam. Vietnam is an emerging market with a high growth rate. To the best of our knowledge, the issue of debt maturity and bankruptcy risk in the context of Vietnam remains unexplored. The short-term interest rate in Vietnam

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is lower than medium and long-term ones, seducing firms to borrow short-term loans for medium and long-term investments. This corporate behavior may lead to a more substantial impact of short-term borrowings on bankruptcy risk than long-term loans. We, therefore, attempts to offer further insight into the issue in the context of Vietnam. Also, the majority of Vietnamese firms are small and medium, with limited financial capacity. These firms, therefore, may be more sensitive to debt financing than big firms. Since public firms' size in developed countries, which often are the sample for the previous studies, are usually large, the Vietnamese data is advantageous for us to examine the issue for small firms.

We use financial data of the companies listed on the Hanoi and Ho Chi Minh stock exchanges till the end of August 2020 (669 companies) to examine the issue. With the implementation of multivariate analyses, the results show that high-leveraged firms have higher bankruptcy risks. However, when examining separately short-term leverage and long-term leverage, the result shows evidence for the short-term debt uses but no evidence for long-term. Our findings suggest that in an emerging market, debt maturity is essential to the probability of default. Furthermore, short-term borrowings have a substantial impact due to its low-interest rate, which affect firms' financing behaviors. We also find that the effect is more significant for firms with better financial conditions in concentrated industries. We, however, do not find a significant difference in the impact between manufacturing and non-manufacturing companies, but the effect is still evident for these subsamples.

Our paper offers several contributions to the literature of leverage and bankruptcy risk in emerging markets. First, we provide robust evidence of the relationship between leverage and bankruptcy risk in the emerging market. Second, we take debt maturity into account when examining the leverage effect on the bankruptcy risk. Specifically, even though total leverage significantly increases bankruptcy risk, we find that the effect comes from short-term debt rather than long-term debt in the emerging market. Low short-term interest rates and limited financial capacity in emerging markets are essential in their financing policies, increasing the bankruptcy risk firms face. This paper is among the first to examine the relation between debt maturity and bankruptcy risk in Vietnam.

In the next section, the paper is divided into six parts. Part 2 presents the literature review of bankruptcy risk and leverage. Part 3 introduces the hypothesis development. Part 4 shows data and methodology. Part 5 is the main empirical results. In part 6, we conduct additional analyses. The final part is the conclusion.

2. Literature Review

Risk is measurable uncertainty of events randomly occurring in the future and causing damage. Risk includes two components: uncertainty and the possibility of loss (Knight, 1921). According to Eichhorn (2004) and Napp (2011), financial risk can take two different forms. Bankruptcy risk due to objective factors comes from changes in financial markets such as interest rates, exchange rates, and commodity prices. Bankruptcy risk caused by subjective factors derives from the financial decisions of managers.

Literature of bankruptcy risk shows many studies attempt to predict the probability of default. Two well-known studies are Ohlson (1980) and Altman (1968). Ohlson (1980) constructs a conditional logit model with four predictive factors: firm size, financial structure, firm performance, and current liquidity. Altman (1968) adopts multiple discriminant analysis (MDA) to predict bankruptcy risk. The author finds that the model correctly classifies the bankrupt and non-bankrupt firms into their actual group with a predictive power of 95%. The model is specifically designed for public manufacturing firms. Later, Altman (1983) provided the other two models for private manufacturing companies and privately traded companies.

Later studies attempt to assess the predictive power of the models of bankruptcy risk. Pongsatat et al. (2004) applied the model of Altman and Ohlson in analyzing the bankruptcy risk of Thai companies. Using size and industry matching methods, the authors construct a sample of 60 matched pairs of bankrupt and non-bankrupt firms. The study indicates that Ohlson's model provides predictive power of 69.64%, higher than Altman's model for large firms. Altman's model, however, is more advantageous in predicting the bankruptcy risk of small firms. Uğurlu and Aksoy (2006) find that Ohlson's logit model is more accurate than Altman's MDA model. The study was conducted on a sample of 27 pairs of Turkish bankrupt and non-bankrupt companies. This study examines the bankruptcy probability from 1993 to 2003 to provide insights into bankruptcy risk in changing economic environment. Ohlson's model shows a higher predictive power of bankruptcy than Altman's does. Xu and Zhang (2009) study the bankruptcy of Japanese listed firms. The authors find that Altman's model and Ohlson's model, which are developed for the US market, are also suitable for Japanese firms. Besides, the accuracy increases when combining both models. They also incorporate institutional characteristics (bank dependence and business groups) in the model to improve predictive power. Hiong et al. (2021) confirm Altman's *Z*-score's power when using data of listed firms in Malaysia.

Some studies examine bankruptcy risk factors (Bryan et al., 2013; Darrat et al., 2016; Gul & Cho, 2019; Verwijmeren & Derwall, 2010). Darrat et al. (2016) study the relationship between corporate governance and bankruptcy risk. The results suggest that a larger board of directors reduces bankruptcy risk in complex firms. Also, firms with more inside board members decrease the risk. Verwijmeren and Derwall (2010) examine the relationship between employee well-being and bankruptcy risk. They find that firms consider employee well-being when choosing a capital structure. Firms with leading track records in employee well-being choose lower leverage and have better credit ratings. Bryan et al. (2013) focus on business strategy and bankruptcy risk. The results show a negative relationship between productivity and bankruptcy risk. They also point out that successful generic strategies decrease bankruptcy risk.

However, most previous studies focus on total leverage, while short-term or long-term debts themselves may potentially impact bankruptcy risk. Therefore, this study not only reexamines the causal effect between leverage and bankruptcy risk but also focuses on the effect of debt types, which has been overlooked in the literature. Besides, most previous studies focus on the causal impact of leverage on bankruptcy risk in developed countries. In contrast, the developing countries have more and more contributed to global economic achievement. Therefore, using Vietnam corporate data, we attempt to fill in this gap.

3. Hypothesis Development

Modigliani-Miller's (M&M) theorem suggests under the assumptions of corporate taxes, a perfect capital market with no transaction costs, firms should use more debts to take advantage of tax-deductibility of interest expense. Bankruptcy risk, however, increases when firms use higher leverage. Higher the borrowings, higher the probability of failure to meet financial obligations concerning creditors. Firms have to cope with this shortcoming when they increase debt rather than equity. As a consequence, the balance between tax shield benefits and bankruptcy risks proposes an optimal capital structure. Besides, using huge debt can lead to underinvestment since agency problems between shareholders and creditors when information asymmetry exists (Myers, 1977; Hennessy, 2004; Titman & Tsyplakov, 2007). In such a situation, some positive net present value projects are forgone. In other words, to some extent, debt overhang prevents firms make new investments, which is likely to increase the probability of default. Therefore, we propose the hypothesis that higher leverage increases bankruptcy risk.

H1: *Higher leverage increases bankruptcy risk.*

While short-term debt decreases firms' internal cash flows, firms cannot raise external funds due to long-term debt burden (Hart & Moore, 1995). These obstacles prevent firms from conducting new investments, which induces a higher probability of bankruptcy. Thus, when increasing short-term or long-term debts, firms induce higher bankruptcy risks.

Since interest rates for short-term debts are often lower than medium- and long-term, enterprises are likely to choose short-term debts for medium- and long-term investments. This is the case when the interest rate differentials between short-term and long-term debts are relatively large. Firms using short-term debts, however, suffer from rollover risk. In other words, these firms have to renegotiate with lenders after each single year of borrowings if they desire to use these short-term loans for medium or long-term projects. In case banks cut off these loans, the medium and long-term investments face stagnancy or cessation.

H2: *Short-term debt increases bankruptcy risk.*
H3: *Long-term debt also increases bankruptcy risk.*

4. Data and Methodology

To examine the impact of leverage on bankruptcy risk, we use the following model:

$$Z\text{-score}_{it} = \alpha + \alpha_1 \text{Leverage}_{it} + \alpha_2 \text{CV}_{it} + \varepsilon_{it}$$

Where i and t are firm i and year t, respectively.

We adopt Z-score is Altman Z-score as the dependent variable of bankruptcy risk. (Altman, 1968). However, Altman (1968) and Altman and Hotchkiss (1993) provide two different calculations for manufacturing and non-manufacturing firms. Following this, we calculate Z-score for manufacturing firms as follows:

$$Z = 1.2\,X_1 + 1.4\,X_2 + 3.3\,X_3 + 0.64\,X_4 + 0.999\,X_5$$

Where:
X_1: working capital to total assets ratio
X_2: retain earnings to total assets ratio
X_3: EBIT to total assets ratio (EBIT: Earnings before interest and tax)
X_4: Equity market value to total liabilities ratio (Share price multiplied by the number of outstanding shares to total liabilities)
X_5: Sales to total assets (Asset turnover)

Altman (1993) also provides an estimation for the bankruptcy risk of non-manufacturing companies. The formula for Z-score is adjusted as follows:

$$Z'' = 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$$

We use a set of control variables: Cash_holdings (cash and cash equivalents to total assets); Ln_assets (natural

logarithm of total assets); Growth (sales growth rate, calculated by the difference in sales between of current year and previous year divided by sales of the previous year); ROA (earnings before interest and taxes on total assets). All the variables used in the model are winsorized at the top and bottom 1% values.

To estimate the model, we use all three common regression models in corporate finance research: Ordinary least square (OLS), Fixed effect model (FEM), Random effect model (REM). Since these models are estimated under different assumptions, results would be more convincing when looking at estimations of all three models.

Data are collected from Cophieu68, a well-known database for financial information of listed companies. This database is advantageous since it provides all financial items on annual financial reports (balance sheet, income statement, and cash flows statement) of all Vietnamese listed firms. Data covers 659 companies and 5916 firm-year observations from 2005 to 2019.

Table 1 presents the industry classification of firms in our sample. The majority of firms in Vietnam are in the manufacturing industry, which accounts for 35.1% of firms in the sample. Construction and Real estate firms are the second highest group with 175 firms (26.6%). At the same time, Advertising, Public Relations and Related Services Architectural, Engineering, and Related Services account for the smallest portions in the sample.

Table 1: Industry Classification

Industry	Number of Firms	Percentage
Accommodation and Food Services	4	0.6%
Administrative and Support and Waste Management and Remediation Services	3	0.5%
Advertising, Public Relations, and Related Services	1	0.2%
Agricultural production	12	1.8%
Architectural, Engineering, and Related Services	2	0.3%
Construction and Real estate	175	26.6%
Information and Technology	29	4.4%
Manufacturing	231	35.1%
Mining, Quarrying, and Oil and Gas extraction	30	4.6%
Professional, Scientific, and Technical Services	9	1.4%
Retail Trade	7	1.1%
Transportation and Warehousing	55	8.3%
Utilities	44	6.7%
Wholesale Trade	57	8.6%
Total	659	100%

This table presents the industry distribution of firms in our sample

5. Empirical Results

Table 2 presents summary statistics of variables used in this study. The entire sample data are reported. Cash holdings are cash and cash equivalents to total assets. Total assets are in a million Vietnam dong (VND). Growth is the sales growth rate, calculated by the difference between the current and previous year divided by the previous year. ROA is earnings before interest and taxes on total assets.

Table 2 presents summary statistics of control variables used in the regression. While the mean total leverage is 0.497, the average value for short-term leverage is 0.396. The statistics suggest that Vietnamese firms prefer short-term borrowings to long-term borrowings. One possible reason is the low-interest rate for short-term debts and the limited financial capacity of Vietnamese firms. On average, cash and cash equivalents account for 9.9% of total assets. Our sample covers a wide range of cash holding ratios when the ratio ranges from 0.1% to 50.5%. Firm sizes are very different from firm to firm. While the smallest firm has an asset size of 20,768 million VND, the largest firm has total assets of 33,200,000 million VND. Vietnamese listed firms, on average, have 1,966,851 million VND on their assets. Growth varies while the minimum value is –91.9% and the maximum value is 898.2%. The average firm has a return on assets of 7.2%, while the median ROA is 5.6%, indicating that majority of the firms in our sample are profitable.

Table 3 presents the results for regression analysis. We first estimate the regression for model with total leverage. We adopt three estimations: fixed effect model, random effect model, and ordinary least square model. Model (1)–(3) show that leverage has negative coefficients on Z-score. The coefficients, however, are only significant when using random effect and ordinary least square estimations, suggesting some evidence that when increased leverage gets firms into the riskier situation. The results are consistent with M&M theory.

Since long-term debt may reduce firms' ability to raise external funds, an increase in this type of debt may constrain firms from conducting positive NPV projects, potentially leading to higher bankruptcy risk. To examine the issue, we substitute total leverage with long-term leverage. Model (4)–(6) presents the results. While the fixed-effect and random effect models show positive coefficients, the OLS model presents negative ones. However, most coefficients are insignificant, except for the OLS model with a 10% significance level. The results suggest no evidence for the hypothesis that long-term leverage increases bankruptcy risk.

Table 2: Summary Statistics

	Mean	Standard Deviation	Min.	Median	Max.	*N*
Total leverage	0.497	0.275	0.001	0.509	8.523	5909
Short-term leverage	0.396	0.232	0.001	0.380	5.456	5909
Long-term leverage	0.117	0.160	0.000	0.053	3.066	5104
Cash_holdings	0.099	0.104	0.001	0.063	0.505	5909
Total assets (mil. VND)	1,966,851	4,644,242	20,768	547,654	33,200,000	5915
Growth	0.270	1.214	–0.919	0.076	8.982	5904
ROA	0.072	0.064	0.001	0.056	0.326	5915

Hart and Moore (1995) argue that short-term debt may reduce internal cash flows for new projects. Not being able to conduct new projects may increase the probability of bankruptcy. Model (7)–(9) examine this issue. Short-term debt over total assets ratio shows significantly negative coefficients for all three models. The coefficients also show an economically significant impact of short-term debt on bankruptcy risk. The fixed-effect model shows that when short-term leverage increases 10%, *Z*-score decreases 0.55. It is worth noting that the *Z*-score is close to three, indicating that firms are in a solid financial position, while a score below 1.8 means firms experience a high probability of bankruptcy. Thus, a decrease by 0.55 is sizable. The results support the hypothesis that firms with high short-term leverage have higher bankruptcy risk.

One possible explanation for the difference in the results of short-term and long-term debt is due to information asymmetries in the emerging market. Information asymmetries in emerging markets are more severe than in advanced countries (Yildiz, 2021; Chung et al., 2017). The presence of information asymmetries makes lenders meet difficulties to determine the borrowers' riskiness as well as to monitor their investment behaviors. Frequent renegotiation is considered a device for lenders to reassess borrowers' riskiness and secure their capital. The signal theory argues that distinctive behaviors can signal investors about firms' capacity. By using short-term debt, firms convince investors that they guarantee to repay debt service in a short period frequently, and their quality is certain. Agency problems between shareholders and creditors may lead to underinvestment problems due to standard returns offered to shareholders (Myers, 1977). Short-term debts with frequent rollover needs motivate firms to decide the lenders' interests. Since short-term debt is more prominently used in emerging markets like Vietnam, it is likely to have a more evident effect on firms' characteristics (i.e., bankruptcy risk).

Concerning control variables, cash holdings show a positive coefficient to bankruptcy risk. However, the coefficient is insignificant or significant at 10%, suggesting that cash holdings do not have a strong effect on leverage. Ln_assets negatively impact *Z*-score, implying that the bankruptcy risk will increase when firm size is large. However, the evidence is weak since some of the coefficients on Ln_assets is insignificant. Growth rate (Growth)'s impact, however, is not evident. ROA has a significantly positive effect on firms' bankruptcy risk, at a 1% level, suggesting that well-performing firms are less likely to go bankrupt. Since firms with high asset efficiency have more stable income than their peers with low efficiency, they should have lower bankruptcy risk. This result is consistent with the M&M theory.

6. Additional Tests

6.1. Capital Structure and Bankruptcy Risk in Firms with Different Financial Conditions

Firms with different financial conditions use a different level of debts. Firms in good condition can raise more debt for their business. However, for the same level of debt, firms with a better financial condition should experience less bankruptcy risk due to higher and more stable cash flows.

To examine the issue, we adopt Hose as a dummy variable to reflect firms' financial condition. Hose is equal to one if firms are listed on the Ho Chi Minh stock exchange and zero otherwise. The Ho Chi Minh stock exchange requirement is stricter than others in Vietnam. For instance, charter capital should be more than 120 billion VND, while the Hanoi stock exchange requires only 30 billion. Besides, the age of the firms is required at least two years for the Ho Chi Minh stock exchange, while the Hanoi stock exchange requires only one year. Therefore, an interaction term of leverage and Hose is adopted to examine the difference in leverage effect between firms on the Ho Chi Minh stock exchange and others.

Table 5 presents the regression result. Model (1)–(3) show significantly negative coefficients on t_lev, indicating that firms with weaker financial conditions experience higher bankruptcy risk while increasing their leverage. This finding is consistent with M&M theory. Importantly, the interaction term has significantly positive coefficients.

Table 3: Regression Results of Capital Structure on Bankruptcy Risk: Entire Sample

Dependent	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	FEM	REM	OLS	FEM	REM	OLS	FEM	REM	OLS
T_lev	–4.006	–4.508*	–5.856**						
	(–1.50)	(–1.67)	(–2.18)						
L_lev				0.430	0.069	–1.821*			
				(0.56)	(0.09)	(–1.81)			
S_lev							–5.589**	–5.850***	–6.253***
							(–2.36)	(–2.61)	(–3.54)
Cash_holdings	2.549*	2.676*	2.631	1.233	1.427	3.152*	2.510*	2.667*	3.064
	(1.70)	(1.72)	(1.24)	(0.97)	(1.10)	(1.70)	(1.65)	(1.71)	(1.51)
Ln_assets	–0.292	–0.284	–0.265**	–0.398	–0.373	–0.255**	–0.494	–0.490**	–0.495***
	(–0.58)	(–0.93)	(–2.30)	(–1.22)	(–1.59)	(–2.46)	(–1.25)	(–2.22)	(–4.59)
Growth	–0.012	–0.009	0.004	–0.009	–0.008	0.005	–0.012	–0.008	0.006
	(–1.38)	(–1.07)	(1.12)	(–1.31)	(–1.09)	(1.05)	(–1.31)	(–1.00)	(1.44)
ROA	16.149***	18.028***	25.904***	17.384***	18.350***	27.617***	17.128***	19.217***	28.099***
	(5.78)	(5.49)	(3.98)	(12.87)	(11.65)	(5.39)	(7.53)	(7.12)	(4.84)
Constant	6.804	5.484*	4.807***	6.048	5.543*	3.569**	9.326**	7.337***	6.715***
	(1.35)	(1.88)	(3.46)	(1.55)	(1.95)	(2.58)	(2.11)	(2.77)	(3.90)
Industry dummy	–	Yes	Yes	–	Yes	Yes	–	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.036	0.036	0.136	0.041	0.041	0.123	0.039	0.039	0.133
N	5815	5815	5815	5025	5025	5025	5815	5815	5815

This table presents regression results of capital structure on bankruptcy risk for the entire sample. The dependent variable is Altman *Z*-score. T_lev is the ratio of total liabilities over total assets. L_lev is long-term liabilities to total assets. S_lev is short-term liabilities to total assets. Cash_holdings is cash and cash equivalents to total assets. Ln_assets is the natural logarithm of total assets. Growth is the sales growth rate, calculated by the difference between the current year and the previous year divided by the previous year. ROA is earnings before interest and taxes on total assets. Firm-fixed effects model (FEM), random-fixed effects model (REM), and ordinary least square model (OLS) with industry and year dummies are adopted. *T*-values estimated by using firm-clustering standard errors are reported in the parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

The coefficients of the interaction term are smaller than the coefficients on total leverage, suggesting that while firms with good financial conditions still witness positive relation between leverage and bankruptcy risk, the magni-tude of the effect is smaller than firms with worse financial conditions.

Model (4)–(6) examines the leverage effect of long-term debts. However, the leverage itself and the interaction term do not show significant results. Nevertheless, the results are consistent with our main analysis' finding that long-term leverage is not associated with bankruptcy risk. Our final models (7)–(9) present short-term leverage regression results. While the coefficients of short-term leverage are significantly negative, the interaction term shows positive coefficients (at 1% level). The results suggest that short-term leverage increase bankruptcy risk. The effect, however, is smaller for firms listed on the Ho Chi Minh stock exchange. In other words, firms with better financial conditions experience less bankruptcy risk than firms in worse conditions at the same level of short-term leverage.

6.2. Capital Structure, Bankruptcy Risk, and Industry Concentration

Firms in a competitive environment should be more effective in their management due to competitiveness pressure. Meanwhile, firms in concentrated industries, especially state-owned enterprises in strategic industries, often loosen their management since they do not have many competitors. Thus, firms in a competitive environment may face less bankruptcy risk increase when they increase debt compared to those in concentrated industries.

We add a dummy variable of competitiveness and its interaction term to examine the difference in leverage effect between different competitive environments. Model (1)–(3) presents the total leverage result. While the coefficients on total leverage are negative, the interaction term shows positive coefficients. Moreover, all the coefficients are significant at least 5% level. The result suggests that firms in concentrated industries show a negative leverage

Table 4: Regression Results of Capital Structure on Bankruptcy Risk: Different Financial Conditions

Dependent	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	FEM	REM	OLS	FEM	REM	OLS	FEM	REM	OLS
T_lev	–11.069***	–8.434***	–7.101***						
	(–6.42)	(–6.42)	(–3.63)						
L_lev				0.607	–0.024	–3.308***			
				(0.75)	(–0.04)	(–3.56)			
S_lev							–10.408***	–9.074***	–7.352***
							(–7.47)	(–8.59)	(–5.22)
T_lev*Hose	8.719***	5.224***	2.296**						
	(3.68)	(3.49)	(2.19)						
L_lev*Hose				–0.259	0.140	2.315			
				(–0.23)	(0.13)	(2.42)			
S_lev*Hose							7.042***	5.034***	2.403***
							(2.79)	(3.00)	(2.60)
Cash_ holdings	1.903	2.189	2.372	1.240	1.423	3.008	2.029	2.277	2.876
	(1.30)	(1.47)	(1.16)	(0.97)	(1.10)	(1.64)	(1.39)	(1.52)	(1.44)
Ln_assets	0.062	–0.428	–0.473**	–0.401	–0.373	–0.296***	–0.375	–0.647***	–0.670***
	(0.14)	(–1.45)	(–2.58)	(–1.23)	(–1.59)	(–2.74)	(–0.96)	(–2.80)	(–5.00)
Growth	–0.010	–0.008	0.006	–0.009	–0.008	0.005	–0.010	–0.007	0.007*
	(–1.36)	(–1.10)	(1.63)	(–1.31)	(–1.09)	(1.07)	(–1.29)	(–0.98)	(1.88)
ROA	14.499***	16.717***	24.976***	17.391***	18.346***	27.423***	16.609***	18.507***	27.380***
	(6.05)	(5.76)	(4.00)	(12.86)	(11.66)	(5.33)	(7.58)	(7.06)	(4.72)
Constant	4.121	6.777**	6.764***	6.072	5.539**	3.964***	8.452*	8.728***	8.345***
	(0.84)	(2.31)	(3.94)	(1.56)	(1.96)	(2.76)	(1.89)	(3.26)	(4.71)
Industry dummy	–	Yes	Yes	–	Yes	Yes	–	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.043	0.041	0.140	0.041	0.041	0.124	0.044	0.043	0.136
N	5815	5815	5815	5025	5025	5025	5815	5815	5815

This table presents regression results of capital structure on bankruptcy risk. The dependent variable is Altman *Z*–score. T_lev is the ratio of total liabilities over total assets. L_lev is long-term liabilities to total assets. S_lev is short-term liabilities to total assets. Hose is a dummy variable that is equal to 1 if firms are listed on the Ho Chi Minh stock exchange and zero otherwise. Cash_holdings is cash and cash equivalents to total assets. Ln_assets is the natural logarithm of total assets. Growth is the sales growth rate, calculated by the difference between the current year and the previous year divided by the previous year. ROA is earnings before interest and taxes on total assets. Firm-fixed effects model (FEM), random-fixed effects model (REM), and ordinary least square model (OLS) with industry and year dummies are adopted. *T*-values estimated by using firm-clustering standard errors are reported in the parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

effect on *Z*-score. In other words, these firms face higher bankruptcy risks while raising more debts for their business. The competitive firms, however, experience a lower leverage effect. Therefore, their bankruptcy risk increases lower when using more debts compared to firms in concentrated industries.

Model (4)–(6) adopt long-term leverage as the main dependent variable. Both the coefficients on long-term leverage and its interaction term are insignificant, suggesting that long-term leverage does not significantly impact firms' bankruptcy risk. Model (7)–(9) present the regression estimation for short-term leverage. While the coefficients of short-term leverage are significantly negative at the 1% level, the interaction term shows significantly positive coefficients. The results suggest that short-term leverage increase bankruptcy risk. The effect, however, is smaller for firms in competitive industries. In other words, firms in a competitive environment experience less bankruptcy risk than firms in concentrated ones at the same level of short-term leverage.

Table 5: Regression Results of Capital Structure on Bankruptcy Risk: Industry Concentration

Dependent	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	FEM	REM	OLS	FEM	REM	OLS	FEM	REM	OLS
T_lev	–6.048**	–7.014***	–11.567***						
	(–2.51)	(–2.96)	(–4.15)						
L_lev				–0.446	–1.015	–4.801***			
				(–0.44)	(–1.07)	(–4.63)			
S_lev							–8.190***	–8.962***	–12.886***
							(–4.06)	(–4.60)	(–4.71)
T_lev*Com	2.203***	2.719***	6.363***						
	(2.82)	(2.98)	(2.86)						
L_lev*Com				0.970	1.205	3.455***			
				(1.36)	(1.71)	(2.97)			
S_lev*Com							2.928**	3.500***	7.497***
							(2.50)	(2.73)	(2.95)
Cash_ holdings	2.506*	2.617*	2.371	1.234	1.424	2.994	2.443	2.596*	3.012***
	(1.68)	(1.69)	(1.13)	(0.97)	(1.10)	(1.61)	(1.63)	(1.68)	(1.49)
Ln_assets	–0.249	–0.248	–0.215**	–0.391	–0.366	–0.246**	–0.466	–0.469**	–0.466
	(–0.50)	(–0.83)	(–1.98)	(–1.20)	(–1.55)	(–2.36)	(–1.18)	(–2.13)	(–4.32)
Growth	–0.010	–0.006	0.011**	–0.009	–0.007	0.006	–.009	–0.005	0.011***
	(–1.35)	(–0.94)	(2.58)	(–1.31)	(–1.08)	(1.38)	(–1.25)	(–0.83)	2.98
ROA	16.161***	18.039***	25.505***	17.388***	18.352***	27.534***	17.239***	19.346***	28.036***
	(5.85)	(5.55)	(4.00)	(12.89)	(11.67)	(5.38)	(7.60)	(7.16)	(4.85)
Constant	6.658	6.276**	6.906***	6.019	5.674**	3.989***	9.285**	8.032***	8.426***
	(1.33)	(2.22)	(4.50)	(1.54)	(2.02)	(3.02)	(2.10)	(3.12)	(4.66)
Industry dummy	–	Yes	Yes	–	Yes	Yes	–	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.037	0.037	0.143	0.041	0.041	0.124	0.040	0.040	0.136
N	5815	5815	5815	5025	5025	5025	5815	5815	5815

This table presents regression results of capital structure on bankruptcy risk. The dependent variable is Altman Z-score. T_lev is the ratio of total liabilities over total assets. L_lev is long-term liabilities to total assets. S_lev is short-term liabilities to total assets. Com is a dummy variable that is equal to 1 if firms are in a competitive industry and zero otherwise. Cash_holdings is cash and cash equivalents to total assets. Ln_assets is the natural logarithm of total assets. Growth is the sales growth rate, calculated by the difference between the current year and the previous year divided by the previous year. ROA is earnings before interest and taxes on total assets. Firm-fixed effects model (FEM), random-fixed effects model (REM), and ordinary least square model (OLS) with industry and year dummies are adopted. *T*-values estimated by using firm-clustering standard errors are reported in the parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

6.3. Capital Structure and Bankruptcy Risk in Manufacture and Non-Manufacture Industries

Manufacturing and non-manufacturing usually have different characteristics in their business. These features may affect the causal effect of leverage on firms' bankruptcy risk. To examine this issue, we add an interaction term of leverage and manufacturing dummy variable to the model. Table (4) presents the result. Model (1)–(3) use total leverage as the main dependent variable. The models show negative coefficients on total leverage. However, two out of three coefficients are insignificant, while the other is marginally significant (at 10% level). The interaction term also does not have significant coefficients. Similar to total leverage, long-term leverage also does not show a significant impact on bankruptcy risk as presented in Model (4)–(6). The coefficients of the interaction term are all insignificant. Finally, we examine the effect of short-term leverage.

Table 6: Regression Results of Capital Structure on Bankruptcy Risk: Manufacture and Non-Manufacture Industries

Dependent	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	FEM	REM	OLS	FEM	REM	OLS	FEM	REM	OLS
T_lev	–3.924	–4.576	–6.685*						
	(–1.30)	(–1.44)	(–1.87)						
L_lev				0.642	0.154	–2.169*			
				(0.75)	(0.17)	(–1.73)			
S_lev							–5.859*	–6.251**	–7.431***
							(–1.91)	(–2.11)	(–2.99)
T_lev*Manu	–0.512	0.395	3.958						
	(–0.18)	(0.13)	(1.19)						
L_lev*Manu				–0.876	–0.358	1.999			
				(–0.95)	(–0.36)	(1.43)			
S_lev*Manu							1.293	1.898	4.832*
							(0.41)	(0.61)	(1.72)
Cash_ holdings	2.524*	2.701*	3.160	1.224	1.424	3.181*	2.570*	2.777*	3.649*
	(1.71)	(1.77)	(1.58)	(0.96)	(1.10)	(1.71)	(1.72)	(1.81)	(1.85)
Ln_assets	–0.282	–0.288	–0.275**	–0.393	–0.372	–0.261**	–0.502	–0.495**	–0.496***
	(–0.59)	(–1.00)	(–2.38)	(–1.20)	(–1.58)	(–2.49)	(–1.28)	(–2.25)	(–4.57)
Growth	–0.012	–0.009	0.004	–0.009	–0.008	0.005	–0.011	–0.008	0.006
	(–1.37)	(–1.06)	(1.16)	(–1.32)	(–1.09)	(1.09)	(–1.30)	(–0.99)	(1.39)
ROA	16.051***	18.116***	24.866***	17.319***	18.323***	27.820***	17.234***	19.403***	28.784***
	(6.29)	(5.97)	(4.18)	(12.68)	(11.59)	(5.42)	(7.73)	(7.32)	(4.96)
Constant	6.755	5.540*	5.086***	6.010	5.522*	3.663***	9.302**	7.435***	6.864***
	(1.36)	(2.00)	(3.66)	(1.54)	(1.94)	(2.64)	(2.10)	(2.81)	(3.88)
Industry dummy	–	Yes	Yes	–	Yes	Yes	–	Yes	Yes
Year dummy	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.036	0.035	0.138	0.041	0.041	0.123	0.039	0.039	0.136
N	5815	5815	5815	5025	5025	5025	5815	5815	5815

This table presents regression results of capital structure on bankruptcy risk. The dependent variable is Altman Z–score. T_lev is the ratio of total liabilities over total assets. L_lev is long-term liabilities to total assets. S_lev is short-term liabilities to total assets. Manu is a dummy variable that is equal to 1 if firms are in the manufacturing industry and zero otherwise. Cash_holdings is cash and cash equivalents to total assets. Ln_assets is the natural logarithm of total assets. Growth is the sales growth rate, calculated by the difference between the current year and the previous year divided by the previous year. ROA is earnings before interest and taxes on total assets. Firm-fixed effects model (FEM), random-fixed effects model (REM), and ordinary least square model (OLS) with industry and year dummies are adopted. *T*-values estimated by using firm-clustering standard errors are reported in the parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

Model (7)–(9) show significantly negative coefficients on short-term leverage, suggesting that when short-term leverage increase, *Z*-score decreases or bankruptcy risk becomes higher. The interaction term is positive but insignificant, indicating no difference between the short-term leverage effect between manufacuring and non-manufacturing companies.

7. Conclusion

Using Vietnamese data of listed firms, we attempt to examine the relationship between the maturity structure of debt and bankruptcy risk. We find that leverage is positively associated with the likelihood of default. Remarkably, short-term leverage shows a significantly positive effect on bankruptcy risk,

while long-term leverage does not show significant results. High information asymmetry in emerging markets may be the main reason for the difference. Besides, firms with better financial conditions and concentrated industries experience higher short-term leverage effects. We, however, do not find a significant difference in the effect between manufacturing and non-manufacturing companies, but the effect is still evident for these subsamples.

Our paper offers several contributions to the literature of leverage and bankruptcy risk in emerging markets. First, we provide robust evidence of the relationship between leverage and bankruptcy risk in the emerging market. Second, we consider debt maturity when examining the leverage effect on the bankruptcy risk. Specifically, even though total leverage significantly increases bankruptcy risk, we find that the effect comes from short-term debt rather than long-term debt in the emerging market. This paper is among the first to examine the relation between debt maturity and bankruptcy risk in Vietnam.

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