

A META-ANALYSIS OF THE EFFECT OF CAPITAL STRUCTURE ON PROFITABILITY

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ABSTRACT

Capital structure represents an essential managerial decision task because of its relative importance in assessing the risk of a firm. Large and multi-national business is constantly faced with the decision of analysing the appropriate mix of debt and equity/assets. This study aimed at investigating the effect of capital structure on profitability using a meta-analysis to ascertain what has been documented in prior literature.

Using a Lilliefors test, a Kolmogorov Smirnov test, a Chi square test and a sample of 23 published journal articles, the results shows that profitability is independent of capital structure. Also, capital structure is not a good fit in explaining variations in profitability.

The implication of this study is that policy makers, business support organisations, banks and academic institutions should not consider the effect of their capital structure decisions when analyzing their profitability. Although there might have been a positive or negative relationship between the two concepts, it is purely by chance. Also, articles that are titled “the effect of capital structure on profitability” should first establish the direction of impact, the effect size, a dependency relationship and a detailed coefficient of determination analysis.

Keywords: Capital Structure, Profitability, Meta-Analysis, Lilliefors Test, Kolmogorov Smirnov test, Chi Square Test.

INTRODUCTION

Capital structure is arguably among the most controversial topics in corporate finance and has gain recent recognition of its importance (Chakraborty, 2010). This is particularly true when considering that capital structure differs across industry and firms. Firms across various sectors have a different level debt-to equity mix, in other words, different leverage mix. When a firm finance it assets mostly with equity, it avoids leverage risk thereby reducing the potential of bankruptcy. However, debt financing allows a firm to pursue its growth strategy while maintaining ownership and control of the business (Chechet & Olayiwola, 2014). It is perceived that optimal capital structure can reduce the overall risk of company by adjusting the different sources of capital, debt and equity, to suit the company goals (Ejupi & Ferati, 2009). Poor capital structure decisions might result in increasing weighted average cost of capital which will cause the net present value of profitable projects to be negative which leverages a firm’s strategy and competitive behaviours.

However, considering the above importance of capital structure, there have been many contradictions on opinions with regards to the link between of capital structure and profitability of a firm. In particular, Modigliani & Miller (1963) contended that, in a competitive market capital structure has no impact on profitability. Modigliani & Miller (1963) are of the opinion that, the mix of debt and equity has no impact on the firm’s value. In their research, they pointed out that, if two identical firms have with the same asset value and identical operations then their value and profitability would be the same regardless of their capital structure. Modigliani &

Miller (1963) illustrated that, if you two pies have the same shape, it doesn't matter how the pie is sliced, in the context of finance the profitability of both firms must be the same. In line with the proposition of Modigliani & Miller (1963), Chung et al. (2013), also contends that the mix of debt and equity is also irrelevant when assessing the profitability of a firm. Chung et al. (2013) also point out that most firms increase their leverage when faced with attractive business opportunity which has no significant effect on their profitability in the short run, implying that equity financing is equally as good as debt financing relative to profitability. However, prior research by Chechet & Olayiwola (2014); Akeem et al. (2014); Zangiabadi et al. (2015); Vätavu (2015); Abata & Migiro (2016); Marandu & Sibindi (2016); Sakr & Bedeir (2019); Reschiwati et al. (2019); Almahadin & Oroud (2019); Otekunrin et al. (2020); Ullah et al. (2020); Dinh & Pham (2020); Wieczorek-Kosmala et al. (2021) have revealed that capital structure significantly affects a firm's profitability and value. Specifically, these authors found a significant relationship between debt-to-equity (DTE) mix and return to equity (ROE), return to assets and profit after tax and other measures of profitability mainly using regression analysis. The implications of these studies are that an optimal capital structure should be implemented in a firm in order to maximise profitability in addition to other recommendations. Evidence gleaned from the above studies suggests that there have been mixed results in this research area which motivates the purpose of this study. There are three considerations of this study, firstly as clearly documented in the study of Rjoub et al. (2017), a regression analysis must first establish the direction of impact. This means there is either a two or one-way direction of impact which implies that does capital structure affects profitability and profitability affect capital structure (2 way) or capital structure only affects profitability (one way)? Studies with 2-way direction of impact should not be considered for publication as it is redundant for profitability to affect capital structure where all the above studies cited did not established this fact. Secondly, there coefficient of determination (R^2) was not the bases of analysis and the main emphasis was on p-values and coefficients. Lastly, these studies (Chechet & Olayiwola 2014); Akeem et al. (2014); Zangiabadi et al. (2015); Vätavu (2015); Abata & Migiro (2016); Marandu & Sibindi (2016); Sakr & Bedeir (2019); Reschiwati et al. (2019); Almahadin & Oroud (2019); Otekunrin et al. (2020); Ullah et al. (2020); Dinh & Pham (2020); Wieczorek-Kosmala et al. (2021) did not present their findings in line with the effect size of capital structure on profitability and a dependency test analysis. Hence, the main aim of this study was to investigate how capital structure affects profitability using a meta-analysis constituting R^2 , effect size and dependency test of a sample of 23 published articles.

LITERATURE REVIEW

As already alluded, several factors affect a firm's value and it is perceived that capital structure might be one of the factors that have a significant impact. As propose by the traditional theory of capital structure, optimal capital mix minimises the weighted average cost of capital which in turn increases the market value per share. Usually, Capital structure is made up of debt and equity and changes to the level of debt or equity will also alter the firm's value. From the tax benefits perspective, most firms are expected to borrow more in order to obtain a higher performance under the tax burden. In this case, using debt and equity ratios to assess a firm's performance may not be a viable assessing tool as there are multiple factors interfering in these relationships. Several empirical research has been conducted to investigate the relationship between a firm s performance and capital structure in which contradictory results where obtain. The Table 1 below presents the findings.

Study (Author & year of study)	Country	Period	Dependent variables used for profitability	Independent variables used for capital structure	Summary of findings
Abor (2005)	Ghana	1998-2002	ROE	SDA, LDA and DA	Profitability depends on debt than the other components of capital structure. Firms should carefully manage their debt ratios
Salawu (2009)	Nigeria	1990 to 2004	profitability	TLR, LTD and STD	Firms should manage their capital structure effectively to improve on their performance.
Gill, Biger & Mathur (2011)	USA	2005 – 2007	ROE	STD, LTD and TD	Capital structure positively affects profitability, firms should increase their the use of debt to improve their profitability.
Ferati & Ejupi (2012)	Macedonia		ROE	STD, TETL and LTDE	Capital structure positively affects profitability with exception of long term debt
Salim & Yadav (2012)	Malaysia	1995-2011	ROA, ROE and EPS	STD, LTD and TD	Significant positive relationship between STD and LTD but negative relationship with TD. Capital structure positively affects profitability
Shubita & alsawalhah (2012)	Jordan	2004-2009	ROE	STD, LTD and TD	Negative relationship between debt components and probability hence firms should focus on measure of equity to finance their projects
Taani (2013)	Jordan	2007-2011	ROIC, NP, ROE and NIM	TDTF, TDTE	Bank performance is directly positively related to all capital measures except ROE Banks can improve their performance by managing their ROIC, NP and NIM effectively
Moghadas et al. (2013)	Iran	2006-2010	Market value	DR, RG, firm size, asset growth	DR and RG significantly positively affects profitability
Ebrati et al. (2013)	Iran	2006 to 2011	ROE, market value and ROA	SDTA, LDTA, TDTA and TDTQ	Capital structure significantly affects ROE and market value while negatively affects ROA.
Hasan et al. (2014)	Bangladesh	2007–2012	ROE,ROA and EPS	STD,LTD and TDR	Capital structure significantly affects profitability and firms should use internal source of funds before considering external sources

Chechet & Olayiwola (2014)	Nigeria	2000-2009	profitability	DR and Equity	DR is negatively related to profitability while equity is positively related to profitability. This explains the concept of agency cost.
Akeem, Edwin, Kiyanjui & Kayode (2014)	Nigeria	2003 - 2012	ROE and ROA	DT and DE	Capital structure is negatively related to profitability, should use more equity to increase their profitability.
Vătavu (2015)	Romania	2003- 2010	ROA, ROE	TOTD, LGTD, SHTD and TE	Debt significantly affects profitability. Firms should use less debt and more equity to finance their operations.
Zangiabadi, Rahimzade & Taboli (2015)	Iran	2001- 2011	ROA and ROE	DTNW, DTAR	DR affects ROE but not ROA. Capital structure positively affects the profitability
Abata & Migirow (2016)	Nigeria	2005 - 2014	ROE and ROA	DTE and TDTA	Firms should use long term debt to finance their projects
Marandu & Sibindi (2016)	South African	2002- 2013	ROE and ROA	Firm size, credit risk and capital	Evidence of strong relationship between capital structure and bank profitability
Almahadin & Oroud (2019)	Jordan	2013-2017	EBIT-TA	DR	The value of the firm is negatively correlated to profitability, firms should carefully consider their capital structure decisions
Reschiwati et al. (2019)	Indonesia	2014-2018	ROA and CR	DR, log of total asset	Capital structure affects the value of a firm and the firm size. Capital structure should be managed effectively.
Sakr & Bedeir (2019)	Egypt	2003-2016	ROE, ROA	STD, LTD and TD	Significant negative relationship between ROA and STD, LTD and TD while ROE positively impacts LTD and TD.
Otekurin, Nwanji et al. (2020)	Nigeria	2003- 2018	ROE	DE and leverage ratio	Significant negative relationship between capital structure and profitability. There is a need to properly manage the mix of debt to equity ratio.
Dinh & Pham (2020)	Vietnam	2015 - 2019	ROE	Leverage ratio and DR	Firms should increase the proportion of debt in their capital structures so as to increase profitability.
Ullah et al. (2020)	Pakistan	2008 – 2017	ROE	DE and TD	Debt to equity in capital structure has a negative relationship with profitability. Managers should reduce their leveraging to increase the financial performance.

Wieczorek-Kosmala, Błach & Gorzeń-Mitka (2021)	Czech Republic	2015–2019	ROE and ROA	DA, LTD and STD	Negative relationship between capital structure and profitability, firms should apply the pecking order theory of financing their operations
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ROA= return on asset, ROE=return on equity, TOTD = total debt to total asset, LGTD= long term debt to total asset, SHTD= short term debt to total debt, TE=total equity, EPS=earnings per share, STD= short term debt, LTD=long term debt, TD=total debt, DR= debt ratio, RG=real growth, DTNW=debt to net worth, DTAR=debt to asset ratio, SDTA=short term debt to total asset, LDTA=long term debt to total asset, TDTA=total debt to asset, TDTQ= total debt to total equity, SDA=short term debt to total capital, LDA=long term debt to capital, DA=total debt to capital, STDL= short term debt to liability, TETL=total equity to total liability and LTDE=long term debt to equity, ROIC= return on invested capital, NP=net profit, NIM= net interest margin, TLR=total liability ratio, EBIT-TA=earnings before interest and tax to total asset.

RESEARCH METHODOLOGY

This study made use of 3 techniques namely, the Lilliefors test, the Kolmogorov Smirnov test and Chi square test to determine the distribution, goodness of fit and dependency between the effect of capital structure on profitability. More specifically, the Lilliefors test and Kolmogorov smirnov tests were used to investigate the distribution of R^2 and how measures of independent variable which in the case of this study is capital structure can be used to account for variability in profitability and the effect size (Massey, 1951). A small effect size means that measures of capital structure can adequately account for profitability. Also, the Chi square test is relevant in assessing the whether profitability is dependent on capital structure. Using the R^2 values for a sample of 23 published articles the following hypothesis were examined.

H_0 : *The values of R^2 are normally distributed and measures of capital structure can be used to explain the variability in profitability and the effect size is small.*

H_1 : *The values of R^2 are not normally distributed and measures of capital structure cannot be used to explain the variability in profitability and the effect size is large.*

H_2 : *The Chi square test value is more than the critical value; therefore capital structure is related and dependent of profitability.*

H_3 : *The Chi square test value is less than the critical value; therefore capital structure is not related and independent of profitability.*

The following data was collected from the journal articles, only studies with R^2 values where considered Table 2.

Study (Author & year of study)	R^2 value	Sample size
Abor (2005)	64.0%	22
Salawu (2009)	7.8%	50
Gill, Biger & Mathur (2011)	9%	272
Salim & Yadav (2012)	11.8%	237
Ferati & Ejupi (2012)	10.5%	150
Shubita & alsawalhah (2012)	30.6%	39

Moghadas, Pouraghajan & Bazugir (2013)	4.0%	290
Taani (2013)	31.1%	12
Ebrati, Emadi, Balasang & Safari (2013)	38%	85
Hasan, Ahsan, Rahaman & Alam (2014)	42%	36
Chechet & Olayiwola (2014)	60%	70
Akeem, Edwin, Kiyanjui & Kayode (2014)	10.7%	10
Zangiabadi, Rahimzade & Taboli (2015)	7.8%	All listed firms
Vätavu (2015)	11.6%	196
Abata & Migiro (2016)	32.3%	297
Marandu & Sibindi (2016)	0.1%	28
Sakr & Bedeir (2019)	34%	62
Reschiwati et al. (2019)	96.4%	15
Almahadin & Oroud (2019)	33.2%	N/A
Otekunrin et al. (2020)	79.8%	8
Ullah et al. (2020)	73%	90
Dinh & Pham (2020)	48.2%	30
Wieczorek-Kosmala et al., (2021)	44.9%	1977

DATA RESULTS

The following results were obtained from Lilliefors test, the Kolmogorov smirnov test and chi square test respectively Figure 1.

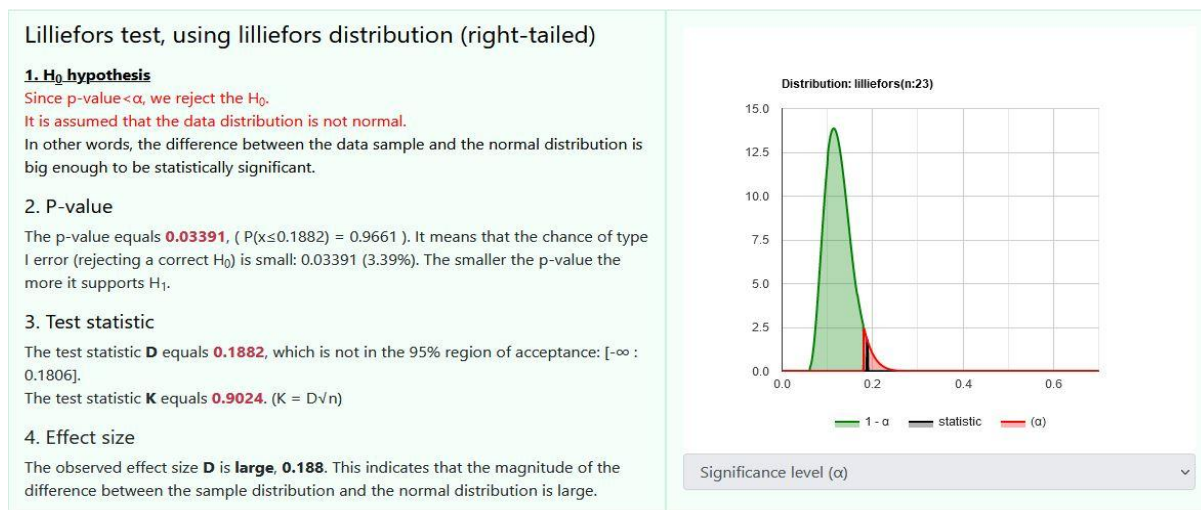


FIGURE 1
LILLIEFORS TEST

The results of the Lilliefors test indicate that the data is skewed to the right indicating assuming a right tail distribution. This is evident in the p-value that is less than 5% (0.03391) supporting that alternate hypothesis should be accepted. To establish the validity of this finding, a Kolmogorov smirnov test was also conducted. The results of the analysis are presented below Table 3 and Table 4.

R-square value	Cummulative	Expected	Rank	NORM.S.INV	Actual	Difference
64.0%	1	0.043478	-0.04348	-1.712	0.870	0.914
7.8%	2	0.086957	0	-1.360	0.163	0.163
9%	3	0.130435	0.043478	-1.124	0.175	0.131
11.8%	4	0.173913	0.086957	-0.939	0.203	0.116
10.5%	5	0.217391	0.130435	-0.781	0.190	0.059
30.6%	6	0.26087	0.173913	-0.641	0.450	0.276
4.0%	7	0.304348	0.217391	-0.512	0.131	0.086
31%	8	0.347826	0.26087	-0.391	0.457	0.196
38.0%	9	0.391304	0.304348	-0.276	0.561	0.256
42%	10	0.434783	0.347826	-0.164	0.619	0.271
60%	11	0.478261	0.391304	-0.055	0.836	0.444
10.7%	12	0.521739	0.434783	0.055	0.192	0.243
7.8%	13	0.565217	0.478261	0.164	0.163	0.315
11.6%	14	0.608696	0.521739	0.276	0.201	0.321
32.3%	15	0.652174	0.565217	0.391	0.475	0.090
0.1%	16	0.695652	0.608696	0.512	0.102	0.507
34.0%	17	0.73913	0.652174	0.641	0.501	0.151
96.4%	18	0.782609	0.695652	0.781	0.990	0.295
33.2%	19	0.826087	0.73913	0.939	0.488	0.251
79.8%	20	0.869565	0.782609	1.124	0.957	0.175
73%	21	0.913043	0.826087	1.360	0.928	0.102
48.2%	22	0.956522	0.869565	1.712	0.704	0.166
44.9%	23	1	0.913043		0.659	0.254

Count	23
Mean	33.93%
Standard deviation	26.7%
Maximum	0.914
Test statistics (5%, n=23)	0.279

The maximum value of the difference between the actual and normal distribution value is 0.914 which is greater than the test statistics values. This means the maximum values falls in the area of rejection in which the hypothesis that the R^2 is normally distributed is rejected at 5% confidence level. Therefore, results of Kolmogorov smirnov test and the Lilliefors test is in tandem. A R^2 histogram was also computed where it also concurs with the Lilliefors distribution as shown below Figure 2.

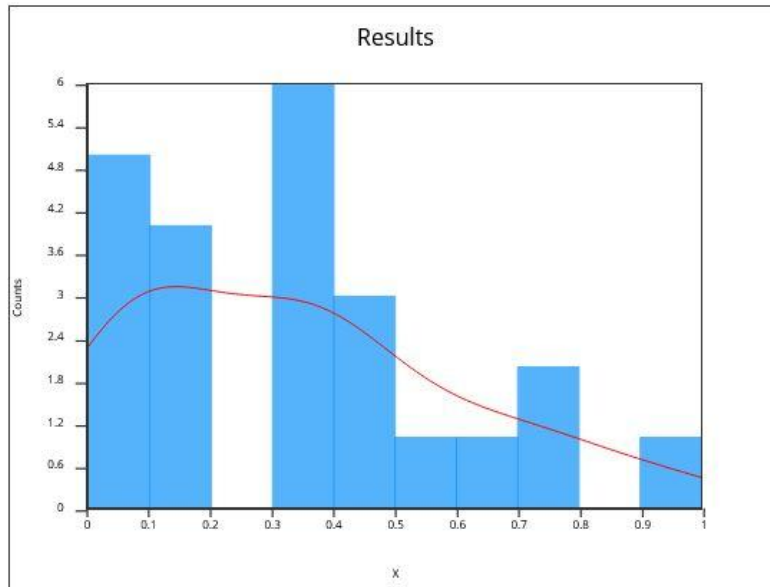


FIGURE 2
HISTOGRAM DISTRIBUTION OF R²

Finally, the chi square dependency test was also conducted to have a vivid idea of the level of dependency between the two concepts of analysis in this study. The results are presented below in table 5.

Observed R-square values	Expected R square values	(Observed- Expected)² / Expected
64.00%	0.339	0.266
7.75%	0.339	0.202
9.00%	0.339	0.183
11.77%	0.339	0.145
10.50%	0.339	0.162
30.60%	0.339	0.003
4.00%	0.339	0.264
31.05%	0.339	0.002
38.00%	0.339	0.005
42.00%	0.339	0.019
60.00%	0.339	0.200
10.70%	0.339	0.159
7.78%	0.339	0.202
11.56%	0.339	0.147
32.28%	0.339	0.001
0.07%	0.339	0.338
34.00%	0.339	0.000
96.37%	0.339	1.149
33.15%	0.339	0.000
79.80%	0.339	0.620
73.00%	0.339	0.450

48.20%	0.339	0.060
44.90%	0.339	0.035
	Chi-square test value	4.61
	Critical value	33.92

The Chi square test value (4.61) is far less than the critical value meaning profitability is independent of capital structure. This finding is in sharp contrast with the studies of Chechet & Olayiwola (2014); Akeem et al. (2014); Zangiabadi et al. (2015); Vätavu (2015); Abata & Migiro (2016); Marandu & Sibindi (2016); Sakr & Bedeir (2019); Reschiwati et al., (2019); Almahadin & Oroud (2019); Otekunrin et al. (2020); Ullah et al. (2020); Dinh & Pham (2020); Wieczorek-Kosmala et al., (2021) who found significant relationship either positive or negative. However, this finding supports the proposition of Modigliani & Miller (1963) which says capital structure is irrelevant and should not be used to access the profitability of a firm. Maybe findings that contradicts this principle should be carefully scrutinised before published. Also, the direction of impact and the effect size should be clearly stated in the abstract. Therefore, H_0 and H_2 are rejected while H_1 and H_3 are accepted

CONCLUSION

The purpose of this study was to investigate the effect of capital structure on profitability using a meta-analysis. This study used a sample 23 published articles across different journals investigate this relationship with a Lilliefors, Kolmogorov smirnov and chi square test. From the analysis, it is evident that profitability is independent of capital structure and firms cannot increase their profitability by increasing their capital structures. However, increasing the debt-to-equity ratio beyond a certain level will negatively affect their businesses as it increases the level of risk in the business. Although a growing business will generally have an aggressive strategy in financing its growth with debt, this should not be analyzed in line with profitability.

Significance of the Study

The findings this study is of significant importance to the academic world publishers will be made aware of the effect of their capital structure decisions on profitability, as well as the various firms and academic institutions that have advanced the concept effectively managing capital structure to increase profitability. The feedback from this study is that capital structure is independent of profitability despite several publications that it's significant effect.

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