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Capital Structure and Performance in Vietnamese Construction Firms: Using Quantile Regression Approach

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Abstract

The paper aims to analyze the impact of capital structure on the performance of construction firms. We used data taken from annual firm survey conducted by General Statistics Office of Vietnam (GSO) associated with 13,912 construction firms. Instead of using only a sample with listed firms, we also added unlisted firms to ensure overall representation. The results from quantile regression show that capital structure positively affects firms' performance. On each different percentile, the level of impact of capital structure is also different. The lower the percentile, the stronger the impact of capital structure on the performance—the strongest impact is at the 0.1 percentile, the lowest is at the 0.9 percentile. This implies that construction firms will well exploit the benefits from debt at lower percentiles. In the high percentiles, construction firms will prioritize using equity over debt.

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1. Introduction

In Vietnam, the outbreak of COVID-19 has caused many firms to face difficulties, but the industry and construction sector make the most prominent contribution to the GDP structure in the first quarter of 2020. According to the General Statistics Office of Vietnam (GSO), at the end of 2020, Vietnam's economic growth reached 2.91%, in which the main growth engine came from the industry and construction sector with a 3.98% increase, outstandingly contributing 53%, construction increased 6.76%, contributing 0.5 percentage points to the growth rate of the total added value of the whole economy. The Vietnamese construction industry is also projected to grow by 6.9% per year to 2028. In the period of 2015-2019, the average growth rate of Vietnam's construction industry reached 9.6%, showing that Vietnam's construction industry is currently at the end of the growth phase and preparing to enter the restructuring phase. That is also when the construction growth rate will slow down, leading to increased pressure among businesses, and identifying factors affecting performance becomes important.

The Vietnamese construction industry has been considered as one of the primary contributors to economic growth. However, there are various difficulties which put a pressure on construction firms' performance (Nguyen & Chileshe, 2013; Panuwatwanicha & Nguyen, 2017). With the specific characteristics of the construction industry in using a lot of capital, capital planning, long payment time, it leads to the need for construction firms to mobilize additional capital from outside (Vu, Le, & Nguyen, 2020). Besides, a variety of reasons, such as the lack of experience in executing complicated project, lack of knowledge and ability in managing construction projects, lack of financial capacity of owners, poor performance of contractors, economic volatility and high inflation, weather, and disasters also adversely affect construction firms. These factors were also concluded by many researchers as the main reasons for construction project failure as well as poor performance of construction firms in Vietnam (Nguyen & Ogunlana, 2004; Luu, Kim, Cao, & Park, 2008).

Particularly, it is riskier for construction companies in developing countries (Ezeldin & Sharara, 2006), and what concerns the most is how to improve the performance for construction firms in Vietnam. Traditionally, most firms assess their performance based on financial measures such as return on assets (ROA), return on equities (ROE), return on investment (ROI), discounted cash flow (DCF), profit margins, and so on. Our research is currently focusing on the fact that Vietnamese construction firms are increasingly interested in corporate governance issues, in order to set up suitable capital structures to maximize their performance. The level of financial leverage of Vietnamese construction firms is quite high, which is an alert signal for listed construction firms in particular and for the whole construction industry in general (Lan, 2013; Vu et al., 2020).

Reasonable capital structure and effective use of capital are key goals in the financial planning of firms. From the perspective of financial management, a properly selected capital

structure not only helps construction firms maximize corporate performance, minimize financial risks but is also a solid foundation to help firms cope with changes from outside. Therefore, the study related to the impact of capital structure on the performance of Vietnamese construction firms is necessary and highly applicable in practice, especially when using samples including both private firms and public firms.

Construction firms listed on Vietnam's stock market have increased revenue over the years, but the ROA and ROE of these firms are quite low. Typically, the average ROA in the period 2010-2019 of these firms was highest at 10.31% in 2010 and lowest at -3.87% in 2017. When the survey sample was expanded to include 15,288 construction firms in Vietnam in the period 2012-2017, ROA also reached only 0.7%. The causes can come from the ability to collect receivables, high financial leverage, poor management, etc. The construction industry in Vietnam still has many problems that need to be addressed in order to improve performance and competitiveness, compared to other industries. One of them is to study the relationship between capital structure and corporate performance. Currently, the majority of construction firms still tend to use high financial leverage, typically the average value of total debt out of total assets of listed enterprises is 133.98%, but their performance is still low. Although the capital market in Vietnam has grown rapidly, it has not satisfied the capital demand of Vietnamese firms. Therefore, credit supply currently remains a popular mobilization channel.

In recent years, there are many studies related to the relationship between capital structure and corporate performance such as Kiprop (2014), Farooq and Masood (2016), Karaca and Savsar (2012), Rajhans (2013). Most of these works research the impact of micro and macro factors on capital structure as well as capital structure on the performance or firm value. Based on previous studies, we examine the relationship between capital structure and performance of listed construction companies in Vietnam. We use ROA as dependent variables to represent the performance of construction firms, and capital structure is measured by the book value of total liabilities over total assets (Jiraporn & Tong, 2010; Zeitun & Gang Tian, 2007). We also use ROE to test the robustness of results (Gill, Biger, & Mathur, 2011; Abor, 2005). Our study has added new empirical evidence in Vietnam, contributing to shaping the governance strategies of construction firms as well as providing information for policymakers.

The study is organized as follows. Section 2 describes the literature review; in Section 3 we detail the sample, proxy variable measurement and the econometric models; We report the results in Section 4 and discuss concluding remarks in Section 5.

2. Literature review

The trade-off theory, the pecking order theory, and the agency theory are three principal models of capital structure. According to Modigliani and Miller (1958), the capital structure does not have any effect at all in perfect markets, as no matter what financing methods are, firms will have

the same market value if having similar future cash flow distribution. However, given that markets are not flawless, this take-out is not practical. As stated in the trade-off theory, it is a trade-off between the benefits of debt and the costs of debt that will set the capital structure. Also, as mentioned in most studies before, there is a balance between the tax benefits of debt and the bankruptcy cost, following the tax-bankruptcy trade-off. According to Jensen and Meckling (1976), who developed agency costs-based models, debt must be repaid; otherwise, bankruptcy is unavoidable. This nature makes debt effective in mitigating the agency problem of free cash flow, resulting in managers being more cautious in cash spending.

In terms of the pecking order theory, initiated by Myers (1984), three principal funding sources firms can get access to include: equity, debt, and retained earnings, among which retained earnings have no severe adverse selection problem, equity has the most, while debt holds the middle position. As a result, retained earnings become the most possible solution firms would turn to. Only under the insufficient conditions of retained earnings that debt and equity become last alternatives.

Nevertheless, firms are reported to choose capital structures different from the theoretically optimal ones. To illustrate, according to Graham (2000), using leverage is what firms are very conservative. In addition, different capital structures can be employed, even by firms with the same fundamentals. Currently, agreements on the relationship between capital structure and corporate performance are not yet finalized in empirical studies. For this reason, an overview of the directions of capital structure influence on the corporate performance will be provided in this research section.

Capital structure has a positive impact on the corporate performance

Abor (2005) when examining the relationship between capital structure and performance of firms in Ghana found a similar and statistically significant relationship between short-term debt and total debt with corporate performance measured in ROE, but there is an inverse relationship between long-term debt and ROE. The results of this study show that the increase in debt size is related to the increase in profits; therefore, the higher the debt is, the higher the performance will be. Gill et al. (2011) also showed similar results. However, the difference in this study is that long-term debt has a positive impact on ROE for manufacturing firms, but it is not statistically significant for the service industry. In addition, when dividing different industries in the same research environment, there is also a difference in the impact of long-term debt on ROE. In addition to using ROA and ROE indicators, some studies also measure the efficiency of firms through Return on Sales (ROS), and Gross Profit Margin (GM), market price per share (PE), market value per book value (Tobin's Q), and earnings per common stock. This result is also proven in many other studies such as Berger and Di Patti (2006), Zeitun and Gang Tian (2007), Jiraporn and Tong (2008), Chowdhury and Chowdhury (2010), Lin and Chang (2011), Khan (2012), Hoque et al (2014), Farooq and Masood (2016).

Capital structure has a negative impact on the corporate performance

Zeitun and Gang Tian (2007) confirm the inverse relationship between capital structure and corporate performance. However, the study also shows that the ratio of short-term debt to total assets is positively related to the performance of firms, which seems to support Myers (1977) that firms with high short-term loans mean that they are operating well and growing well. Also using research model developed by Abor (2005) to evaluate the impact of capital structure on ROE, Shubita and Alsawalhah (2012) found the opposite result. The results show that indicators measuring capital structure are inversely related to ROE. The reason is that the time of the study was the recession period of the economy, the average value of ROE in this research period was only 8%, much lower than that of Abor (2005). Besides, other evidence also used different measures of firm's performance (ROA, ROE, EPS, and Tobin'Q) and all showed similar results (Ebaid, 2009; Ahmad et al, 2012; Lin & Chang, 2011; Khan, 2012; Salim & Yadav, 2012; Zeitun & Haq, 2015)

Capital structure has no impact on the corporate performance

Phillips and Sipahioglu (2004) show no relationship between capital structure and performance of UK hospitality firms. Rajhans (2013) also showed similar results, in which the variable representing the financial structure is debt-to-equity ratio, and firm's performance is the capitalization of ordinary shares. Karaca and Savsar (2012) study the effect of financial ratios on the firm value. The results, supported by Hasan et al (2004), show that only the quick ratio measures, the after-tax return on equity and inventory turnover have impact on the corporate performance and are statistically significant, while other variables on financial institutions are not statistically significant.

Capital structure has a non-linear effect on the corporate performance

The study of Nieh et al (2008) used Hansen threshold regression with variables representing performance of firms as ROE and EPS. The results show that the appropriate debt ratio for firms is from 12.37% to 51.57%, and the optimal debt ratio is between 12.37% and 28.7%, improving firms' performance. The result of Lin and Chang (2011) has discovered two thresholds between the ratio of debt and performance of that firm is 9.86% and 33.33%. If the debt ratio exceeds 33.33%, the operating efficiency of the firm will not increase. Also using this method, Cheng et al. (2010), Berzkalne (2015) also reached similar conclusions. In Vietnam, Vu et al. (2020) also examines the impact of the capital structure on the performance of construction firms listed on the Vietnam Stock Exchange by using a sample of 59 listed construction companies in 2014-2016 period. Applying a linear regression model, the study shows that the ratios of total debt to total equity and long-term debt to total equity have a negative impact on the corporate performance measured by ROA.

With specific characteristics of the construction industry in using a lot of capital, capital planning and long payment time lead to the need for construction firms to mobilize additional

capital from outside. This fact also shows that Vietnamese construction firms are using high financial leverage, but their performance is still low (Vu et al., 2020; Lan, 2013; Luu et al., 2008; Nguyen & Ogunlana, 2004), especially for listed companies with easier access to capital. In summary, although there have been many studies on the impact of capital structure on the corporate performance, there are several certain limitations, especially in Vietnam. In this paper, we will focus on the following gaps: (i) there have been some studies on the impact of capital structure on the corporate performance, but the sample only stops at listed firms, without researching the unlisted firms in the economy; (ii) the assessment of the relationship between capital structure and corporate performance of a specific economic sector is not much, especially the construction industry; and (iii) the use of the quantile regression has not been applied much in the previous research.

3. Data, model, and methodology

3.1. Data

The study uses data from the annual firm survey conducted by the General Statistics Office of Vietnam (GSO) for the period 2012-2017. To collect data on variables, we used data from the financial statements of 15,288 firms over 6 years to examine the impact of capital structure on the performance of construction firms in Vietnam. After eliminating firms with insufficient observational data for 6 years, and firms with inadequate information, the remaining sample were 13,912 firms, corresponding to 83,472 observations as balanced panel data.

3.2. Model and methodology

Based on the mentioned theory and empirical studies, we inherited the model of Jiraporn and Tong (2010), Zeitun and Gang Tian (2007) to build a research model on the impact of capital structure on the performance of construction firms in Vietnam as follows:

$$ROA_{i,t} = \beta_0 + \beta_1 CS_{i,t} + \varphi V_{i,t-1} + \delta_t + \alpha_i + \mu_{i,t} \quad (1)$$

Where i refers to firm and t refers to time period; δ_t is the error term related to time-specific effects; α_i is the error term associated with firm-specific effects which includes unobservable firm-specific characteristics; $\mu_{i,t}$ is the random error term; $V_{i,t-1}$ denotes a vector of firm-level control variables that potentially affect the firm's performance. Table 1 provides a detailed description of the variables in model 1.

Table 1. Variable definitions

Variables	Definition	Expectation	Measurement	Research
Dependent variable				
ROA	Return on average assets		Profit after tax / Average total assets	Zeitun and Gang Tian (2007), Jiraporn and Tong (2010)
Explanatory variable				
CS	Capital Structure	+	Total debt / Total assets	Zeitun and Gang Tian (2007), Jiraporn and Tong (2010)
Control variables				
PS	Property structure	+	Fixed assets / Total assets	Zeitun and Gang Tian (2007), San and Heng (2011), Hoque et al(2014)
IP	Inventory proportion	-	Inventory / Total assets	Zeitun and Gang Tian (2007)
PRT	Proportion of accounts receivable in total assets	-	Short-term receivables / Total assets	Zeitun and Gang Tian (2007)
SIZE	Firm size	+	Ln (total assets)	Carpentier (2006), Choi and et al (2014)
GRO	Growth	+	[Annual revenue (t) - Annual revenue (t-1)] / Annual revenue (t-1)	Carpentier (2006), Chowdhury amd Chowdhury (2010), Ahmad et al (2012); Hasan et al (2014).
AGE	Firm age	+	Year (t) - Year of establishment	Hoque et al (2014)

Table 2. Descriptive statistics for the sample of Vietnamese construction firms (N = 83,472)

Variable	Obs	Mean	Std.Dev.	Min	Max
ROA	83,472	0.007	0.429	-104.988	49.714
CS	83,472	0.197	0.198	0.005	0.897
PS	83,472	0.265	0.030	0.000	0.765
PRT	83,472	0.359	0.375	0.0186	0.784
IP	83,472	0.502	0.255	0.000	0.867
SIZE	83,472	9.297	1,427	0.000	16.670
GRO	83,472	-97.322	35.799	-100.00	1,181.092
AGE	83,472	7.434	5.503	1.000	65.000

Descriptive statistics of the variables in the model are shown in Table 2. We can see that the performance of construction firms measured by ROA in the 2012-2017 period is relatively different. Capital structure (CS) of construction firms has an average value of 19.7%. This is

reflected in the research sample of construction firms having access to low loans, and mainly using their own capital. Besides, the inventory value of construction firms is very large, accounting for over 50% of total assets, while the value of fixed assets accounts for a small proportion of 26.5%. Receivables also have a large average value in the total assets of the construction firm. The average number of years of construction firms operating in the market as of the surveyed time is 7.34 years, and the largest firm is 65 years old. The revenue growth rate of construction firms has tended to decrease in recent years, and there is a huge difference in addition to this growth.

Currently, quantitative studies often use three popular methods in panel data regression: (1) Pooled Regression Model (Pooled OLS); (2) Fixed Effects Model (FEM); and (3) Random Effects Model (REM). After that, these studies will use F-test, LM-test (Breusch-Pagan Lagrange Multiplier) and Hausman test to choose suitable estimation method. However, Getzmann et al (2010) pointed out that one of the weaknesses from the Pooled OLS, FEM, and REM models is that it has not yet overcome the latent endogenous phenomenon. Some studies showed that the dependent variable ROA representing performance has an impact on firm's capital structure and vice versa (Huang, 2006, Margaritis & Psillaki, 2007). Therefore, to control the potential endogeneity and unobservable heterogeneity associated with fixed firm effects in dynamic model, we also use System-GMM (S.GMM) approach developed by Arellano and Bover (1995), Blundell and Bond (1998) to test the aims of this study. To test the validity of the model's specifications, (1) we consistently employ Sargan/Hansen test of overidentification of restrictions with null hypothesis of the instruments as a group are exogenous and (2) the Arellano-Bond test for autocorrelation has a null hypothesis of no autocorrelation in the residuals. More importantly, we also use additional quantile regression to examine the impacts of capital structure on the performance of construction firms in different percentiles. We select the basic percentiles of the distribution functions of the ROA variable to analyze, including: 0.1; 0.25; 0.5; 0.75 and 0.9. The quantile regression is used to examine the different effects of capital structure on ROA, when the trend shows that Vietnamese construction firms use high financial leverage, but ROA is quite low. This also implies that financial leverage can help improve ROA but can also negatively affect this indicator, depending on the different percentiles.

4. Results

With the results in Table 3, the S.GMM model is the most suitable model and is used by the authors to analyze the impact of capital structure on the operational efficiency of the construction firm. The results of the estimation of the variables in the models are mostly statistically significant. Our study has also performed Sargan/Hansen test of the exogenous of instrumental variables, the Arellano-Bond test of the second order autocorrelation in the residuals. The results in Table 3 show that the instrumental variables in the models are appropriate and the regression results achieve high reliability (p-value > 0.1).

Table 3. The impacts of capital structure on the performance of construction firms in Vietnam

Variables	Dependent variable (ROA)			
	OLS	**FEM**	**REM**	**S.GMM**
CS	0.2354***	0.3418***	0.4430***	0.0796***
	(4.96)	(5.66)	(2.06)	(7.72)
PS	0.1749***	0.1746***	0.4486***	0.0798***
	(4.17)	(4.17)	(2.36)	(12.47)
IP	-0.0218***	-0.0378***	-0.1266***	-0.0103***
	(-3.34)	(-5.64)	(-4.26)	(-10.02)
PRT	-0.2274***	-0.3033***	-0.5669***	-0.1312***
	(-9.17)	(-9.6)	(-5.04)	(-24.58)
SIZE	0.0023**	0.0022**	0.0168**	0.0013***
	(2.12)	(1.98)	(3.38)	(8.11)
GRO	0.0130	0.0002	0.0012	0.0051
	(2.73)	(0.92)	(0.19)	(0.67)
AGE	0.0004*	0.0002	0.0009*	0.0004***
	(1.66)	(0.88)	(0.75)	(2.34)
Constant	-0.0206	-0.0037	-0.0978	0.0034
	(-1.38)	(-0.25)	(-1.45)	(1.50)
N. observ.	83,472	83,472	83,472	83,472
AR (2)				0.115
Sargan test				0.109
Hansen test				0.268

Notes: Model 1 was estimated by Pooled OLS, FEM, REM, and System GMM. T statistic values are reported in parentheses. ***, ** and * denote statistical significance of the coefficients at 1%, 5% and 10% levels respectively.

Capital structure has a positive relationship with performance as measured by ROA at the 1% significance level. This shows that the more capital structure increases, the more efficient the business is. This result supports our hypothesis when finding total debt has a positive relationship with corporate performance, as in previous empirical studies (Berger &Di Patti, 2006; Zeitun & Gang Tian, 2007; Jiraporn & Tong, 2010). The bottom line is that the positive relationship between capital structure and corporate performance has contributed to supporting Modigliani-Miller theorem in terms of taxes, and trade-off theory when it is given that the efficiency of the debt-free firm is greater than the value of the firm without debt, and also supporting the pecking order theory order when it is said that the firm prioritizes the use of debt over mobilizing capital from the owner thanks to the positive impact of financial leverage.

Regarding the relationship between asset structure and corporate performance, our results show that if firms increase the proportion of fixed assets, they will help them improve their performance. This conclusion is consistent with the point of view of Zeitun and Gang Tian (2007), San and Heng (2011), Choi et al. (2014). This implies that when construction firms in Vietnam increase investment in fixed assets, it will create conditions for firms to modernize their

machinery and equipment, which will increase labor productivity, and quality of products, helping firms increase their competitiveness in the marketplace. As a result, it contributes to improving the business efficiency as well as maximizing firm value.

Besides, the proportion of accounts receivable in total assets (PRT) and inventory proportion (IP) have negative effects on ROA. This proves that bad debt collection will adversely affect the performance in construction firms. Because construction firms carry out a relatively large volume of works, to make the payment to the investor, it must be done through many steps, and through many parts. Besides, the proportion of unfinished products accounts for mainly in inventories. Therefore, the higher the value of work in progress, the more capital stagnant in the business, the higher financial risks increase, and the lower performance. The results from Table 3 all show that increasing size will help firms improve corporate performance, supported by Carpentier (2006). This is because the large firms often have brand names and reputation in the market, so it will be easier to carry out activities: raising capital and selling. The age of the firm has a very small impact on performance. This can be explained by the fact that long-term firms have great stamina, and it is difficult to timely access the market fluctuations, so operational efficiency will decrease compared to active young firms.

Table 4. The results from quantile regression approach

Variables	**Dependent variable (ROA)**				
	Quantile Regression				
	0,1	**0,25**	**0,5**	**0,75**	**0,9**
CS	0.2968***	0.0409***	-0.0316***	-0.0329***	-0.1326***
	(58.27)	(14.67)	(-30.15)	(-12.66)	(-15.60)
PS	0.0025	0.0047*	0.0012	0.0014	-0.0009
	(0.56)	(1.91)	(1.35)	(0.61)	(-0.12)
IP	0.0136***	0.0115***	0.0080***	0.0065***	0.0043***
	(19.32)	(29.92)	(55.25)	(17.99)	(3.69)
PRT	-0.2147***	-0.0612***	-0.0215***	-0.0283***	0.0095
	(-80.64)	(-41.96)	(-39.32)	(-20.85)	(0.21)
SIZE	-0.0002	0.0003***	0.0003***	0.0004***	0.0002
	(-0.19)	(4.83)	(11.41)	(6.58)	(0.87)
GRO	-0.0001***	-0.0000	0.0001*	0.0001	-0.0001
	(-2.68)	(-0.30)	(1.83)	(0.28)	(-0.23)
AGE	0.0002	-0.0001***	0.0001***	0.0003***	0.0003***
	(-0.91)	(-6.56)	(4.93)	(20.45)	(7.53)
Constant	-0.0073***	0.0024***	0.0118***	0.0180***	0.0457***
	(-4.58)	(-2.76)	(35.95)	(21.82)	(17.15)
N. observ.	83,472	83,472	83,472	83,472	83,472

Notes: Model 1 was estimated by quantile regression. T statistic values are reported in parentheses. ***, ** and * denote statistical significance of the coefficients at 1%, 5% and 10% levels respectively.

The statistical evidence from quantile regression shows that the capital structure of construction firms in Vietnam has a positive impact on ROA with a statistical significance at 1%, which means that in the absence of other factors, when the firm increases the use of debt, the operational efficiency tends to increase thanks to the tax shield from interest. This result is consistent with the research of Bhardwaj et al. (2010). The percentile regression coefficient of the CS variable is shown in Table 4, showing that the impact level of the variable CS on the ROA is different at different percentiles. The impact of CS was largest at the 0.1 percentile and the lowest at the 0.9 percentile with the high level of statistical significance. The effect of CS on ROA was positive at the 0.1 and 0.25 percentiles with a statistical significance at 1%. On the other hand, the higher the percentiles, the lower the impact of CS on ROA. This shows that construction firms will exploit the benefits from debt at lower percentiles. From the 0.5 percentile onwards, the relationship between CS and ROA changes from (+) to (-), reaching a statistical significance at 1%, demonstrating that the higher the percentile level, the more construction firms use ineffective loan use consistent with pecking order theory. It means that the construction firms in Vietnam will prioritize using equity over debt in the high percentiles.

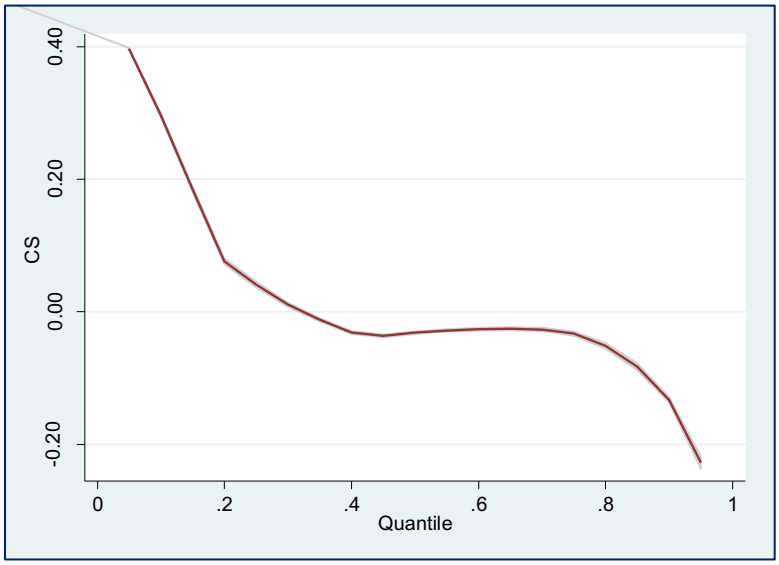

Figure 1. Regression coefficient CS on the percentiles

To test the robustness of our results to alternative measures of corporate performance, we use ROE to measure the performance of construction firms in different ways. Appendix A and Appendix B show that our results are still robust. Besides, we also examine the different impacts of capital structure on the performance of listed construction firms and unlisted construction firms in Vietnam. The result in Appendix C shows that listed construction firms in Vietnam amplifies the impact of capital structure on firms' performance with a performance at the 0.1 percentile and 0.25 percentile. This implies that the listed construction firms use their funding effectively, have good supervision and management ability, minimize representative conflicts, and take more cautions in investment and funding decisions.

5. Conclusion

Our results show that the performance of Vietnamese construction firms is positively influenced by capital structure, asset structure, firm size, and age of the firm. Meanwhile, the receivable structure and the inventory structure have a negative impact on the relationship between capital structure and performance. The results of quantile regression also show a strong differentiation of the impact of factors on construction firm group according to the percentile of corporate performance proxied by ROA. This means that this signal will be different when considered in each different percentile. Therefore, to achieve the highest level of efficiency, business executives should pay attention to the factors that affect operational efficiency corresponding to the percentile of their firm.

Based on the research results, we make some recommendations for construction firms to rationally allocate capital structure in order to improve their operational efficiency. For firms with performance at the 0.1 percentile and 0.25 percentile, the use of debt should be increased rather than the use of equity. In addition, this group of firms should also invest in additional fixed assets, which will help improve their performance better because these percentile levels all show positive and statistically significant. However, when expanding its fixed asset portfolio, firms also need to consider financial capacity, and efficiency of using fixed assets to avoid wasting resources. Moreover, firms' investment activities can be supported by finance leasing companies, which is also a good approach to innovate in production technology, machinery, and equipment.

In the entire construction industry in Vietnam, 98 percent are private firms, primarily small and micro firms. Therefore, accessing to capital from commercial banks or credit institutions continues to be hampered by numerous obstacles such as collateral, administrative procedures, formal and informal costs, and so on. Firms can also diversify their funding sources by forming alliances and joint ventures with investment partners. Besides, when building a capital structure policy, firms also need to pay attention to the macroeconomic situation, specific economic characteristics in Vietnam, and industry risk to forecast growth targets as well as to make decisions about building an appropriate source of capital.

However, in the agency theory of Jensen and Meckling (1976) and Jensen (1986) it is argued that if the use of debt is too high, and the benefit of the debt exceeds the cost of debt, including agency cost of debt and financial risk, it can lead to negative impact on the corporate performance. In addition to the advantages of the tax shield that the capital structure offers, which makes managers prefer to choose the leverage factor, it can be said more about one of the disadvantages for firms when using equity is that the cost is often higher than the cost of debt. Moreover, no investor wants to invest money in a business to bear the risks of the business operation and results of the firm and receive interest equal to the interest rate on loans. This, coupled with the non-exempt nature, makes the cost of capital even higher. Another unfavorable point is that the higher the equity, the greater the number of owners, the greater the pressure on

investors' expectations as well as their management and supervision on the business executives. However, equity will still have to increase when the business needs money. This is to balance debt and keep the business in a healthy financial position.

Finally, our findings still have some certain limitations in space, only mentioning construction firms but not fully covering firms in Vietnam. This study only mainly looks at micro factors without mentioning macro factors such as economic policy, and industry competitive environment. The results also fail to fully reflect measured corporate performance in many ways.

Appendices

Appendix A. Robustness tests – an alternative measure of corporate performance

Variables	Dependent variable (ROE)			
	OLS	**FEM**	**REM**	**S.GMM**
CS	0.3104***	0.7171***	0.5925***	0.0629***
	(5.74)	(2.62)	(6.72)	(8.17)
PS	0.5027***	0.4485***	0.4217***	0.0643***
	(7.54)	(5.36)	(10.27)	(10.98)
IP	-0.0374*	-0.1808***	-0.1487***	-0.0420***
	(-4.12)	(-5.93)	(-4.06)	(-9.74)
PRT	-0.5120*	-0.7758***	-0.7320***	-0.1730***
	(-13.27)	(-5.41)	(-8.23)	(-14.23)
SIZE	0.0003**	0.0050**	0.0010**	0.0021***
	(0.58)	(3.19)	(1.20)	(5.28)
GRO	0.0021	0.0002	0.0004	0.0005
	(1.09)	(0.19)	(0.56)	(0.73)
AGE	0.0001*	0.0003	0.0003*	0.0001***
	(0.69)	(0.26)	(0.86)	(1.28)
Constant	-0.0157	-0.0381	-0.0723	0.0731
	(-0.81)	(-0.56)	(-1.87)	(1.26)
N. observ.	83,472	83,472	83,472	83,472
AR (2)				0.74
Sargan test				550.96
Hansen test				73.25

Notes: Model 1 was estimated by Pooled OLS, FEM, REM, and System GMM. T statistic values are reported in parentheses. ***, ** and * denote statistical significance of the coefficients at 1%, 5% and 10% levels respectively.

Appendix B. Robustness tests – an alternative measure of corporate performance with quantile regression approach

Variables	Dependent variable (ROE)				
	Quantile Regression				
	0,1	**0,25**	**0,5**	**0,75**	**0,9**
CS	0.6818***	0.1140***	-0.0394***	-0.0675***	-0.3271***
	(45.61)	(17.11)	(-15.65)	(-10.16)	(-17.80)
PS	0.0060	0.0121***	0.0047**	0.0023	0.0089
	(0.46)	(2.06)	(2.14)	(0.38)	(0.55)
IP	0.0365***	0.0365***	0.0254***	0.0217***	0.0308***
	(17.67)	(39.61)	(73.13)	(23.61)	(12.15)
PRT	-0.4973***	-0.1423***	-0.0606***	-0.0655***	0.0297
	(-63.63)	(-40.84)	(-46.00)	(-18.86)	(3.10)
SIZE	0.0001	0.0002***	0.0004***	0.0003*	-0.0003
	(0.38)	(3.74)	(7.5)	(1.74)	(-0.70)
GRO	-0.0009	-0.0002	0.0001	-0.0001	-0.0001
	(-0.82)	(-0.36)	(0.91)	(-0.29)	(-0.78)
AGE	0.0000	-0.0002***	0.0000***	0.0007***	0.0011***
	(0.14)	(-6.99)	(5.68)	(18.91)	(10.86)
Constant	0.0199***	0.0012***	0.0222***	0.0439***	0.0913***
	(-4.26)	(-0.57)	(28.04)	(21.10)	(15.95)
N. observ.	83,472	83,472	83,472	83,472	83,472

Notes: Model 1 was estimated by quantile regression. T statistic values are reported in parentheses. ***, ** and * denote statistical significance of the coefficients at 1%, 5% and 10% levels respectively.

Appendix C. The impacts of capital structure on the performance of listed construction firms and unlisted construction firms in Vietnam.

Variables	Dependent variable (ROA)				
	Quantile Regression				
	0,1	**0,25**	**0,5**	**0,75**	**0,9**
CS	0.3521***	0.1304***	-0.0921***	-0.0519***	-0.0921***
	(58.27)	(18.21)	(-20.19)	(-18.21)	(-18.05)
CS x LISTED	0.4809***	0.2870***	-0.2809	-0.7021	-0.0986***
	(38.21)	(18.24)	(-15.03)	(-17.29)	(-13.82)
PS	0.0908*	0.0981*	0.0076	0.0008	-0.0053
	(2.98)	(6.09)	(0.15)	(-5.89)	(-0.28)
IP	0.1305	0.0603	0.2504	0.0903	0.0063
	(21.08)	(13.26)	(19.03)	(17.23)	(18.20)
PRT	-0.0306**	-0.0671**	-0.0402**	-0.0608	0.0317
	(-34.29)	(-30.28)	(-24.08)	(-28.05)	(9.21)
SIZE	0.0001	0.0008	0.0018*	0.0007*	0.0003

	(0.29)	(1.86)	(8.02)	(0.92)	(0.81)
GRO	-0.0018	-0.0013	-0.0006*	-0.0018	-0.0005
	(-3.21)	(-1.84)	(-0.25)	(-2.01)	(-0.61)
AGE	0.0018	0.0005*	0.0004	0.0019	0.0003*
	(1.05)	(7.83)	(3.05)	(1.98)	(3.02)
Constant	0.1872	0.3708	0.7603	0.0542	0.3415*
	(23.91)	(19.08)	(18.02)	(16.02)	(18.93)
N. observ.	83,472	83,472	83,472	83,472	83,472

Notes: Model 1 was estimated by quantile regression. T statistic values are reported in parentheses. ***, ** and * denote statistical significance of the coefficients at 1%, 5% and 10% levels respectively. To consider the difference in the capital structure-performance nexus of listed construction firms and unlisted construction firms in Vietnam, we construct an interacted variable CS × LISTED in the regression. We define the dummy variable LISTED as equal to 1 if a Vietnamese construction firm listed on Ho Chi Minh City Stock Exchange (HSX) and Hanoi Stock Exchange (HNX) during 2012-2017, and 0 otherwise.

An alternative measure of corporate performance

Variables	**Dependent variable (ROE)**				
	Quantile Regression				
	0,1	**0,25**	**0,5**	**0,75**	**0,9**
CS	0.3562***	0.0527***	-0.0821***	-0.0671***	-0.1829***
	(41.24)	(25.18)	(-32.14)	(-16.24)	(-21.04)
CS x LISTED	0.6421***	0.1203***	-0.4101***	-0.0903***	-0.2108***
	(35.17)	(21.36)	(-38.27)	(-29.18)	(-14.29)
PS	0.0210	0.0038	0.0189	-0.0046	-0.0006
	(1.96)	(0.78)	(1.05)	(-1.27)	(-0.18)
IP	0.0189*	0.0210	0.0063	0.0078	0.0076*
	(18.29)	(25.17)	(47.21)	(12.98)	(11.24)
PRT	-0.1789***	-0.0891***	-0.0819***	-0.0469***	0.0057***
	(-47.21)	(-35.18)	(-27.81)	(-21.87)	(0.81)
SIZE	0.0008	0.0021	0.0049***	0.0057***	0.0005
	(0.87)	(8.29)	(12.37)	(9.28)	(0.67)
GRO	-0.0013	-0.0004	0.0057*	-0.0007	-0.0008
	(-2.698)	(-0.47)	(5.72)	(-0.12)	(-0.57)
AGE	-0.0024	-0.0013*	0.0006	0.0005	0.0018*
	(-0.87)	(-8.27)	(2.87)	(8.27)	(5.18)
Constant	0.0136**	0.0187	0.0138	0.0340	0.0361*
	(21.19)	(13.78)	(21.19)	(32.19)	(20.09)
N. observ.	83,472	83,472	83,472	83,472	83,472

Notes: Model 1 was estimated by quantile regression. T statistic values are reported in parentheses. ***, ** and * denote statistical significance of the coefficients at 1%, 5% and 10% levels respectively. To consider the difference in the capital structure-performance nexus of listed construction firms and unlisted construction firms in Vietnam, we construct an interacted variable CS × LISTED in the regression. We define the dummy variable LISTED as equal to 1 if a Vietnamese construction firm listed on Ho Chi Minh City Stock Exchange (HSX) and Hanoi Stock Exchange (HNX) during 2012-2017, and 0 otherwise.

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