Capital Structure and Firm Performance: Evidences from Commercial Banks in Tanzania

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Abstract

The aim of the study was to assess the impact of capital structure on bank performance in Tanzania. The study used panel data for the period of 5 years and 38 banks operating in the country. The study used fixed effect regression model to estimate the relationship between the firm leverage and firm performance.

The findings of the study show that banks in Tanzania use more debts as their source of finance than equity financing. Comparatively, the banks were found to use more short term debts which are mainly composed of deposits mobilized from customers than long term commercial debts. From the study results, it was deduced that, the impact of capital structure on firm performance depends on the variables and indicators that are used to approximate capital structure and performance. The study results indicated presence of negative trade-off between the use of debts and firm performance when capital structure was measured using the ratio of debts to equity and performance was measured by cost efficiency and return on equity. Contradicting results were observed when capital structure was measured as the ratio of debt to asset and when performance was measured as the ratio of debt to asset.

The study concludes that, banks in Tanzania prefer to use more short term debts in form of deposits other than commercial debts hence they still have a chance to excel as the debts to asset ratio was found to have significant positive impact on return on equity. Using commercial debts the banks can extend the operations to rural areas hence save unbanked population. The findings of this study were consistent with most of previous results but did not provide a single stand on whether the leverage has impact on the firm performance. The firm leverage depends on the estimation variables hence should be critically assessed before making generalization.

Keywords: Capital structure, Performance, Commercial Banks, Tanzania

1. Introduction

Financing decision is among the major issues in business firms both small and large. Most of the business firm's especially small ones are said to die or poorly perform due different challenges facing managers or owners on the financing decisions. Firm's decision on the use of different forms of financing results into different capital structures which may have different impact on the firm performance. Studies on capital structure have presented with different perspectives some of which supporting the earlier theories such as MM theory on irrelevance of capital structure, others focusing on pecking order and agency cost theories which insists that firms should balance its capital structure to create an optimal structure which enhances its performance.

Financing decision in commercial banks is not very similar to other business firms due to the nature of operations of these financial institutions. Although commercial banks are able to raise finance using equity and debts, the fact that they mobilize deposits which can act as source of finance, make their capital structure unique as compared to other business firm (Abdabi & Abu-Rub, 2012, Taani, 2013). To what extent does capital structure decision in commercial bank affect performance and in which direction, is among the major concern of studies in commercial banks capital structure. Different studies have tried to examine the application of different capital structure theories in banking sector and other financial institutions and their results are diverse.

In Tanzania, commercial banks are the major player of the country financial sector which has recently experienced a rapid growth in terms of geographical coverage, number of players and number of financial products offered. Statistics shows that Tanzania financial sector has more than 250 financial institutions which are regulated by central bank of Tanzania including commercial banks, bureau de change and other financial institutions. (BOT, 2014). Although the banking sector has been growing faster in the country still most of the population in the country especially in rural areas are not served with formal banking services from banks hence use informal banking services (Finscope, 2009). Why commercial banks have not been able to cover all the population in both rural and urban area in Tanzania is among the questions which have not yet been answered.

Among the said reasons is the risk associated with offering services especially in the rural areas as well as availability of funds to meet the needs of all prospective customers (Finscope, 2009, 2013). Studies conducted in banking sectors in Tanzania have highly concentrated on the bank efficiency and bank performance in terms of their financial performance (Gwahula 2013, Aikaeli, 2008). Such studies have not been able to examine the extent to which the choice of financing affects the performance of the bank. This study seeks to examine and provide evidence on whether the choices of financing sources that make up the capital structure have any impact on the firm financial performance in commercial banks operating in Tanzania.

2. Literature Review

Capital Structure decision involves the choice of different sources of finance in business firms. Most of the firms at the start ups use owners' equity to finance their investments and operations, as the firms grow, the use of both equity finance and debts increases. The choice of which source of finance should be used in the firm is very important to managers since a wrong mix of financing source may affect the performance of the firms and their survival in the market (Chinaemeren & Anthony, 2012). Managers of the firms have a duty of maximizing return of not only shareholders but also other stakeholders of the firm and the choice of financing source is very important as it affects the ability of the firm to deal with competitive environment (Victor & Badu, 2012).

The implication of capital structure on firm performance have long been studied since the seminar paper of Modiglian and Miller (1958) which stressed that under perfect conditions without bankruptcy costs, frictionless capital and with no taxes the capital structure of the firm has no impact on the value of the firm. Different empirical studies have since then been conducted to examine the relevance of MM theories in the business firms. Some of them have supported the irrelevance of capital structure (Carpentier, 2006, Myers, 2001) while other findings have stressed on the relevance of capital structure in business firms. MM theory of capital structure have also been rejected by other capital structure theories which came up later after it, some of these theories include the perking order theory, static trade off theory and agency cost theory. The trade-off theory is built on the tax advantage of debt financing in business firms. The theory suggests the presence of optimal capital structure at a point where the tax benefit of the debt financing outweigh the leverage associated costs including the financial distress and bankruptcy costs. Hence, the theory propose that firms should continue borrowing funds until the marginal tax advantage of additional debt is offset by the marginal expected costs of financial distress. Empirical studies that have tested the tradeoff theory have reported mixed findings, some of them have supported the theory (Boodhoo, 2009, Akintoye, 2008, Qnaolapo and Kajola 2010) while others have presented findings which reject the arguments of the theory (by Myers, 2001, Zeitun and Tian, 2007, Rao and Syed, 2007, Victor & Badu, 2012 and Chechet and Olayiwola, 2014). Likewise, the perking order theory proposes the order of financing source that a firm should follow in order to minimize the financing costs. According the theory, firm should start using retained earnings then debts before going to equity shares. With such view it is difficult for the firm to have an optimal capital structure since the focus of the firm is not on balancing the equity and debts financing options. Lastly, the agency cost theory which proposes the use of debt financing as way of monitoring managers of the firm to focus on overall objectives of the organization apart from their own interests. Empirical studies on agency cost theory have also presented mixed findings; some of them have supported the theory by indicating that debt reduces the agency costs since manager's efficiency increases as a push from requirement to pay interest and creditors concern which in turn enhance firm performance (Buferna et al, 2005, Jensen & Mackling, 1976).

Capital structure in banking sector is so far unique as compared to other business firms. Operationally, banks are financial intermediaries which mobilize funds from surplus units and channel them to deficit units in the society. With such view, banks mobilize funds in terms of deposits which can then be used to finance different projects and to provide loans apart from commercial debts financing or equity shares financing. Likewise, due the nature of the operation, banks are subject to more unique set of laws, regulations and supervisory issues locally and internationally. The uniqueness of bank capital structure is also contributed with fact that bank debts includes deposits from smaller depositors who may not have any motive or expertise to monitor bank operation which limits the disciplinary roles as suggested by the tradeoff theory (Dewatripont &Tirole, 1994). Among the theoretical arguments on bank capital structure versus performance is that bank with high leverage have greater lender scrutiny which result into high screening, monitoring, efficiency and performance (Yafeh & Yosha, 2003). Likewise, the amount of deposits mobilized in most banks are lower than the amount of loan required by clients hence banks use debts and equity to finance such need as well as investing in other chosen projects. Hence, banks should have high leverage as compared to other non-financial institutions to enable them save more clients' needs (Inderst &Mueller, 2008, Flannery, 1994). Although banks need enough capital to finance its operation,

most of managers often seek to hold less capital due to cost associated with holding capital, as a results most of them hold capital as per requirements of laws and regulation on minimum capital reserves.

Empirical evidences on the impact of capital structure on firm performance have provided mixed findings. Some of them have evidences showing presence of significant positive relationship between leverage and firm performance/such as San & Hang (2011) in construction companies in Malaysia, Nirajini & Priya (2013) in listed trading companies in Sri Lanka, and Abu Rub (2012) is listed companies in Palestinian Security exchange, other studies support the fact include Frank & Goyal (2003) and Hadlock & James (2002). Others have reported presence of negative impact of leverage on firm performance such as Ebaid (2009) in listed Egyptian firms, Chakraborty (2010) in India, Karadeniz et al (2009) in Turkish lodging companies and Huang and Sang (2006) in China.

Empirical evidence of banking sectors have similarly presented mixed findings on the impact of capital structure of banks performance. Pratomo & Ismail (2006), tested the impact of capital structure of bank performance in Malaysian banks, the findings show that higher leverage is associated with higher profit efficiency in banks, Siddiqui & Shoaib (2011) found positive impact of leverage on performance in Pakistan banks and Berger and Di Patti (2000) indicated the positive association between leverage and bank performance. On the other side, studies such as Berger and Bouwman (2013), Adbabi & Abu-Rub, (2012) and Victor & Badu, (2012) all reported the negative impact of capital structure on banks performance.

3. Methodology

This study was conducted in Tanzania in which a total of 38 banks were involved. The study uses secondary data from financial statements for the period from 2007 to 2011. The secondary data were obtained from three major sources, institutions websites, the central bank of Tanzania and Bank scope website. The study focused on examining the impact of capital structure on firm performance. The study uses three performance ratios as dependent variables, these includes return on total asset (ROA), return on equity (ROE) and firm operational cost efficiency (Eff) which is the measure of the extent to which banks minimize their operating costs. Capital structure of the bank is measured using total debt to equity ratio, long-term debt to equity, short term debt to equity, total debt to total asset, long term debt to asset and short term debt to asset ratio. Such ratios have been used by different empirical studies as measures of capital structure as Victor & Badu, (2012), Berger, (2002), Taani, (2013) and Chechet & Olayiwola, (2014). To test the impact of capital structure of bank performance, the study uses the following hypothesis

Ho: Capital structure has positive impact on firm performance

Basing on agency cost theory, leverage act as a driving force for managers to perform well in the organization. The use of debts requires managers to perform better so that the firm pays interests and other debts hence avoid loss of employment as a result of bankruptcy (Akintoye, 2008, Pratomo & Ismail, 2006). Likewise the tradeoff theory suggest the positive impact of debt on firm financing as a result of tax advantages, though the use of more debt increases bankruptcy risk.

To test the above hypothesis, the study uses panel data estimation which captures the effect of omitted variables in the model specification. The general fixed effect regression model is presented as:

$$Y_{it} = \lambda + \beta x_{it} + u_{it} -(1)$$

Where, Yit is the dependent variable, λ is the intercept term, β is a kx1 vector of parameters to be estimated on the explanatory variable, Xit is the 1xk vector of observations on the explanatory variables, t denotes time period t=1…T , i denote cross section i=1…N.

Panel data estimation includes fixed effect and random effect models. This study uses fixed effect regression model to estimate three regression equation of the study. The choice of the model was supported by Hausman test results which indicated a p-value of less than 0.05 hence supported the use of fixed regression model as against random effect model.

$$EFF_{it} = \lambda + \beta_1 x_{(TD/EQ)it} + \beta_2 x_{(LD/EQ)it} + \beta_3 x_{(SD/EQ)it} + \beta_4 x_{(TD/AST)it} + \beta_5 x_{(LD/ASST)it} + \beta_6 x_{(SD/AST)it}$$
$$+ \mu_{it} - - - - - - -(2)$$

$$ROE_{it} = \lambda + \beta_1 x_{(TD/EQ)it} + \beta_2 x_{(LD/EQ)it} + \beta_3 x_{(SD/EQ)it} + \beta_4 x_{(TD/AST)it} + \beta_5 x_{(LD/ASST)it} + \beta_6 x_{(SD/AST)it}$$

$$+ \mu_{it} ------- (3)$$

$$ROA_{tt} = \lambda + \beta_1 x_{(TD/EQ)it} + \beta_2 x_{(LD/EQ)it} + \beta_3 x_{(SD/EQ)it} + \beta_4 x_{(TD/AST)it} + \beta_5 x_{(LD/ASST)it} + \beta_6 x_{(SD/AST)it}$$

$$+ \mu_{it} ------- (4)$$

Where: EFFit is efficiency of bank i^{th} at time t, ROAit is the return on asset of bank i^{th} at time t, ROEit is the return on equity of bank i^{th} at time t, TD/EQit is total debt to equity ratio of the ith bank at time t, LD/EQit is long term debt to equity ratio and SD/EQit is the short term debt to equity ratio for i^{th} bank at time t.TD/ASTit, LD/ASTit and SD/ASTit are total asset, long term asset and short term asset to equity ratio for i^{th} bank at time time, λ, β and μ_{it} are the intercept, regression coefficients and error terms of the regression model. The dependent variables on the three models included performance indictors which are return on total asset (ROA), return on equity (ROE) and operational efficiency of the bank. The independent variables of the model were the indicators of capital structure in banks; this included the ratio of total debts to equity (TD/EQ), long-term debt to equity (LD/EQ), short term debt to equity (SD/EQ), total debt to asset (TD/AST), long-term debt to asset (LD/AST) and short term debt to asset (SD/AST).

Before estimating the models above we tested for regression assumptions to ensure that the available data and the models developed can actually be estimated using regression analysis. We tested for multicoliniality, model linearity, heteroskedasticity and serial correlation using Stata software. The results show that panel data estimation can be used to estimate the model; the test of multicollinearity did not show presence of high perfect on non-perfect correlation among predictors of the regression models. The variance inflation factor (VIF) test was found to be below 10 VIF which means the value were above the minimum tolerance value (1/VIF) of 0.1 below which multicollinearity is considered to be a problem (Appendix 1). To test for data linearity we used a graph plot and we applied a natural log for the values of which were found to be nonlinear. We also tested for heteroskedasticity to check the presence of constant variance among the error terms of the regression models. The test results show Chi square values of 0.03, 0.12 and o0.08 with p values of 0.8574, 7253 and 7673 which were higher than 5% significance level hence null hypothesis that the variances of the error terms in the three models were homogenous was accepted (Appendix 2). We lastly tested for serial correlation or autocorrelation between the error terms using Wooldridge autocorrelation test, the results show F value of 1.25, 1.73 and 0.25 for the three regression models with probability value of 0.0748, 0.0698 and 0.6203 for the three models respectively. The p- values were all higher than 5% level of significance hence no autocorrelation between the error terms of the regression models (Appendix 3).

3. Findings

We tested for the impact of capital structure on bank performance using a panel data of 38 banks and five years period. The descriptive statistics of average bank performance and capital structure for the five years is summarized in Table 1 below.

Table 1: Descriptive statistics

	EFF	ROE	ROA	TD/EQ	LD/EQ	S.D/EQ	TD/AST	LD/AST	SD/AST
Mean	0.1374	0.1603	0.0119	7.9264	0.1647	6.6883	0.8016	0.0231	0.6714
Standard Deviation	0.0677	0.2873	0.0285	9.7998	0.2842	8.1401	0.1883	0.0423	0.2087
Range	0.3600	1.9088	0.1203	61.7044	0.9578	50.8285	0.9187	0.1707	0.8549
Minimum	0.0400	-0.5183	-0.0596	0.0987	0.0000	0.0310	0.0654	0.0000	0.0200
Maximum	0.4000	1.3905	0.0607	61.8031	0.9578	50.8595	0.9841	0.1707	0.8749

We measured bank performance using bank using three indicators operational cost efficiency (EFF), return on equity (ROE) and return on asset (ROA). The average operational cost efficiency was found to be 13.74%, which indicates that both interest and non interest costs incurred by the banks are less than 15% of the total loans and advances made by the bank. Hence the banks in Tanzania are generally minimizing their financing and other operational costs which facilitate their performance. The average return on equity was found to be 16.03% while the average return on asset was found to be 1.19%, this indicate that on average the banks do not utilize well

their asset to generate profit to the shareholders/ owners. On each shilling invested in asset the banks were able to generate an average net profit of 0.0119 shilling, while on each shilling invested by owners/shareholders the banks were able to generate an average profit of 0.1603 in the five years period. Bank capital structure was estimated using six indicators, total debt to equity (TD/EQ), long term debt to equity (LD/EQ), short term debt to equity (SD/EQ), total debt to asset (TD/AST), long term debt to asset (LD/AST) and short term debt to asset (SD/AST). On average the banks in Tanzania were found to use more debts than equity financing, the total debt to equity ratio show an average of 7.93times more debts that equity in the banks. Comparatively, the results show that banks use more short term debts that long term debts, the ratio of long term debts to equity indicates that equity financing was about 16.5% of the total equity financing, while short term debts were found be 668% of the equity financing hence dominate bank financing and capital structure. Bank assets were also found to be highly financed by the debts as compared to equity. The ratio of total debt to asset show that 80.16% of the total asset are financed by debts, the results also show that more than 67% of the assets were financed by short term debts on average.

We used fixed effect panel regression analysis to test for the impact of capital structure on bank performance. We used Hausman test to select between fixed effects versus random effect regression model. The Hausman test results all supported the use of fixed effect panel regression model as presented in table 2 below.

Table 2: Hausman test for Fixed, Random Effect

Ho: Difference in coefficients not systematic			
	Model 1(EFF)	Model 2 (ROE)	Model 3 (ROA)
Chi 2 (6)	69.55	14.33	285.64
Prob>Chi 2	0.0000	0.0262	0.0000

We also tested for other regression assumptions such as multicollinerity using Collin diagnostic test, heteroskedasticity using Breusch Pagan test, serial/auto correlation using Wooldridge test and others such as normality and linearity. The tests results are shown in the appendix.

Testing for the relationship between capital structure and firm performance, we first tested for the association between measures of capital structure and performance indicators using partial correlation test. The test results show negative significant association at 5% level of significance between firm efficiency and ROE with both total debt to equity ratio and long term debt to equity ratio. This indicates a primary possibility of the negative tradeoff between the use of more debts versus firm performance in term on their ability to minimize operating costs and the return on equity. On the other hand, the test results also indicated presence of significant positive association between the short term debt to equity ratio and firm performance in term of efficiency and return on equity. This implies that the use of more short term debt financing in banks which is mainly composed of customer deposits, contributes positively on bank performance especially on bank cost reduction efficiency since there no or little financing costs as well as providing high return to shareholders.

Table 3: Partial correlation results

	Partial correlation of					
	efficiency		ROE		ROA	
With			Corr.	Sig.	Corr.	Sig.
TD/EQ	-0.2409	0.001	-0.1004	0.089	0.3434	0.000
LD/EQ	-0.2133	0.005	-0.1444	0.058	0.1889	0.013
SD/EQ	0.2400	0.001	0.1359	0.075	-0.3547	0.000
TD/AST	0.1766	0.020	0.2030	0.007	-0.2837	0.000
LD/AST	0.2413	0.001	0.1072	0.160	-0.2471	0.001
SD/AST	-0.1970	0.009	-0.1407	0.065	0.4112	0.000

The association results on debt to asset ratios versus performance indicators provided contradicting results as compared to debt to equity results. Both total debts to asset and long term debt to asset ratio were found to be week but significant positive association with efficiency and return on equity. The results indicate that when

most of the asset is financed by debt the firm performance is affected positively. The results on short term debt to asset ratio show a weak negative association but significant at 5% level of significance. The results on the impact of capital structure on return on asset (ROA) show presence of significant positive association with total debt to equity ratio, long term debt to equity ratio and short term debt to asset ratio. This implies that the use of more commercial debts that equity financing improves the bank return on asset employed by the firm. On the other hand, the use of more short term debt than equity financing and more debts to finance assets has negative significant relationship with return on asset.

The panel data regression results using fixed effect model also supported the results under partial correlation. The regression results shows that total debt to equity and long term debt to equity have significant negative causality relationship with cost efficiency (-0.0167, -00636) and return on equity (-0.0984, -0.2461) performance indicators respectively. This indicates a trade-off between capital structure (leverage) with bank performance in term of cost efficiency and return on shareholders' equity. The use of long-term debts which are commercial debts results into high interest payments which in turn affect the bank performance. The test results on relationship between short term debt to equity with efficiency and return on equity were all positive with coefficients of 0.24 and 0.1359 and significant at 10% level of significance, this also support partial correlation test that the use of short term debts which are mainly composed of customer deposits as source of finance, positively contributes to the bank performance. The results on impact of debt to asset ratio on efficiency and return on equity all have positive coefficients which are significant at 5% level of significance, this implies that that the use of model debts to finance assets have positive causal relationship with firm performance.

Table 4: Fixed Effect Panel Regression Results: Summary

Variables	Efficiency		ROE		ROA	
	Coef	P>|t|	Coef	P>|t|	Coef	P>|t|
TD/EQ	-0.0167	0.074	-0.0984	-2.610	0.0105	2.600
LD/EQ	-0.0636	0.024	-0.2461	-2.190	0.0253	2.110
SD/EQ	0.0181	0.110	0.1387	3.040	-0.0126	-2.580
TD/AST	0.2911	0.001	0.8370	2.430	-0.1731	-4.710
LD/AST	0.6113	0.013	1.9460	1.980	-0.2408	-2.300
SD/AST	0.0296	0.765	-1.4413	-3.610	0.0959	2.250
Cons	-0.1011	0.059	0.2966	1.380	0.0911	3.970
R-sq:						
within	0.4548		0.3601		0.4748	
between	0.0338		0.0221		0.4075	
overall	0.1614		0.1643		0.3123	
F test : all u_i=0: F(35,36)	test	6.5400		2.5900		4.7000
P>|t|		0.0000		0.0000		0.0000

The test result on the relationship between capital structure with firm performance in terms of return on asset show positive but insignificant relationship between total debt and long-term debt on return on asset. The results also show negative but insignificant relationship between total debt to asset and long term debt to asset ratio.

The week partial correlation results in table 3 were also supported by R- squared results in the panel regression. The model tests show that the independent variables of the models explained about 45.48%, 36.01% and 47.48% of the fixed within effect in the efficiency, ROE and ROA regression models respectively. The results also show the independent variables only explained about 3.4%, 2.2% and 40.75% of all within effect in the efficiency, ROE and ROA regression models. Such results and the results on overall effect indicate presence of other factors apart from the ones in the models that explains the variations in the dependent variables. All the models were found to be statistically significant at 1% level of significance.

The findings of this study were consistent with most of the previous findings on the impact of capital structure on firm performance. The results of the study indicate negative relationship between long term debt and total debt to equity and cost efficiency, this rejects the agency cost theory which indicates that high leverage are better

to shareholders as the debts can be used as monitoring tools. These findings were inconsistent with the findings by Boodhoo, 2009, Akintoye, 2008, Qnaolapo and Kajola 2010 and others which supported the use of debts but supported the findings by Myers, 2001, Zeitun and Tian, 2007, Rao and Syed, 2007, Victor & Badu, 2012 and Chechet and Olayiwola, 2014. The study results on capital structure measured by debt to asset ratio contradicted the results under debt to equity ratio; this indicates that the impact capital structure on firm performance is subject to the capital structure indicators used as well as the performance indicator used in the model. On the other hand the findings on impact of leverage on bank performance measured by return on asset (ROA) were all insignificant which was also consisted with some previous studies that did not find any significant relationship between capital structure and firm performance (Carpentier, 2006, Frank and Goyar, 2003).

5. Conclusion

The aim of the study was to assess the impact of capital structure on bank performance in Tanzania. The study used panel data for the period of 5 years and 38 banks operating in the country. The study used fixed effect regression model to estimate the relationship between the firm leverage and firm performance.

The findings of the study show that banks in Tanzania use more debts as their source of finance than equity financing. Comparatively, the banks were found to use more short term debts which are mainly composed of deposits mobilized from customers than long term commercial debts. The model estimation results indicate a presence of significant negative association and causality relationship between total debt to equity and long term debt to equity with bank cost efficiency and return on equity. This implies presence of negative trade-off between firm leverage and firm performance. This effect was not observed under short term debt to equity ratio which indicated positive impact of using customer deposits and other short term financing on performance. On the other hand, the results show significant positive association and causality relationship between the use of more debts to finance asset versus firm performance in term of cost efficiency and return on equity. The findings on firm leverage versus return on asset did not provide significant causality relationship although significant associations were observed in a partial correlation. The results show that total debt to equity ratio, long term debt to equity ratio, and short term debt to asset ratio have significant positive association while short term debt to equity ratio, total debt to asset ratio and long term debt to asset ratio all have significant negative association with return on asset.

From the study results it was deduced that, the impact of capital structure on firm performance depends on the variables and indicators that are used to approximate capital structure and performance. The study results indicated presence of tradeoff between the use of debts and firm performance when capital structure was measured using the ratio of debts to equity and performance was measured by cost efficiency and return on equity. Contradicting results were observed when capital structure was measured as the ratio of debt to asset and when performance was measured as the ratio of debt to asset. The study also concludes that, banks in Tanzania prefer to use more short term debts in form of deposits other than commercial debts hence they still have a chance to excel as the debts to asset ratio was found to have significant positive impact on return on equity. Hence commercial banks in Tanzania have a chance of using commercial debts to expand their services to rural areas and other areas with unbanked population. The findings of this study were consistent with most of previous results but did not provide a single stand point on whether leverage has impact on the firm performance. The firm leverage depends on the estimation variables hence should be critically assessed before making generalization.

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Appendix

    1.   Multicollineality test

Collin Diagnostic Test		
Variable		VIF	1/VIF
DT/EQ	6.590	0.152
LD/EQ	8.470	0.118
SD/EQ	4.20	0.238
DT/AST	5.07	0.197
LD/AST	9.14	0.109
SD/AST	1.970	0.509
Mean VIF	5.91	

    2.   Heteroskedasticity test

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity			
Ho: Constant variance	Model 1	Model 2	Model 3
Variables: fitted values of	Efficiency	ROA	ROE
chi2(1)	0.03	0.12	0.08
Prob > chi2	0.8574	0.7253	0.7673

    3.   Serial/ Autocorrelation test

Wooldridge test for autocorrelation in Panel Data			
H0: no first-order autocorrelation	Model 1	Model 2	Model 3
F(1, 35)	1.25	1.73	0.25
Prob > F	0.0748	0.0698	0.6203

4. Fixed effect regression results

Model 1(Dependent variable: Cost Efficiency -EFF)

```
Fixed-effects (within) regression              Number of obs      =        178
Group variable: bank                           Number of groups   =         36

R-sq:  within  = 0.4548                         Obs per group: min =          3
       between = 0.0338                                        avg =        4.9
       overall = 0.1614                                        max =          5

                                                F(6,136)           =      18.91
corr(u_i, Xb)  = -0.1651                         Prob > F           =     0.0000
```

efficiency	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
tdebtequity	-.0167491	.0093095	-1.80	0.074	-.0351593	.001661
ldebtequity	-.0636337	.0278167	-2.29	0.024	-.1186429	-.0086245
sdebtequity	.0181381	.0112806	1.61	0.110	-.0041699	.0404461
debtasset	.2910532	.0852098	3.42	0.001	.1225457	.4595607
ldebtasset	.6113216	.2425706	2.52	0.013	.1316235	1.09102
sdebtasset	.0295757	.0988117	0.30	0.765	-.1658304	.2249818
_cons	-.1011176	.0531521	-1.90	0.059	-.2062291	.003994

```
sigma_u     .08550303
sigma_e     .05184695
    rho     .73115909   (fraction of variance due to u_i)
```

F test that all u_i=0:   F(35, 136) =   6.54   Prob > F = 0.0000

Model 2 (Dependent variable: Return on Equity – ROE)

```
Fixed-effects (within) regression              Number of obs      =        178
Group variable: bank                           Number of groups   =         36

R-sq:  within  = 0.3601                         Obs per group: min =          3
       between = 0.0221                                        avg =        4.9
       overall = 0.1643                                        max =          5

                                                F(6,136)           =      12.75
corr(u_i, Xb)  = -0.3921                         Prob > F           =     0.0000
```

roe	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
tdebtequity	-.0984272	.0376521	-2.61	0.010	-.1728866	-.0239679
ldebtequity	-.246133	.1125039	-2.19	0.030	-.4686162	-.0236498
sdebtequity	.1386709	.045624	3.04	0.003	.0484467	.2288951
debtasset	.8369659	.3446285	2.43	0.016	.155442	1.51849
ldebtasset	1.946033	.9810703	1.98	0.049	.0059071	3.88616
sdebtasset	-1.44132	.3996411	-3.61	0.000	-2.231635	-.6510056
_cons	.2966083	.2149723	1.38	0.170	-.1285125	.721729

```
sigma_u     .20585654
sigma_e     .2096936
    rho     .49076708   (fraction of variance due to u_i)
```

F test that all u_i=0:   F(35, 136) =   2.59   Prob > F = 0.0000

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Model 3 (Dependent variable: Return on Asset – ROA)

```
Fixed-effects (within) regression          Number of obs      =        178
Group variable: bank                       Number of groups   =         36

R-sq:  within  = 0.4748                     Obs per group: min =          3
       between = 0.4075                                    avg =        4.9
       overall = 0.3123                                    max =          5

                                           F(6,136)           =      20.49
corr(u_i, Xb)  = 0.1031                    Prob > F           =     0.0000
```

roa	Coef.	Std. Err.	t	P>|t|	[95% Conf. Interval]	
tdebtequity	.0104607	.0040181	2.60	0.010	.0025146	.0184068
ldebtequity	.0252921	.0120061	2.11	0.037	.0015492	.0490349
sdebtequity	-.0125765	.0048689	-2.58	0.011	-.022205	-.002948
debtasset	-.1731144	.0367779	-4.71	0.000	-.245845	-.1003838
ldebtasset	-.2408251	.1046974	-2.30	0.023	-.4478706	-.0337795
sdebtasset	.0958675	.0426487	2.25	0.026	.0115271	.180208
_cons	.0911306	.0229413	3.97	0.000	.0457627	.1364985
sigma_u	.03667014					
sigma_e	.02237799					
rho	.72864717	(fraction of variance due to u_i)				

```
F test that all u_i=0:     F(35, 136) =      4.70                Prob > F = 0.0000
```

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