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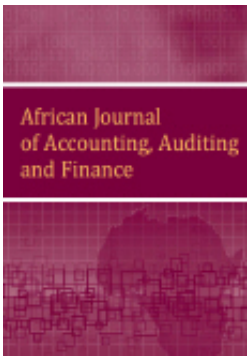

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Capital structure and solvency of manufacturing firms: evidence from Ghana

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Abstract: This paper explores the association between the capital structure and solvency of listed manufacturing firms in Ghana. To achieve this objective, annual data spanning a period of ten years (2010–2019) from 13 publicly traded manufacturing firms was collected and analysed. Hence, a dataset, which consisted of 130 observations, was utilised. The study utilised equity and debt ratios (DBTR) as proxies for capital structure, and interest coverage ratio (INCR) and liquidity ratio (LIQR) to gauge long and short-term solvency. Employing multivariate regression analysis, the study reveals compelling empirical evidence that supports the influence of equity and debt on long-term and short-term solvency. For the management of manufacturing firms, the findings suggest that they should be cognisant of the capital structure they employ, given its significant impact on the firm's short- and long-term solvency.

Keywords: solvency; liquidity; capital structure; manufacturing firms; Ghana.

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1 Introduction

The Ghanaian manufacturing sector has struggled with survivability, reducing its contribution to economic growth and development (Arthur, 2019). This may be due to a number of factors, including financial management issues. As noted by prior studies conducted by Mohamed and Gregory (2018), Hossain and Hossain (2015), and Arthur (2019), capital structure decisions have been identified as one of the primary factors that contribute to the failure of manufacturing firms worldwide, including those in Ghana. To grow and survive in the global competitive environment, manufacturing firms must be proactive in making decisions about the use of debt and equity (Manurung, 2014). Anarfo (2015) explains that entities that survive use an appropriate mix of debt and equity in the optimal proportion. Singh and Bagga (2019) emphasise that firms that can lower their cost of capital can enhance their overall value. In line with this assertion, this study makes the case that functioning with the right capital structure mix is necessary to establish enterprises' solvency.

The fact that capital structure is a subject of pivotal importance is not in doubt. Notwithstanding the importance of capital structure, most studies have been conducted primarily in developed countries. Furthermore, studies on emerging economies, such as Musah and Kong (2019) and Aidoo et al. (2022), have focused on firm performance, primarily using profitability as an indicator. Thus, few published results show how capital structure affects firm survival in developing economies such as Ghana. This paper fills the gap and contributes to a better understanding of how firms can avoid failure, as studies such as Amoa-Gyarteng (2021) have shown that solvent firms face little risk of financial distress. As a result, the study adds to the limited literature on how firms in an emerging economy can maintain financial stability.

It is also worth noting that prior studies conducted in Ghana on capital structure have primarily focused on different sectors of the economy, such as the service industry (Tornyeva, 2013), publicly traded companies (Abor, 2005), nascent small and medium enterprises (Amoa-Gyarteng and Dhliwayo, 2022), and the insurance industry (Akoto et al., 2013a). However, these studies produced conflicting findings. Therefore, given the paucity of research on the impact of capital structure on solvency of manufacturing firms in Ghana, the current study assumes particular significance. In response to the scarcity of literature on the topic, this study investigates the relationship between debt ratio (DBTR), equity ratio (EQTR), and solvency of manufacturing firms as determined by the interest coverage ratio (INCR) and liquidity ratio (LIQR).

Thus, this study makes two main significant contributions to the literature. Firstly, it provides valuable insights into the financing decision-making of manufacturing firms in Ghana, a developing country. Secondly, the study investigates the impact of capital structure on solvency and, by extension, firm survival. This is in contrast to previous research efforts that have concentrated on exploring the impact of capital structure on profitability or firm performance of Ghanaian firms. The study's findings have practical implications for manufacturing firms in Ghana, particularly those struggling with solvency issues. The study highlights the importance of adopting an appropriate capital structure to improve solvency and enhance firm survival.

The remainder of the paper is structured as follows: Section 2 provides a comprehensive review of the relevant literature and outlines the study's hypotheses. Section 3 presents the research methodology, including a detailed description of the variables, empirical models, data, and descriptive statistics employed in the analysis.

Section 4 presents the main empirical findings of the study. Section 5 provides a discussion of the results. Finally, Section 6 concludes the paper.

2 Literature review and hypothesis development

This study is rooted in theories that explain the financing preferences of firms. Such theories include the Modigliani and Miller theory, the trade-off theory, the pecking order theory and the signalling theory.

2.1 Theoretical review

Modigliani and Miller (1958) put forth a seminal theory that showed that capital structure is irrelevant to the value of the firm. According to the theory, businesses function in efficient settings, and options for debt or equity do not affect the company's capital cost. This meant that capital structure does not affect the firm's worth or profitability. Although the capital structure irrelevance theory had a strong theoretical foundation, it was based on faulty presumptions. In order to make it more accurate, Modigliani and Miller (1963) added the effect of tax on cost of capital and firm value. The new viewpoint addressed the concept of debt-producing interest as a tax shelter, implying that the company could continue to use high leverage to maximise its value. In sum, Modigliani and Miller's (1958) revised argument favours high debt levels for firm value and profitability (Minnema and Anderson, 2018).

In contrast to the Modigliani and Miller (1968) theory, the trade-off theory advocates that businesses should have an optimal capital structure to achieve high firm value or profitability (Myers, 1984). Rather than advocating for companies to increase their debt levels indefinitely in order to increase their value, the trade-off theory suggests that companies should strive for a balance of debt and equity to maximise their performance (Myers, 1984). Leverage offers tax advantages while also putting the firm at risk of insolvency (Minnema and Anderson, 2018).

The next major capital structure theory is the pecking order theory. According to the theory, firms prefer internal funds to external funds in order to maximise shareholder wealth. They prefer debt when they have no choice but to rely on external funding. Hence external equity is the last option for funds, per this theory. Another major capital structure theory, signalling theory, is about the signal that managers send to potential investors regarding the value of their business. Signalling theory posits that companies can use their financing decisions, such as the use of debt, to signal to external investors their positive outlook regarding the firm's future earnings and solvency. In this way, the use of debt can serve as a credible signal to external investors that the firm's management has confidence in its ability to generate future cash flows and meet its financial obligations (Chipeta, 2012). As a result, according to the signalling theory, the use of debt can positively impact the firm's solvency, as it may increase the confidence of external investors in the firm's financial health and encourage them to provide additional financing (Chipeta, 2012).

As can be noticed from the preceding, there are several theoretical approaches to capital structure in the existing literature, but none is thought to be superior to the other. According to Myers (2001), there is no universal theory on capital structure choices. The findings of this study are explained within the framework of conventional corporate

capital structure theories, and they have practical implications for manufacturing firms in Ghana looking to make optimal capital structure decisions to maximise their solvency. The capital structure theories outlined in the literature review are relevant to the study because they provide a theoretical framework for understanding how firms make decisions about their mix of debt and equity financing. The theories suggest that firms have different preferences for debt and equity financing and that these preferences depend on a range of factors such as tax advantages, risk of insolvency, and signalling effects inter alia.

2.2 The impact of capital structure on the solvency of firms

Enakirerhi and Chijuka (2016) investigated the determinants of capital structure in UK FTSE firms and found that capital structure significantly and positively impacts the solvency of these firms. This finding aligns with the trade-off theory, which posits that firms make capital structure decisions by considering the trade-off between the benefits and costs of debt. Similarly, Ooi (1999) studied 83 UK property companies and found that capital structure significantly impacts solvency. Azhagaiah and Gavoury (2011) argue that while companies have the option to choose between debt and equity, the optimal financing option is a combination of both. These findings suggest that the choice of capital structure can significantly impact a firm's solvency, which may have implications for its overall financial health and ability to meet its financial obligations. Therefore, understanding the factors that drive capital structure decisions is crucial for firms seeking to maximise their performance and achieve long-term financial stability.

2.3 The relationship between equity ratio, debt ratio and solvency (long term and short term)

EQTR determines the proportion of equity funds invested in a firm's assets base and, as a result, the percentage of equity funds as a percentage of total assets (Mwangi and Murigu, 2015). According to Aziz and Abbas (2019), EQTR is a good indicator of a company's level of shareholders' funds because it measures the proportion of total assets financed by stockholders rather than creditors. Cole's (2013) empirical research on American firms found that the company's solvency also grows as the number of equity options grows. Dahlstron and Persson (2010); Giacosa and Mazzoleni (2017) found a significant positive correlation between EQTR and solvency of manufacturing firms

DBTR indicates the percentage of a corporation's total debts as a percentage of its total assets. The ratio reveals how debt, rather than equity, is used to fund an organisation's finances (Hossain and Hossain, 2015). The relationship between increasing debt use in a company's capital structure and solvency produces a range of outcomes. Mwangi and Murigu. (2015), Yegon et al. (2014), and Niresh (2012) found a positive correlation between DBTR and solvency in their studies. Other studies, such as Nassar (2016) and Ibrahim (2009), found a negative correlation between firm solvency and debt choices. Relative to the literature, the following hypotheses have been developed:

Hypothesis 1 There is a statistically significant relationship between EQTR and long-term solvency of manufacturing firms.

Hypothesis 2 There is a statistically significant relationship between DBTR and long-term solvency of manufacturing firms.

Hypothesis 3 There is a statistically significant relationship between EQTR and short-term solvency of manufacturing firms.

Hypothesis 4 There is a statistically significant relationship between DBTR and short-term solvency of manufacturing firms.

3 Methodology

This study presents an empirical analysis of the effect of capital structure on the solvency of manufacturing firms listed on the Ghana stock exchange. A correlation matrix and multivariate regression are used to analyse the data collected from the financial statements of listed 13 manufacturing firms within ten years, starting from 2010 to 2019. The study evaluates the correlation between capital structure, as defined by the EQTR and DBTR, and solvency, as determined by the INCR and LIQR.

Previous studies suggest that variables such as firm size (FSIZ), firm age (FAGE), and leverage ratio (LEVR) influence firm solvency either positively or negatively and thus are used as controls in this study. All manufacturing companies in Ghana that are under the aegis of the Association of Ghana Industries are the study's target population. The sample size was determined by the availability of the companies' annual audited financial reports. As a result, a dataset of 130 observations covering 13 publicly traded manufacturing firms over a ten-year period is examined.

3.1 Description of variables

The variables used to analyse the association between capital structure and solvency are presented in this section. Table 1 shows a summary of the variables and how they are defined.

Table 1 Variables indications, definitions, and possible outcomes

Variables indications	*Variable definitions*	*Possible outcome*
INCR	The percentage of earnings before interest and taxes divided by interest expense	
LIQR	Total current assets divided by total current liabilities	
EQTR	Total equity divided by total assets	+/–
DBTR	Total debt divided by total assets	+/–
FSIZ	The natural logarithm of firms' total assets	+/–
FAGE	A firm's age starting from the date it was listed on the Ghana stock exchange	+/–
LEVR	Total debt divided by total equity	+/–

3.2 Dependent variables

As dependent variables, the study uses two accounting-based measures of solvency (INCR and liquidity (LIQR)). The INCR assesses a company's ability to pay interest on its outstanding debts. It is mostly used to determine a company's long-term solvency (Han et al., 2016). In their studies, Enekwe et al. (2015) and Han et al. (2016) calculated the INCR by dividing earnings before interest and taxes by interest expense. The LIQR also refers to the extent to which a company's current assets are used to meet immediate financial obligations. It also refers to how quickly a company pays its short-term financial obligations in order to avoid bankruptcy or financial distress (Mekonnen, 2011). As a result, this ratio is the most appropriate for determining short-term solvency. In their study, Enakirerhi and Chijuka (2016) and Raheman and Nasr (2007) calculated liquidity as total current assets divided by total current liabilities.

3.3 Independent variables

As independent variables, this study uses two capital structure measures (EQTR and DBTR). The EQTR calculates the proportion of an owner's investment in a company's assets and divides total equity funds by total assets (Mwangi and Murigu, 2015; Cole, 2013; Giacosa and Mazzoleni, 2017). On the other hand, the DBTR is defined as the proportion of a company's total debts to its total assets (Cole, 2013; Ghosh et al., 2000). The ratio also reveals how debt, rather than equity, is used to fund an organisation's finances (Hossain and Hossain, 2015).

3.4 Control variables

Firm size (FSIZ), firm age (FAGE), and leverage ratio (LEVR) are also used as control variables in the study. These three variables reflect the internal characteristics of manufacturing firms that influence their long-term and short-term solvency as a result of management decisions. In their study of the impact of capital structure on firm profitability, Enakirerhi and Chijuka (2016) defined firm size as the natural logarithm of total assets. The age of a company refers to the number of years it has been in business since its inception (Beck et al., 2005). But this study considers firm age as the number of years in which a firm has been listed on the Ghana stock exchange. Cole (2013), in the study of capital structure and its impact on a firm's solvency, measured leverage as the ratio of total debt to total equity. These variables are found in the extant literature to influence solvency and hence are controlled.

3.5 Econometric model specification

- Model 1 (Fixed-effect)

$$Y_{it} = \alpha + \beta X_{it} + \varepsilon_{it},$$

- Model 2 (Random-effect)

$$Y_{it} = \alpha + \beta X_{it} + \varepsilon_{it},$$

The subscript i represents listed manufacturing firms. t represents the time-series dimension in years.

i: manufacturing firms = 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 and 13, t: time = 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018 and 2019 respectively.

The left-hand variable, Y_{it} represents the dependent variable in the model, which is the solvency of the manufacturing firms, X_{it} contains the set of independent variables in the estimation models, whilst α is the constant and β represents the coefficients of the independent variables. ε also represents the error term or differences between variables (fixed-effect) and the difference between the firms' (random-effect).

Using econometric model 1 and 2 therefore, the models for the empirical investigation for both fixed effect and the RE respectively are expressed for the dependent variables as:

$$\begin{aligned} INCRit = {} & \beta 0 + \beta 1(EQTRit) + \beta 2(DBTRit) + \beta 3(FSIZit) \\ & + \beta 4(FAGEit) + \beta 5(LEVRit) + \varepsilon \end{aligned} \tag{1}$$

$$\begin{aligned} LIQRit = {} & \beta 0 + \beta 1(EQTRit) + \beta 2\ (DBTRit) + \beta 3(FSIZit) \\ & + \beta 4(FAGEit) + \beta 5(LEVRit) + \varepsilon \end{aligned} \tag{2}$$

These extended functions of econometric equations 1 and 2 create a relationship between interest coverage and LIQRs with EQTR and DBTR, controlled by firm size, age, and leverage.

4 Empirical results

4.1 Descriptive statistical analysis

For this study, the first dependent variable, INCR, has a mean value of 18.17. This means that an average non-financial listed firm has a debt-servicing capacity of 18.17% during the study's analysis period. The study's sampled firms are highly long-term solvent. This is because the INCR measures how well a company's earnings before interest and taxes can cover its finance costs (expenses). This result is higher than the 9.58% average value found by Enekwe et al. (2015) in their five-year analysis of all publicly traded oil and gas companies in Nigeria on the same topic. Furthermore, the findings are higher than those of Enekwe et al. (2014), who found a mean INCR of 2.76% for three quoted pharmaceutical firms in Nigeria over a 12-year period from 2001 to 2012. In contrast, the results are lower than those found in a study by Ji (2019), who found an average value of INCR of 28.60 on 9,232 listed companies in South Korea from 2011 to 2018.

The second dependent variable, the LIQR, has a mean of 2.00% over the study period. The LIQR measures the rate at which a company maintains adequate current assets to mitigate current liabilities, and the average figure of 2.00% is very encouraging. Furthermore, the sampled firms have approximately two times capacity to cover their short-term financial obligations as they become due. Therefore, during the study's analysis period, an average selected listed firm achieved short-term solvency of 2.00%. This result is higher than the 0.95% average LIQR that Salman (2019) discovered in his study of tobacco companies listed on the Karachi stock exchange in Pakistan from 2011 to 2016. Similarly, the findings are higher than that of Akoto et al. (2013b), who found a

mean LIQR of 1.73% for 13 listed manufacturing firms on the Ghana stock exchange over a five-year period from 2005 to 2009. In contrast, the findings are lower than those of Yakubu et al. (2017), who found an average LIQR of 2.26% among five non-financial firms listed on the Ghana stock exchange over a six-year period (2010–2015).

Table 2 The descriptive analysis results

Variable	*Obs.*	*Mean*	*Std. dev.*
INCR	130	18.17001	7.032230
LIQR	130	1.999519	0.699488
EQTR	130	6.885404	6.174628
DBTR	130	5.316344	4.432788
FSIZ	130	18.73994	2.815988
FAGE	130	19.81667	13.99061
LEVR	130	9.518945	1.002446

Source: Estimated from Stata 15.0

On the capital structure indicators, the EQTR, which is the first independent variable, has an average value of 68.85%. The findings suggest that approximately 68.85% of the selected firms financed their investment and operational activities with more equity than debt during the study's investigation period. This indicates that equity makes up the majority of a company's capital structure mix amongst manufacturing firms in Ghana. This finding is in line with Abor (2007), who found that an average of 81.67% of Ghanaian and South African SMEs used more equity to finance their investment and operational activities over a six-year period (1998–2003).\

The DBTR, which is the second independent variable of the sampled firms, has an average value of 53.16% from 2010 to 2019. The findings suggest that, on average, 53.16% of the companies sampled prefer debt to equity as a source of funding for their operational and investment activities. This is in line with Enekwe et al. (2014).

In terms of the control variables, firm size (FSIZ) has an average value of 18.74, indicating that manufacturing firms in Ghana have a relatively strong asset capitalisation base. The second control variable, firm age (FAGE), which represents the years a firm has been listed on the Ghana stock exchange before the study period, has a mean of 20 years. This indicates that Ghanaian manufacturing firms which have secured a position on the Ghana Stock Exchange are predominantly characterised by a state of maturity. Mature firms have less information asymmetry and, thus, are much more appealing to both debt and equity providers (Bergh et al., 2019). Leverage has a mean value of 9.52, signifying that Ghanaian manufacturing firms are highly geared, despite the high use of equity.

4.2 Correlation matrix for multicollinearity test analysis

Multicollinearity occurs when the independent variables correlate with one another (Jurczyk, 2011). Researchers typically prescribe an absolute correlation value greater than 0.8 as being sufficient to cause multicollinearity (Studenmund, 2011). Accordingly, before presenting the regression model analysis, multicollinearity test was conducted and presented by correlational matrix. Table 3 presents the results of the multicollinearity tests for the two econometric models specified for the study.

4.2.1 Correlation matrix for the regression models

The highest value among the independent variables used is 0.6558, which represents the correlation between EQTR and DBTR, as shown in Table 3. This is less than the absolute value of 0.8 which is the limit to determine multicollinearity. Hence, it is concluded that there is no problem of multicollinearity among the independent variables in this study.

Table 3 Correlation matrix

INCR	*EQTR*	*DBTR*	*FSIZ*	*BASI*	*LEVR*
EQTR	1.0000				
DBTR	–0.6558	1.0000			
FSIZ	0.0597	0.0145	1.0000		
FAGE	0.0037	0.0071	0.2216	1.0000	
LEVR	0.0082	–0.0048	0.0179	0.0787	1.0000

Source: Estimated from Stata 15.0

Multicollinearity between the independent variables was further investigated in this study by the use of VIF. The VIF values ranged from 0.613 to 2.038. Each value met the cut-off point of five, as Gareth et al. (2013) suggested.

Table 4 Variance inflation factor (VIF)

Variable	*VIF*
EQTR	0.820
DBTR	2.038
FSIZ	1.320
FAGE	0.613
LEVR	0.720

4.3 Heteroscedasticity test analysis

Regression is the most effective method for determining the relationship between the dependent and independent variables. Nonetheless, heteroscedasticity is a common issue that arises with this type of analysis. Heteroscedasticity occurs when the error term's variance is not constant, and it is a violation of the regression assumptions. Although the presence of heteroscedasticity has no effect on the regression model's coefficients, it can affect the variance and covariance of the outcome. And it is for this reason that a heteroscedasticity test must be performed prior to regression analysis. White test is used to determine whether heteroscedasticity exists in this study. If the chi-square value is greater than the 5% significant value, the null hypothesis of heteroscedasticity should be rejected.

4.3.1 White heteroscedasticity test results for the regression model one: INCR

The white heteroscedasticity test in Table 5 yields a prob $chi^2 = 0.4164$, which is less than the 5% ($p > 0.05$) significance level, so the study rejects the null hypothesis and concludes that heteroscedasticity exists in the residual. In this regard, there is a treatment

for heteroscedasticity for the data prior to the presentation and analysis of the regression model one results, which uses the INCR as a proxy for the solvency of the sampled firms. STATA software is used to add a robust standard error command to the regression variables command to correct for the presence of heteroscedasticity in the results.

Table 5 White heteroscedasticity test results for model one INCR

Source	*chi*^{2}	*Df*	*Prob. > chi*^{2}
Heteroskedasticity	19.64	19	0.4164
Skewness	4.92	5	0.4252
Kurtosis	–8656293.48	1	1.0000
Total	–8656268.91	41	1.0000

Source: Estimated from stata 15

4.3.2 White heteroscedasticity test results for the regression model two: ROE

Table 6 shows that the result of the white heteroscedasticity test is a prob chi^2 = 0.0000, which is less than the 5% (p > 0.05) significance level, and thus the study rejects the null hypothesis and concludes that there is heteroscedasticity in the residual. There is a treatment for heteroscedasticity for the data prior to the presentation and analysis of the regression model two results, which uses the LIQR as a proxy for the solvency of selected firms. A robust standard error command is added to the regression variables command in STATA software to correct for the presence of heteroscedasticity in the results.

Table 6 White heteroscedasticity test results for model two: LIQR

Source	*chi*^{2}	*Df*	*Prob > chi*^{2}
Heteroskedasticity	148.16	19	0.0000
Skewness	1.64	5	0.8958
Kurtosis	3.26	1	0.0709
Total	153.07	25	0.0000

Source: Estimated from Stata 15.0

4.4 Hausman test results for the models

- Hausman test for model –1, fixed and random effect: The study estimates the panel regression analysis for the models using both fixed and random techniques. Hausman test is conducted to ascertain the right technique to adopt for the analysis and discussion of the regression results. The Hausman test results for model one indicate a Prob > chi^2 = 0.1090 > 0.05 (at 5% significance level) and, therefore, significant. This means that the study fails to reject the null hypothesis and therefore uses the random effects (RE) model to present and discuss the regression result in model one. Table 7 presents the Hausman test for model one.

Table 7 Hausman test for model –1 (INCR): fixed and random effect

INCR	*(b) fixed*	*(B) random*	*(b-B) Difference*	*sqrt(diag(V_b–V_B)) S.E.*
EQTR	–15.65744	3.983399	–19.64084	9.624791
DBTR	9.075757	–9.338078	18.41384	12.21736
FSIZ	–555.2909	–221.6362	–333.6547	672.8892
FAGE	–116.4000	65.52984	–181.9299	113.8828
LEVR	–0.9033678	–0.3255983	–0.5777696	1.570246

Notes: b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic
$chi^2(5) = (b–B)'[(V_b–V_B)^{(–1)}] (b–B)$
= 9.00
Prob > chi^2 = 0.1090.

Source: Estimated from Stata 15.0

- Hausman test for model –2, fixed and random effect: The study estimates the panel regression analysis for the models using both fixed and random techniques. Hausman test is conducted to ascertain the right technique to adopt for the analysis and discussion of the regression results. The Hausman test results for model two indicates a Prob > chi^2 = 0.9343 > 0.05 (at 5% significance level) and therefore significant. This means that the study fails to reject the null hypothesis and therefore uses the RE model for the presentation and discussion of regression result in model two. Table 8 presents the Hausman test for model two.

Table 8 Hausman test for model –2 (LIQR), fixed and random effect

LIQRit	*(b) fixed*	*(B) random*	*(b-B) Difference*	*sqrt(diag(V_b–V_B)) S.E.*
EQTR	–0.0110573	–0.0088268	–0.0022305	0.0045546
DBTR	0.0205883	0.0174454	0.003143	0.005859
FSIZ	–0.0232416	–0.0103098	–0.0129318	0.2982862
FAGE	0.0021419	0.0278779	–0.0257359	0.0502848
LEVR	0.0531567	0.0527605	0.0003962	0.0007468

Notes: b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic
$chi^2(5) = (b–B)'[(V_b–V_B)^{(–1)}] (b–B)$
= 1.31
Prob > chi^2 = 0.9343.

Source: Estimated from Stata 15.0

4.5 Regression results for the models

Tables 9 and 10 show the empirical findings of this study. Table 9 shows the results of the selected non-financial firms when INCR is used as a proxy for long-term solvency, whereas Table 9 shows the results when LIQR is used as a measure of short-term solvency.

4.5.1 Regression result for model 1 (INCR) random effect

The slope coefficient is shown in Table 8, with the probability values as P(x1 = 0.000 0.05); P(x2 = 0.000 0.05). These model results of P(x1 = 0.000 0.05); P(x2 = 0.000 0.05) are all less than the critical P-value of 0.05. These, on the other hand, specify that EQTR and DBTR indicators of the independent variable (capital structure) have a statistically significant association with the dependent variable (INCR) being an indicator for the long-term solvency of sampled Ghanaian listed manufacturing firms.

Table 9 The regression result for model –1 (INCR) random effect

INCR	*Robust*					
	Coef.	*Std. err.*	*t*	*P>|t|*	*[95% Conf. interval]*	
EQTR	7.784751	1.689226	4.61	0.000	4.45074	11.11876
DBTR	–13.76755	3.706499	–3.71	0.000	–21.08304	–6.452066
FSIZ	–200.7781	121.3257	–1.65	0.100	–440.2375	38.6813
FAGE	71.40983	60.75992	1.18	0.241	–48.51152	191.3312
LEVR	–0.3699496	0.8393892	–0.44	0.660	–2.026645	1.286746
CONS	4187.58	2367.805	1.77	0.079	–485.7353	8860.896

Source: Estimated from Stata 15.0

Table 9 shows a statistically significant positive correlation between EQTR and INCR, which is consistent with the study's prediction of a positive relationship between EQTR and long-term solvency. As a result, hypothesis 1 is accepted. It can be inferred that firms that choose equity financing over debt financing reduce interest expenditure, increasing long-term solvency.

Furthermore, the results of Table 9 show that DBTR has a significant negative correlation with the long-term solvency of the selected manufacturing firms. Hypothesis 2 is therefore accepted. Increasing a corporation's debt base increases interest payments and other financial costs, reducing the debt servicing capacity of such firms in the long run as profitability declines.

This study also demonstrates that the firm size index (FSIZ) has a weak negative correlation with long-term solvency (INCR). The results show that all other factors being constant; the larger the firm, the lower the long-term solvency. Consequently, the long-term solvency of manufacturing companies deteriorates as they expand. The findings show a relationship between INCR as a measure of long-term solvency and firm age (FAGE) that is not statistically significant. Leverage ratio (LEVR) as well shows a relationship to INCR that is not statistically significant.

4.5.2 Regression result for model-2 (LIQR) random effect

Table 10 presents the slope coefficient that shows the probability values as $P(x_1 = 0.000 < 0.05)$; $P(x_2 = 0.000 < 0.05)$. These results $P(x_1 = 0.000 < 0.05)$; $P(x_2 = 0.000 < 0.05)$ are all lesser than the statistically significant P-value of 0.05. These, however, specify that EQTR and DBTR indicators of the independent variable (capital structure) have a statistically significant relationship, with the dependent variable (LIQR) being an indicator of the short-term solvency of the selected listed non-financial firms in Ghana.

Table 10 The regression result for model -2 (LIQR) random effect

LIQR	*Robust*					
	Coef.	*Std. err.*	*t*	*P>|t|*	*[95% Conf. interval]*	
EQTR	–0.0073514	0.0019608	–3.75	0.000	–0.0112213	–0.0034814
DBTR	0.0152626	0.0027493	5.55	0.000	0.0098364	0.0206888
FSIZ	–0.0029694	0.0404625	–0.07	0.942	–0.0828299	0.0768911
FAGE	0.030191	0.0149796	2.02	0.045	0.0006258	0.0597562
LEVR	0.0524404	0.0121966	4.30	0.000	0.028368	0.0765127
_CONS	0.92718	0.9137163	1.01	0.312	–0.876214	2.730574

Source: Estimated from Stata 15.0

Table 10 shows a statistically significant negative correlation between EQTR and LIQR. Hypothesis 3 is hence accepted. Thus, the higher the EQTR, the lower the firm's short-term solvency, and vice versa.

Table 10 also shows that DBTR significantly correlates positively with short-term solvency as measured by the LIQR. Thus, hypothesis 4 is accepted. From this study's findings, firms achieve higher short-term solvency by opting for relatively more debt over equity in their capital structure.

In this study, firm size (FSIZ) is determined to have a relationship with short-term solvency (LIQR) that is not statistically significant. The findings show a statistically significant direct relationship between the LIQR and farm age (FAGE). All other variables constant; an increase in the firm's age increases the short-term solvency of listed manufacturing firms in Ghana. The leverage ratio (LEVR) is also statistically significantly related to the LIQR. All other variables remain constant; an increase in leverage ratio increases listed firms' short-term solvency.

5 Discussion of the regression results

To provide an interpretation of the relationship between solvency and capital structure, the findings are discussed in light of the literature review and the study's objectives.

5.1 The relationship between equity ratio and solvency

The study's empirical result indicates a statistically significant positive correlation between long-term solvency (INCR) and EQTR. This, therefore, shows that the greater the use of equity financing by firms, the higher the INCR. This specifies that manufacturing firms in Ghana that can expand their equity capital are likely to experience an increase in their long-term solvency. This outcome is in line with the findings of Arthur (2019) and Enekwe et al. (2015).

In contrast, the findings of this study show a statistically significant negative relationship between EQTR and short-term solvency. As such, the higher the EQTR, the lower the LIQR of listed manufacturing firms in Ghana. The inverse relationship can be explained by the fact that increasing equity capital necessitates the payment of dividends, taxes, and issuance fees, all of which deplete liquid assets. This backs up the findings of

researchers such as Mishra and Tannous (2010) and Ozkan (2001), who found a negative relationship between EQTR and firm solvency.

5.2 The relationship between debt ratio and solvency

The empirical regression results show that long-term solvency, as measured by the INCR, has a statistically significant inverse relationship with DBTR. The fact that long-term solvency has an inverse relationship with debt is not surprising, given Ghana's high-interest rates on long-term debt. Capital structure studies conducted in Ghana, such as Aidoo et al. (2022), have identified the negative impact of debt on firm financial performance.

DBTR was however found to have a significant positive relationship with short-term solvency (LIQR). This means that the greater the DBTR, the more liquid manufacturing firms. This is consistent with Muigai and Murithi (2017), who argue that debt and liquidity have a significant positive relationship. This study shows that, despite Ghana's high-interest rates, firms can still meet their short-term obligations. This is because inflation rate has no relationship with firm liquidity (Dang, 2020). Thus, firms in Ghana could opt for short-term rather than long-term debt as it has a positive relationship with liquidity.

6 Conclusions and recommendations

This study uses theoretical and empirical evidence to support the fundamental role of capital structure in a firm's survival. Using dataset from an emerging economy, the study confirms previous findings while extending the literature by focusing on solvency, a crucial factor in firm survival. Our results emphasise the importance of capital structure to the survivability of firms.

This study extends the relevance of capital structure theories to firm survival, particularly in the context of firms in emerging economies. The study has made a modest contribution to the extremely limited literature on solvency and capital structure, particularly in Africa. Some studies have been conducted on firms' capital structure in the African context. However, the majority of these studies, such as those conducted by Amoa-Gyarteng and Dhliwayo (2022), Musah and Kong (2019), and Aidoo et al. (2022), have primarily focused on firm performance, utilising profitability as the primary indicator. This study pushes the boundaries by focusing on how capital structure affects the solvency of Ghanaian manufacturing firms. Therefore, a significant contribution of this study to the empirical literature is that it has strengthened the discourse on capital structure and how it relates to firm survival.

The study proffers advice to firm managers, the most important of which is that while using equity leads to long-term solvency, it also leads to a squeeze on liquidity. As such, firms must rely primarily on short-term debt for short-term projects that promise short payback periods and turn to external equity for long-term projects and long-term firm survival. This supports the trade-off theory, which espouses an optimal capital structure. The study, therefore, recommends that firms develop an appropriate capital structure that encapsulates an appropriate mix of debt and equity to enhance both short-term and long-term solvency.

The relatively small sample size is the study's main limitation. As a result, future studies should include firms listed on other African stock exchanges to increase the generalisability of the findings. Accounting standards are not universally applied throughout the world. This also limits the study's generalisability because financial ratios from different countries using different accounting principles could be dissimilar and incomparable. Future studies can take samples from different countries with different accounting standards and test for statistical differences in the results.

References

Abor, J. (2005) 'The effect of capital structure on profitability: an empirical analysis of listed firms in Ghana', *The Journal of Risk Finance*, Vol. 6, No. 5, pp.438–445.

Abor, J. (2007) 'Debt policy and performance of SMEs: evidence from Ghanaian and South African firms', *Journal of Risk Finance*, Vol. 8 No. 4, pp.364–379.

Aidoo, E., Ahmed, I.A. and Musah, A. (2022) 'Analysis of the capital structure and profitability of manufacturing companies listed on the Ghana stock exchange', *Asian Journal of Economic Modelling*, Vol. 10, No. 3, pp.178–191.

Akoto, R.K., Awunyo-Vitor, D. and Angmor, P.L. (2013) 'Working capital management and profitability: Evidence from Ghanaian listed manufacturing firms', *Journal of Economics and International Finance*, Vol. 5, No. 5 pp.373–379.

Akoto, R.K., Gatsi, J.G. and Gadzo, S.G. (2013) 'Degree of financial and operating leverage and profitability of insurance firms in Ghana', *International Business and Management*, Vol. 7, No. 2, pp.57–65.

Amoa-Gyarteng, K. (2021) 'Corporate financial distress: the impact of profitability, liquidity, asset productivity, activity and solvency', *Journal of Accounting, Business and Management (JABM)*, Vol. 28, No. 2, pp.104–115.

Amoa-Gyarteng, K. and Dhliwayo, S. (2022) 'The impact of capital structure on profitability of Nascent small and medium enterprises in Ghana', *African Journal of Business and Economic Research*, Vol. 17, No. 2, pp.275–291.

Anarfo, E.B. (2015) 'Determinants of capital structure of banks: evidence from Sub-Saharan Africa', *Asian Economic and Financial Review*, Vol. 5, No. 4, pp.624–640.

Arthur, P. (2019) 'Effects of capital structure on profitability of the manufacturing industry: testing the fixed and random effect model on selected firms in Ghana', *Journal of Asian Business Strategy*, Vol. 9, No. 2, pp.204–219.

Azhagaiah, R. and Gavoury, C. (2011) 'The impact of capital structure on profitability with special reference to I.T. industry in India. Managing global transitions', *International Research Journal*, Vol. 9, No. 4, pp.371–393.

Aziz, S. and Abbas, U. (2019) 'Effect of debt financing on firm performance: a study on non-financial sector of Pakistan', *Open Journal of Economics and Commerce*, Vol. 2, No. 1, pp.8–15.

Beck, T., Demirgüç-Kunt, A.S.L.I. and Maksimovic, V. (2005) 'Financial and legal constraints to growth: does firm size matter?', *The Journal of Finance*, Vol. 60, No. 1, pp.137–177.

Bergh, D.D., Ketchen Jr, D.J., Orlandi, I., Heugens, P.P. and Boyd, B.K. (2019) 'Information asymmetry in management research: past accomplishments and future opportunities', *Journal of Management*, Vol. 45, No. 1, pp.122–158.

Chipeta, C. (2012) *Financial Liberalisation and the Capital Structure of Firms Listed on the Johannesburg Stock Exchange* (Doctoral thesis), University of Pretoria, Pretoria, South Africa [online] https://repository.up.ac.za. (accessed 1 November 2021).

Cole, R.A. (2013) 'What do we know about the capital structure of privately held U.S. firms? Evidence from the surveys of small business finance', *Financial Management*, Vol. 42, No. 4, pp.777–813.

Dahlström, N. and Persson, A. (2010) *Capital Structure Decisions: a Case Study on High Growth SMEs Listed on NGM Equity in Sweden*, Umeå: Umeå School of Business, Sweden.

Dang, H.T. (2020) 'Determinants of liquidity of listed enterprises: evidence from Vietnam', *The Journal of Asian Finance, Economics and Business*, Vol. 7, No. 1 pp.67–73.

Enakirerhi, L.I. and Chijuka, M.I. (2016) 'The determinants of capital structure of FTSE 100 firms in the U.K.: a fixed effect panel data approach', *Research Journal of Finance and Accounting*, Vol. 7, No. 13, pp.59–73.

Enekwe, C.I., Agu, C.I. and Eziedo, K.N. (2014) 'the effect of financial leverage on financial performance: evidence of quoted pharmaceutical companies in Nigeria', *IOSR Journal of Economics and Finance*, Vol. 5, No. 3, pp.17–25.

Enekwe, C.I., Nweze, A.U. and Agu, C.I. (2015) 'The effect of dividend payout on performance evaluation: Evidence of quoted cement companies in Nigeria', *European Journal of Accounting, Auditing and Finance Research*, Vol. 3, No. 11, pp.40–59.

Gareth, J., Daniela, W., Trevor, H. and Robert, T. (2013) *An Introduction to Statistical Learning: with Applications in R,* Spinger, Berlin.

Ghosh, C., Nag, R. and Sirmans, C. (2000) 'The pricing of seasoned equity offerings: evidence from REITs', *Real Estate Economics*, Vol. 28, No. 3, pp.363–84.

Giacosa, E. and Mazzoleni, A. (2017) 'Companys indebtedness trend for the growth and survival', *African Journal of Business Management*, Vol. 11, No. 14, pp.304–315.

Han, J-J., Kim, H.J. and Yu, J. (2016) 'Empirical study on relationship between corporate social responsibility and financial performance in Korea', *Asian Journal of Sustainability and Social Responsibility*, Vol. 1, No. 1, pp.61–76.

Hossain, I. and Hossain, A. (2015) 'Determinants of capital structure and testing of theories: a study on the listed manufacturing companies in Bangladesh', *International Journal of Economics and Finance*, Vol. 7, No. 4, pp.176–190.

Ibrahim (2009) 'The impact of capital structure choice on firm performance in Egypt', *Journal of Risk Finance*, Vol. 10, No. 5, pp.477–487.

Ji, H. (2019) 'The impact of interest coverage ratio on value relevance of reported earnings: evidence from South Korea', *Sustainability*, Vol. 11, No. 24, pp.71–93.

Jurczyk, T. (2012) 'Outlier detection under multicollinearity', *Journal of Statistical Computation and Simulation*, Vol. 82, No. 2, pp.261–278.

Manurung, S.D. (2014) 'The influence of capital structure on profitability and firm value (a study on food and beverage companies listed in Indonesia stock exchange 2010-2012 period)', *Jurnal Administrasi Bisnis*, Vol. 7, No. 2, pp.112–123.

Mekonnen, M. (2011) *The Impact of Working Capital Management on Firms' Profitability,* Unpublished Master Thesis, Addis Ababa University: Ethiopia.

Minnema, J. and Andersson, A. (2018) *The Relationship Between Leverage and Profitability: a Quantitative Study of Consulting Firms in Sweden,* Umea School of Business Economics and Statistics, Umea University, Sweden [Online] https://www.diva-portal.org/smash/get/diva2:1234028/FULLTEXT01.pdf (accessed 5 January 2021).

Mishra, D. and Tannous, G. (2010) 'Securities laws in the host countries and the capital structure of U.S. multinationals', *International Review of Economics and Finance*, Vol. 19, No. 3, pp.483–500.

Modigliani, F. and Miller, M. (1958) 'The cost of capital, corporation finance, and the theory of investment', *American economic Review*, Vol. 48, No. 6, pp.261–197.

Modigliani, F. and Miller, M. (1963) 'Corporate income taxes and the cost of capital: a correction', *American Economic Review*, Vol. 53, No. 3, pp.433–443.

Mohammed, S. and Gregory, J.A. (2018) 'The effects of ownership change on bank performance and risk exposure: evidence from Indonesia', *Journal of Banking and Finance*, Vol. 88, pp.483–497.

Muigai, R.G and Muriithi, J.G. (2017) 'The moderating effect of firm size on the relationship between capital structure and financial distress of non-financial companies listed in Kenya', *Journal of Finance and Accounting*, Vol. 5, No. 4, pp.151–158.

Musah, M. and Kong, Y. (2019) 'The association between capital structure and the financial performance of non-financial firms listed on the Ghana Stock Exchange (GSE)', *International Journal of Research in Social Sciences*, Vol. 9, No. 5, pp.92–123.

Mwangi, M. and Murigu, J.W. (2015) 'The determinants of financial performance in general insurance companies in Kenya', *European Scientific Journal*, Vol. 11, No. 1, pp.288–297.

Myers, S.C. (1984) 'The capital structure puzzle', *Journal of Finance*, Vol. 39, No. 69, pp.575–592.

Myers, S.C. (2001) 'Capital structure', *Journal of Perspectives*, Vol. 15, No. 12, pp.18–102.

Nassar, S. (2016) 'The impact of capital structure on financial performance of the firms: evidence from Borsa Istanbul', *Journal of Business and Financial Affairs*, Vol. 5, No. 2, pp.1–5.

Niresh, J.A. (2012) 'Capital structure and profitability in Srilankan banks', *Global Journal of Management and Business Research*, Vol. 12, No. 13, pp.82–90.

Ooi, J. (1999) 'The determinants of capital structure evidence on U.K. property companies', *Journal of Property Investment and Finance*, Vol. 17, No. 5, pp.464–480.

Ozkan, A. (2001) 'Determinants of capital structure and adjustment to long run target: evidence from U.K. company panel data', *Journal of Business Finance and Accounting*, Vol. 28, Nos. 1–2, pp.175–198.

Raheman, A and M. Nasir, (2007) *Working Capital Management and Profitability – Case of Pakistani Firms*, International Review of Business Research Papers. Vol. 3, No. 2, pp.275–296.

Salman, A. (2019) 'Effect of capital structure on corporate liquidity and growth: evidence from tobacco industry in Pakistan', *Academy of Strategic Management Journal*, Vol. 18, No. 2, pp.1–20.

Singh, N.P and Bagga, M. (2019) 'The effect of capital structure on profitability: an empirical panel data study', *Jindal Journal of Business Research*, Vol. 8, No. 1, pp.65–77.

Studenmund, A.H. (2011) *Using Econometrics: A Practical Guide*, Pearson Publishers, New York.

Tornyeva, K. (2013) 'Determinants of capital structure of insurance companies in Ghana', *Research Journal of Finance and Accounting*, Vol. 4, No. 13, pp.52–60.

Yakubu, I.N., Alhassan, M.M., Mikhail, A. and Alhassan, A.N.I. (2017) 'Commercial banks performance in Ghana: Does capital structure matter?', *International Journal of Accounting and Financial Reporting*, Vol. 7, No. 1, pp.333–342.

Yegon, C., Cheruiyot, J., Sang, J. and Cheruiyot, P.K. (2014) 'The effect of capital structure on firm's profitability: evidence from Kenyan banking sector', *Research Journal of Finance and Accounting*, Vol. 5, No. 9, pp.152–159.