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Factors Affecting Credit Risk Exposure of Commercial Banks in Ethiopia: An Empirical Analysis

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Abstract

This study was designed to empirically investigate factors affecting credit risk exposure of selected commercial banks in Ethiopia. A panel of nine commercial banks each having 11 years of observations was included. The banks were selected on the basis of number of annual financial report (2005-2015) to come up with sufficient number of observations. Alternative econometric estimation models such as fixed effect, random effect, Feasible Generalized Least Square, Ordinary Least Square and xtscc were used to indicate whether the results are robust and are convergent irrespective of diagnostic test procedures. The result indicates that total equity to total assets, proxy of capital negatively and significantly affect credit risk under the five alternative models in four of the five models at α=1% level of significance. Cash reserve ratio, proxy of banking regulation positively and significantly affect credit risk at α=1% in the three of the five estimation models (fixed effect, random effect and Ordinary Least Square). Moreover, Loan to Deposit ratio, proxy of lending structure positively and significantly affect credit risk under all the five models at α=5% or α=1% level of significance. Liquidity has positive and significant effect on credit risk under the four of the five alternative mode at α=1%. It has also been found out that government owned commercial bank has significantly higher credit risk exposure than privately owned banks. Finally, both economic growth rate and bank specific financial performances have no significant effect on credit risk. The author suggests that banks need to reduce the level of their debt; keep their liquidity at optimal level, reduce cash reserve ratio only to the level legally required to reduce their risk exposure.

Key words: credit risk, capital structure, loan loss provision, liquidity

1. INTRODUCTION

Ethiopian banking industry is of unique features compared to that of the rest of the world in many ways. There is no commercial bank owned by foreign investors as the government officially ruled out foreign ownership of financial sector. Moreover, the government strictly controls credit and fixes interest rates mostly in favour of government priority areas. On top of this, a single government owned commercial bank possesses significant market share in the industry and the privately owned banks are compulsorily forced to acquire government bonds amounting to 27% of the loan they extend every time they do so at the interest rate far below risk free rate. Besides, it seems that the government strictly limits entry of new domestic firms in to the industry as it is evident that the minimum capital requirement to establish commercial bank, which was equal to Ethiopian Birr 75 million and endorsed by directive number SBB/24/99 has been repealed and replaced by directives number SBB/50/2011 in 2011 which increased the minimum requirement to Ethiopian Birr 500 million, as a result of which no single bank has joined the banking market since then.

2. STATEMENT OF THE PROBLEM

By its very nature, the banking firm is so susceptible that more than 85% of their liability is deposits accepted (Cornett, Marcus, Saunders, & Tehranian, 2007). As part of their core business process, banks utilize these deposits to extend credit for their borrowers in order to generate revenue for banks. Obviously, in this credit creation process, banks are exposed to high default risk which could lead to financial distress as well as bankruptcy. However, they must create credit for their clients no matter how these risks inevitably exist to make money, grow and continue in the competitive market.

A study made by Arunkumar & Gowdara (2006) indicates that credit risk accounts for about seventy percent(70%) of the total banking risk and the remaining proportion of the total risk(30%) is attributed to market and operational risk. It is also apparent that managers of commercial banks are aware that credit risk is the dominant source of banking insolvencies (Carey & Stulz, 2005). Besides, it is argued that credit risk is a critical factor for banking instability and hence capital is commonly understood as an effective protection against the insolvency of banks. Basel Committee, supervisory body of banking also argues that the largest source of banking problems is credit risk(Khan, 2003).

Credit risk is fundamentally caused by non-performance by borrowers. This non performance could relate to unwillingness or an inability of borrowers to honor the terms of the contract as prescribed. Credit risk is the loss by the bank in the event the borrowers fail to honor the debt obligation as per the credit term on maturity. This can affect the lender holding the loan contract, as well as other lenders to the creditor. Therefore, the financial condition of the borrower as well as the current value of any underlying collateral is of considerable interest to its bank. The real risk from credit is the deviation of portfolioôs performance from its expected value. Accordingly, credit risk is diversifiable, but difficult to avoid completely. Credit risk is sometimes called counter party risk and may put bank in bankruptcy if inappropriately managed(Abbas, Haider, & Rana, 2014).

To authorôs best knowledge, previous studies didnôt thoroughly address the determinants of credit risk exposure of commercial banks with special reference to the lending structure, ownership and bank specific performance of commercial banks. Besides, almost all of the studies mainly focused on the credit risk management and the effect of credit risk on banking performance for relatively shorter time span. Moreover, given the highly repressive financial sector and dominant government owned bank, which makes this situation special, attention should have been given to contribute perhaps a unique result to the contemporary literature using panel data. Thus this study is particularly designed to address these gaps.

3. OBJECTIVE OF THE STUDY

The objective of the study was to investigate factors that affect credit risk exposure of commercial banks in Ethiopia for a panel of nine selected banks each having eleven years of observation using econometric estimation models. More specifically, the study tried to address the following objectives:

- To explain the effect of bankôs capital level on credit risk exposure of commercial banks in Ethiopia.
- To examine whether bank liquidity, cash reserve ratio and lending structure have effect on credit risk exposure of commercial banks in Ethiopia.
- To investigate whether bank specific financial performance and macroeconomic performances influence credit risk exposure of banks and
- To show whether there is significant mean difference in credit risk exposure between government and privately owned commercial banks

4. REVIEW OF THE RELATED LITERATURE

A banking crisis is attributed to many factors. In first place, banks are ever defending themselves against liquidity and/or insolvency problems caused by the increase of bad or nonperforming loans in their balance sheets. This also means that giving utmost attention to the banking credit risk is a prerequisite for looking at the causes of banking crisis. Therefore, analysis of credit risk is essential as it can provide signals of vulnerability to shocks. This can help the regulatory authorities to take measures to prevent a possible crisis (Agnello & Sousa, 2012). According to Heffernan(2005), the analysis of the credit risk is important because many banksô bankruptcies are related to the huge ratio of nonperforming loans to the total loans.

Lending is the most important business activity for most commercial banks. The loan portfolio is typically the largest asset and the dominant source of revenue. As such, it is one of the greatest sources of risk to a bankôs safety and soundness. Due to this situation, loan default will give huge influence on profit level of banks. Clear understanding about credit risk will help banks in managing their assets portfolio (Bhatti & Misman, 2010).Customarily, for most banks, loans are the largest and most obvious source of credit risk. Most studies indicate that structure of lending has significant importance for bank risk exposure. Hanson, Pesaran, & Schuermann (2008) suggests that if firm parameters come from different sectors, there will be further scope for risk diversification by changing the portfolio weights, even in the case of sufficiently large portfolio.

According to Beck, Jakubik, & Piloiu (2013), GDP growth was the major driving force of non-performing loan, which is proxy of credit risk during the past decade. Thus, a fall down in global economic activity remained an important risk factor for bank asset quality. At the same time, economic activity cannot fully explain the trend of non-performing loans across countries and over time.

Ali (2004) found out that liquidity results into failure of banks irrespective of whether they have access to external liquidity or not. Thus, understanding the nature of liquidity and its impact on credit risk is an important empirical step to come up with evidence of interaction between liquidity and credit risk. A portion of the default risk may, in fact, result from the systematic risks even though banks can still reduce the credit risks through diversification. In such situations, the credit risk is difficult to be transferred, and precise estimates of loss are not easy to obtain(Altman & Saunders, 1997).

The credit risk might be affected by the ownership structure of banks, i.e. whether the bank is private or state owned. In line with this argument, the relationship between public owned or state-owned banks and their levels of risk shows that state owned bank take more risk as compared to the privately owned banks (Zribi & Boujelbegrave, 2011).

According to Amidu & Hinson (2006), traditionally, banks maintain capital as a safeguard against insolvency, and they hold liquid assets to guard against unexpected withdrawals by depositors. These conditions force banks to eagerly examine and take appropriate level of risks on a daily basis as part of their major business processes. Given the vital role of market and credit risk in their core business, the banksô success requires that they are able to identify, assess, monitor and manage these risks in a more efficient and sophisticated manner.

Banks must have effective ways to determine the appropriate amount of capital that is necessary to cover unexpected loss arising from their market, credit and operational risk exposures. However, there is a great deal of debate concerning capital level and credit risk and insolvency factors. Some believe that if a bank has large capital to asset ratio, the bank can use the capital as buffer against insolvency and hence it is good for the bank. On the other hand, according to Modigliani and Miller, as a firm uses more and more of leverage(debt financing) , the firm will get the chance of reducing the overall cost of capital and hence this will enable the firm to lower down the lending rate and possibly the borrowerôs ability to pay might be enhanced.

The result of study recently conducted by (Zribi & Boujelbegrave, 2011) on banking sector in developing countries that shows that capital has negative and statistically significant effect on credit risk exposure. This implies that the more banks use equity financing than the debt, the less they will be exposed to credit risk.

In Ethiopian context, and the rest of the world, majority of studies focused on credit risk management; effect of credit risk on banking performances(Tehulu, 2014). For instance Tadesse(2014) specifically studied the impact of credit risk on banking performance taking into account variables related to lending activities, over the period of 5 years (2008-2012). These indicate the presence of a gap in the subject matter and study context that necessitates conducting

empirical study concerning factors that affect credit risk exposure of commercial banks in Ethiopia.

5. MATERIALS AND METHODS

The study used explanatory research design where a panel of nine commercial banks each having eleven years of observation were selected. The inclusion criterion of those banks was number of years over which the banks were in operation with an intention of coming up with optimal number of observations. Accordingly, as suggested by Malhotra (2009), conclusive research design was used. Under conclusive research design, particularly descriptive: longitudinal (panel) research was used. Stata software package has been used particularly in order to statistically show the direction and significance of the explanatory variables in affecting credit risk exposures of commercial banks.

For the study purpose, secondary data were exclusively used so as to achieve the research objectives and to do so, annual financial reports were obtained from National Bank of Ethiopia of nine commercial banks each having eleven years of reports.

The Ethiopian banking industry consists of seventeen commercial banks of which one is government owned. Hence, in order to obtain balanced panel data and to come up with sufficient number of observations, banks having at least eleven years of financial reports were considered as sampling units. Based on this inclusion criterion, only nine (the two government owned and seven privately owned) commercial banks were include.

A panel data of nine selected commercial banks each having eleven years of annual financial reports were considered and the panel data classical linear regression model has been specified as follows:

$$LLP\_TL_{it}=\alpha+\beta_1 TE\_TA_{it}+\beta_2 CRR_{it}+\beta_3 LNDP_{it}+\beta_4 GDPgrwth_t+\beta_5 roa_{it}+\beta_6 liq_{it}+\beta_7 OS_{it}+\varepsilon$$

Where:

Description of each of the variable is indicated in the table 1 and i stands for bank ώô andάôstands for t-year.

Table -1 Variable Definition and Expected sign

Variable	Symbol	Definition/description of the variable	Expected symbol
Credit risk	LLP_TL	The ratio of loan loss provision to total loans	
Capital	TE_TA	The ratio of total equity to total asset, which serves as proxy of capital level	Negative
Regulation	CRR	Cash reserve ratio that serves as proxy of financial regulation	Positive
Lending structure	LNDP	Loan to deposit ratio which serves as proxy of lending structure	Positive

Macroeconomic performance	GDP-growth	Nominal gross domestic product growth rate each year, which serves as proxy of macroeconomic performance	Positive/ negative
Return on asset (bank specific performance)	roa	Return on assets which serves as proxy of bank specific financial performance	Negative
Liquidity	liq	The ratio of liquidity assets to total assets which serves as liquidity	Positive/ negative
Ownership	OS	Dummy variable, 1 is government owned and 0 otherwise	Positive

Source: Compiled from literature

6. RESULTS AND DISCUSSION

Descriptive Analysis

Table 2 shows the central tendency and variability of the scores across the banks and years of observation for each variable under consideration. Accordingly, the outcome variable, loan loss provision to total loan has the overall average of 4.1%, which means that on average, each commercial bank in Ethiopia put aside about 4% of the loan they provide, which is expected to be lost potentially because of default risk with the minimum and maximum level of 0% and 21.2% during 2005 through 2015 in Ethiopia. On average, the between banks variation for loan loss provision to total loan is less than the within years variation, which is 0.025 and 0.031 respectively. This shows that the variation of this score is less than between banks than among years of observation.

The average equity to total asset ratio of commercial banks in Ethiopia is about 13.2% for the period under consideration. This implies that on an average a typical commercial bank has contributed 13 cents for every Birr invested in total assets, i.e., about 87% of total financing is obtained from external source in the form of debt. The minimum and maximum equity contribution to total asset ratio is 4.2% and 86.8% respectively, which indicates the existence of a huge gap between most dependent and least dependent bank in terms of financing. The standard deviation shows that the rate of variability between banks is smaller than that of within the years of observation.

On average, a typical commercial bank in Ethiopia has a cash reserve ratio of 20.2% during the period under consideration. This score is much higher than the statutory reserve ratio of 5% which is in effect during 2013-2015 and 15% during 2008-2012. This indicates that banks were reserving cash far more than what they are legally required and this is indicative of the fact that there is strict government regulation which could affect the liquidity position of the banks.

On average, commercial banks in Ethiopia lend 62.4% of the deposit they mobilize, with the minimum and maximum 20% and 129% respectively. This indicates that about 38% of the deposits they accept were used for non traditional banking activities which including investment.

When we come to the macroeconomic performance of the nation, the average of GDP growth rate is 11% during study under consideration, with the minimum and maximum rate of 8.7%and 13.5% respectively. This variable is expected to boast the deposit mobilization and loan allocation role of commercial banks and in this regard, its effect on credit risk is expected to be positive or negative.

Commercial banking sector in Ethiopia has earned an average of about 3 cents of net profit per one Ethiopian Birr investment in total assets during the period under consideration, with the minimum of -2.4% and maximum of 4.9%. The variation of this variable is higher for with in the years than between the banks, indicating that bank specific financial performance is more volatile as time passes. Finally, the ratio of liquid asset to total asset is on average about 36% for all banks with minimum and maximum ratio of 13% and about 94%. The variation liquidity is more within the years than between the banks (for more information, refer to table2).

Table 2: Descriptive Statistics Result

	Variable	Mean	Std. Dev.	Min	Max	Observations	
LLP_TL	overall	0.041	0.039	0.000	0.212	N =	99
	between		0.025	0.011	0.089	n =	9
	within		0.031	-0.048	0.181	T =	11
TE_TA	overall	0.132	0.095	0.042	0.868	N =	99
	between		0.055	0.061	0.253	n =	9
	within		0.080	-0.024	0.746	T =	11
CRR	overall	0.202	0.129	0.048	0.767	N =	99
	between		0.043	0.167	0.313	n =	9
	within		0.122	-0.047	0.655	T =	11
LNDP	overall	0.624	0.175	0.200	1.286	N =	99
	between		0.089	0.408	0.731	n =	9
	within		0.153	0.174	1.260	T =	11
GDPGrwth	overall	0.110	0.013	0.087	0.135	N =	99
	between		0.000	0.110	0.110	n =	9
	within		0.013	0.087	0.135	T =	11
roa	overall	0.029	0.011	-0.024	0.049	N =	99
	between		0.006	0.017	0.037	n =	9
	within		0.010	-0.012	0.062	T =	11
liq	overall	0.359	0.130	0.130	0.938	N =	99
	between		0.040	0.311	0.443	n =	9
	within		0.125	0.128	0.854	T =	11

Source: Author's computation on data obtained from national bank of Ethiopia

Diagnostic Tests Results: Assumptions of Panel Data

To get the valid estimates of the values required and minimize estimation biases, it is a matter of necessity to conduct diagnostic tests before running the final model for inference. The following are the pertinent diagnostic tests in panel data.

1. Testing Multicollinearity

To test multicollinearity problem, the VIF (Variance Inflation Factor) should be used. As a rule of thumb, if the value of VIF is not more than 10, there is no problem of multicollinearity. A Tolerance (1/VIF) of less than 0.1 is equivalent to the value of VIF more than 10 and the same interpretation holds, i.e, a Tolerance value of less than 0.1 is a matter of concern as far as multicollinearity is considered. The VIF table3indicates that all the values are less than 10 or the tolerance values are all more than 0.1 indicating that there is no problem of multicollinearity in the model under consideration.

Table 3: Variance Inflation Factor (VIF) test result

Variable	VIF	1/VIF
liq	2.73	0.366
CRR	2.72	0.368
TE_TA	2.00	0.501
roa	1.54	0.650
LNDP	1.40	0.715
OS	1.30	0.772
GDPgrwth	1.15	0.867
Mean VIF	1.83	

Source: Author's computation on data obtained from national bank of Ethiopia

2. Test for Heteroskedasticity

This is a very important assumption in parametric process as the stability of variance is of important implication in estimating the values essential for the study purpose.

Table4: Test result for Heteroskedasticity

```
. hettestresid
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

Ho: Constant variance
Variables: residual

chi2(1)     =     0.09
Prob> chi2  =   0.7613
```

Source: Author's computation on data obtained from national bank of Ethiopia

Here the Bresusch-Pagan/Cook-Weisberg test for heteroskedasticity hypothesizes that the variance is constant. In the study under consideration, particularly at 5% level of significance, the test result shows that null hypothesis is accepted(p-value=0.7613); indicating that the variance is constant, i.e there is no problem of heteroskedasticity.

3. Checking Normality of Residuals

To test the normality of the distribution, the residual values should be computed first and the test should be conducted on the residual values. To perform normality test of the distribution, it is customary to use Shapiro-Wilk W test.

Table 5: Test result for normality of the distribution- Shapiro-Wilk W Test

Shapiro-Wilk W test					
Variable	Obs	W	V	z	Prob>z
residual	99	0.97406	2.052	1.59	0.0559

Source: Author's computation on data obtained from national bank of Ethiopia

The null hypothesis assumed is that the distribution is normal. The p-values of Shapiro-Wilk W Test(p=0.0559) indicate that the distribution of the error terms (residuals) is normal. Therefore, further empirical procedure can be undertaken following absence of normality problem in the data.

4. Test for Cross Sectional Independence

Pasaranôs test of CD (cross-sectional dependence) is used to check whether or not the error terms are correlated across entities. As cross-sectional dependence may result in bias in test results also known as contemporaneous correlation, such post estimate test is of its own significance.

Table 6: Cross Sectional Dependence Test Result

```
. xtcsd,pesaran abs

Pesaran's test of cross sectional independence =     3.594, Pr = 0.0003

Average absolute value of the off-diagonal elements =     0.436
```

The null hypothesis here is that error terms/residuals are not correlated.
The Pr= 0.0003 is significant, suggesting the null hypothesis is rejected. Thus, there is cross sectional dependence among the banks.

5. Testing for Autocorrelation

Autocorrelation or serial correlation refers to the degree of similarity of measured values between consecutive time periods, i.e, it measures the extent of association between a lagged version of itself over successive time intervals. In other words, it calculates the correlation between two time series. In calculating autocorrelation, the values couldvary from +1 to -1.0, in line with the conventional correlation statistic. Indeed, serial correlation tests are used for macro panels with relatively long time series, perhaps for over 20-30 years. It is not great concern of micro panels.

Table7: Serial Correlation Test result

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,        8) =     59.372
           Prob > F =      0.0001
```

The test result shows that the null hypothesis is not accepted as p-value=0.0001 is smaller than the default 0.05 level of significance. Thus, there is problem of serial correlation. To deal with this problem, provided that the time series is greater than the number of cross sectional units, the Feasible Generalized Least Square (FGLS) is used as suggested by Reed & Ye (2011)(see table 11).

OLS Estimator

In order to roughly show the percentage of variation in the outcome variable accounted for by the explanatory variables(R-square), the probability the coefficients of the variables are different from zero; the values of each coefficient and the total number of observations and other details, the OLS estimator is an important starting point. Accordingly, there are a total of 99 observations (nine banks multiplied by eleven years). The R-square value as indicated in the table 8 is about 58%, which shows that about 58% of the total variation in the credit risk is explained by the variation of the explanatory variables used in the model. The four of the seven explanatory variables have p-value of less than 0.05, indicating that the corresponding variables significantly affect credit.

Table 8: OLS Estimator Result

Source	SS	df	MS		Number of obs	99
					F(7, 91)	17.75
Model	0.087	7	0.012		Prob> F	0.000
Residual	0.064	91	0.001		R-squared	0.577
					Adj R-squared	0.545
Total	0.150878	98	0.00154		Root MSE	0.026
LLP_TL	Coef.	Std. Err.	t	P>t	[95% Conf.Interval]	
TE_TA	-0.168	0.040	-4.24	0.000	-0.247	-0.090
CRR	0.062	0.034	1.81	0.073	-0.006	0.130
LNDP	0.063	0.018	3.5	0.001	0.027	0.099
GDPgrwth	0.287	0.223	1.29	0.200	-0.155	0.730
roa	0.117	0.295	0.4	0.692	-0.468	0.702
liq	0.123	0.034	3.64	0.000	0.056	0.191
OS	0.048	0.007	6.63	0.000	0.034	0.063
_cons	-0.079	0.028	-2.78	0.007	-0.135	-0.023

Source: Author's computation on data obtained from national bank of Ethiopia

Selecting between OLS and Random Effect

In order to statistically justify and select the appropriate estimator, further tests need to be conducted. Thus, it is more meaningful to conduct Breusch Pagan Lagrangian Multiplier test to check whether Pooled OLS or random effect model is appropriate. In line with this, the null hypothesis is that Pooled OLS is appropriate. The test result shows that the p-value is 0.1229 indicating that the null hypothesis is retained. Thus, the pooled OLS indicated in the table 8 is appropriate.

Table 9: Test result of Lagrange Multiplier

```
. xttest0

Breusch and Pagan Lagrangian multiplier test for random effects

        LLP_TL[id,t] = Xb + u[id] + e[id,t]

        Estimated results:
                         |       Var      sd = sqrt(Var)
                 --------+------------------------------
                   LLP_TL|    .0015396        .0392374
                       e |    .0006402        .0253026
                       u |    .0001602        .0126571

        Test:    Var(u) = 0
                              chibar2(01) =      1.35
                           Prob > chibar2 =    0.1229
```

Source: Author's computation on data obtained from national bank of Ethiopia

Estimator Result for eliminating Cross sectional Dependence Problem

As indicated in the cross sectional dependence test subsection, it has been found out that there is problem of cross sectional dependence. To eliminate the problem, we have to install the xtscc program and use as a command to estimate the dependent variable against independent variables. In table 10, the test result of xtscc program is indicated, which gives the estimation result controlling the cross sectional dependence violation and provides the result free of such problem.

Table 10: Test Result after eliminating Cross sectional Dependence problem

Regression with Driscoll-Kraay standard errors	Number of obs		99
Method: Pooled OLS	Number of groups		9
Group variable (i): id(banks)	F(7,10)		142.59
maximum lag: 2	Prob> F		0.000
	R-squared		0.577
	Root MSE		0.027

LLP_TL	Coef.	Drisc/Kraay Std. Err.	t	P>t	[95% Conf.	Interval]
TE_TA	-0.168	0.036	-4.700	0.001	-0.248	-0.088
CRR	0.062	0.061	1.020	0.333	-0.074	0.198
LNDP	0.063	0.027	2.300	0.044	0.002	0.124
GDPgrwth	0.287	0.421	0.680	0.511	-0.652	1.227
Roa	0.117	0.342	0.340	0.740	-0.645	0.879
Liq	0.123	0.074	1.660	0.128	-0.042	0.289
OS	0.048	0.015	3.300	0.008	0.016	0.081
_cons	-0.079	0.028	-2.810	0.018	-0.141	-0.016

Source: Author's computation on data obtained from national bank of Ethiopia

Estimator Result for eliminating Autocorrelation Problem

The autocorrelation test result indicates that there is problem of autocorrelation problem as p-value=0.0001 is smaller than the default 0.05 level of significance. To deal with this problem, provided that the time series is greater than the number of cross sectional units, the Feasible Generalized Least Square (FGLS) is used as suggested by Reed & Ye (2011)(see table 11).

Table 11: Test Result that eliminate Autocorrelation problem

Cross-sectional time-series FGLS regression
Coefficients: generalized least squares
Panels: heteroskedastic
Correlation: common AR(1) coefficient for all panels (0.6285)

Estimated covariances	= 9	Number of obs	99
Estimated auto correlations	= 1	Number of groups	9
Estimated coefficients	= 8	Time periods	11
		Wald chi2(7)	58.79
		Prob > chi2	0.000

LLP_TL	Coef.	Std. Err.	z	P>z	[95% Conf.	Interval]
TE_TA	-0.106	0.022	-4.760	0.000	-0.150	-0.062
CRR	0.006	0.015	0.430	0.666	-0.023	0.036
LNDP	0.024	0.011	2.070	0.039	0.001	0.046
GDPgrwth	0.030	0.072	0.420	0.674	-0.110	0.171
Roa	-0.180	0.161	-1.120	0.263	-0.496	0.135
Liq	0.080	0.018	4.380	0.000	0.044	0.116
OS	0.048	0.015	3.100	0.002	0.018	0.078
_cons	0.003	0.016	0.210	0.835	-0.027	0.034

Source: Authorôs computation on data obtained from national bank of Ethiopia

Comparison of Test Results of credit Risk under Different Models

In the previous sections, it has been statistically identified that pooled OLS is appropriate. However, in order to check whether the different estimation results consistently provide similar or closer results, the estimation results of OLS, random effect, fixed effect, FGLS and xtscc estimator are provided. Accordingly, Total Equity to Total Asset ratio, proxy of capital has consistently negative effect on credit risk. This means that as banks possess more and more capital, their credit risk will be lower and lower. This result is consistently significant at Ŭ=0.01 under the five models indicated in table 12, where p-value is about 0.000. This result is consistent with the result of previous researchers. For instance, according to Amidu & Hinson(2006), traditionally, banks maintain capital as a safeguard against insolvency, and they hold liquid assets to guard against unexpected withdrawals by depositors. Moreover, the result of study recently conducted by Zribi & Boujelbegrave (2011) on banking sector in developing countries shows that capital has negative and statistically significant effect on credit risk exposure. This implies that the more banks use equity financing than the debt, the less they will be exposed to credit risk. Cash reserve ratio, which is the proxy of banking regulation has positive effect on credit risk and this effect is statistically significant at Ŭ=0.1 under OLS, fixed effect and random effect regression models. This indicates that as the banks are strictly regulated,

they will be more exposed to credit risk. The descriptive statistics indicates that the cash reserve ratio score is much higher than the statutory reserve ratio of 5% which is in effect during 2013-2015 and 15% during 2008-2012. This indicates that banks were reserving cash far more than what they are legally required and this is indicative of the fact that there is strict government regulation which could affect the liquidity position of the banks.

Loan to deposit ration, as proxy of lending structure has positive and significant effect on credit risk exposure of commercial banks in Ethiopia consistently under the five models where p-value is about 0.000 under OLS, random effect and fixed effect models and about 0.039 and 0.044 under FGLS and xtscc estimators respectively. This shows that as more and more amount of loan is extended to the borrowers relative to the deposits accepted, there will be more and more credit risk. This result is consistent with the research results of the previous researchers. For instance, even if the conceptualization of lending structure is different from the study under consideration, Amidu & Hinson (2006) found out the lending structure positively affects credit risk of banks.

Under four of the five alternative models used in this study, it has been consistently shown that liquidity positively and significantly affects credit risk exposure of commercial banks in Ethiopia. In these four models, the p-value is about 0.000, which implies that the effect of liquidity on credit risk is statistically significant at Ŭ=0.01. This implies that the more banks hold liquid assets, the more will be credit risk. This could be justified on the basis of the logic that credit risk will be higher if firms fail to optimally use the funds for productive purpose. This is because; liquid assets are relatively less productive than loans.

Finally it has been found out that both firm specific financial performance and macro economic performance have no significant effect on credit risk of commercial banks in Ethiopia under all of the five estimation models. Beck, Jakubik, & Piloiu (2013) suggest that GDP growth was the major driving force of credit risk during the past decade. They also claim at the same time that economic activity cannot fully explain the trend of non-performing loans across countries and over time. Therefore, study at hand is consistent with these previous research results. This indicates that the different estimators result into the same value irrespective of whether or not the assumptions under each model are satisfied.

Table13. Comparison of Test Results of credit Risk under Different Models

	OLS estimator			Fixed effect estimator			Random Effect estimator		
LLP_TL	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>t	Coef.	Std. Err.	P>z
TE_TA	**-0.17**	**0.04**	**0**	**-0.167**	**0.042**	**0.000**	**-0.168**	**0.04**	**0.000**
CRR	**0.062**	**0.034**	**0.073**	**0.063**	**0.035**	**0.076**	**0.064**	**0.034**	**0.06**
LNDP	**0.063**	**0.018**	**0.001**	**0.073**	**0.021**	**0.001**	**0.069**	**0.02**	**0.000**
GDPgr	0.287	0.223	0.2	0.198	0.219	0.368	0.23	0.214	0.282
Roa	0.117	0.295	0.692	-0.165	0.317	0.604	-0.071	0.302	0.815
Liq	**0.123**	**0.034**	**0.000**	**0.139**	**0.037**	**0.000**	**0.133**	**0.035**	**0.000**
OS	**0.048**	**0.007**	**0.000**	**0**	**(omitted)**		**0.049**	**0.012**	**0.000**
_cons	-0.08	0.028	0.007	-0.062	0.028	0.033	-0.074	0.028	0.009
				sigma_u=	0.0244		sigma_u = 0.013		
				sigma_e=	0.0253		sigma_e= 0.025		
				rho=	0.4822		rho =		0.2

Source: Authorôs computation on data obtained from national bank of Ethiopia

Table 13 continuedé

	xtscc estimator			FGLS estimator		
LLP_TL	Coef.	Drisc/Kraay Std. Err.	P>t	Coef.	Std. Err.	P>z
TE_TA	**-0.17**	**0.036**	**0.001**	**-0.11**	**0.022**	**0**
CRR	**0.062**	**0.061**	**0.333**	**0.006**	**0.015**	**0.666**
LNDP	**0.063**	**0.027**	**0.044**	**0.024**	**0.011**	**0.039**
GDPgr	0.287	0.421	0.511	0.03	0.072	0.674
Roa	0.117	0.342	0.74	-0.18	0.161	0.263
Liq	**0.123**	**0.074**	**0.128**	**0.08**	**0.018**	**0.000**
OS	**0.048**	**0.015**	**0.008**	**0.048**	**0.015**	**0.002**
_cons	-0.08	0.028	0.018	0.003	0.016	0.835

Source: Authorôs computation on data obtained from national bank of Ethiopia

Ownership structure and credit risk exposure

In this section, the study result of whether or not credit risk depends ownership structure, i,e being government owned bank and private bank affects credit risk exposure was tested. Accordingly, in the main model, it has been found out that ownership structure significantly affects credit risk exposure. The next concern is to show whether there is significant difference in credit risk exposure between government owned and privately owned banks. In line with this, t-test has been made and found out that government owned banks have significantly more credit risk exposure than privately owned banks.

Table 14 shows that the average risk exposure of government owned banks is far more than that of privately owned banks. To test whether this difference is statistically significant, the independent sample test result is indicated in table 15.

Table 14: Group Statistics

	Ownership Structure	N	Mean	Std. Deviation	Std. Error Mean
Credit Risk	Government owned	22	.080480	.0605892	.0129177
	Privately Owned	77	.029652	.0197284	.0022483

Source: Author's computation on data obtained from national bank of Ethiopia

Accordingly, Levene's Test for Equality of Variances shows that equal variance not assumed is found to be appropriate as the corresponding sig. value is 0.000, implying that the null hypothesis that claims that equal variance is assumed will be rejected. Therefore, the p-value under equal variance not assumed row will be considered. Thus, there is significant credit risk mean score difference between government owned and privately owned commercial banks in Ethiopia. This result is consistent with the result of previous studies. For instance, according to Zribi & Boujelbegrave (2011), the relationship between public owned or state-owned banks and their levels of risk shows that state owned bank take more risk as compared to the privately owned banks (for further information, refer to table 15).

Table 15: Independent Samples test result Credit risk

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Credit Risk	Equal variances assumed	89.33	0.00	6.34	97.00	.000	.051	.008	.035	.067
	Equal variances not assumed			3.88	22.29	.001	.051	.013	.024	.078

Source: Author's computation on data obtained from national bank of Ethiopia

6. CONCLUSION AND RECOMMENDATION

Based on the findings of the study, it could be concluded that capital (negatively and significantly affect credit risk under the five alternative models. On the other hand, banking regulation positively and significantly affect credit risk; lending structure(loan to Deposit ratio) positively and significantly affect credit risk under all the five models and finally bank liquidity has positive and significant effect on credit risk under the four of the five alternative modes.

It has also been found out that credit risk depends on ownership structure, where government owned commercial bank has significantly more mean score of credit risk exposure than privately owned banks. Finally, both macroeconomic performance and ROA as proxy of firm specific performance have no significant effect on credit risk.

The author thus suggests that banks need to reduce the level of their debt; keep their liquidity at optimal level, reduce cash reserve ratio only to the level legally required so as to reduce their risk exposure.

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