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Factors Influencing the Level of Credit Risk in the Ethiopian Commercial Banks: The Credit Risk Matrix Conceptual Framework

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Abstract
This paper investigates factors influencing credit risk. The study applied both descriptive and econometric model using data from1990-2012. The study finds that quantity of risk and quality of risk management related variables has got much influence on the credit risk level of Banks. Nevertheless, risk direction related measures, which are mostly external focus, have limited influence on credit risk. More specifically the variation in the effect of stock and flow measures entails banks to further enhance mostly two of Basel principles: operating under a sound credit granting process and maintaining an appropriate credit, administration, measurement and monitoring process.

Introduction

Credit risk is the potential that a contractual party will fail to meet its obligations in accordance with the agreed terms (Brown and Moles, 2012). It, as defined by the Basel Committee on Banking Supervision (2001), is also the possibility of losing the outstanding loan partially or totally, due to credit events (default risk). The committee asserts that loans are the largest and most obvious source of credit risk for banks. This fact is also applies to Ethiopian banks whose more than half of their asset portfolio is constituted by loans and advances. In addition, recent financial record as well shows that banks hold excess provision than expected due to problems in the quality of assets. To be exact the provision held for loans even triples the general provision requirement for healthy loans. In addition, a survey of the literature shows that the studies are highly focused to separate the influence of macro- and microeconomic factors that led to an increase in bad loans. In such endeavor, polarization towards selecting specific internal or specific external factors is noted. Therefore, the main purpose of this study is to follow a comprehensive approach towards identifying credit risk influence factors. A credit risk matrix model approach with consideration for the three basic elements of the matrix: the quantity of risk, quality of risk management and direction of credit risk is followed. In addition, the study aims to develop a workable conceptual framework to be applied for the assessment of credit risk.

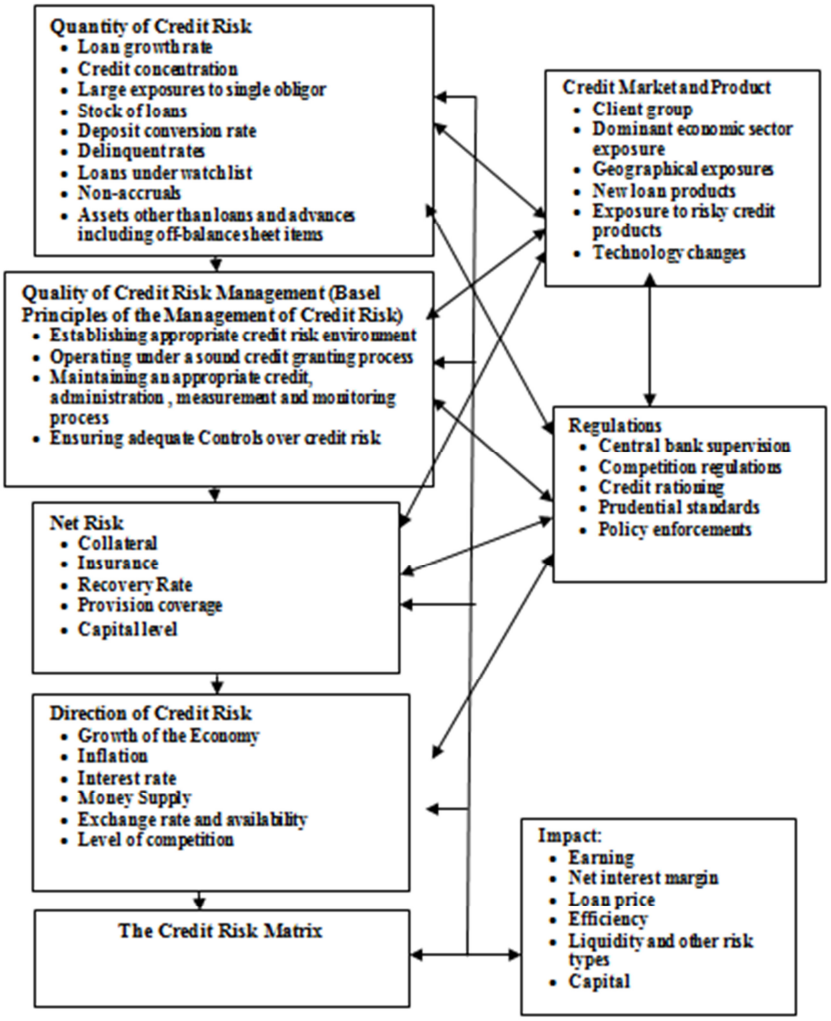
Literature Review and Conceptual Framework of the Model

Literature

There have been mixes of approaches used by the literature to analyze factors that possibly influence credit risk. Some of the research works are focused on internal variables only (Moses 2013, Ayni and Moki, 2012, Newaz 2012), others provide separate evaluation of external variables (including macro and industry factors) (Demirgüç-Kunt and DetrIche 2011; Ravi 2013). The rest few also have consideration for both internal and external variables (David 2013, Grigori and Igor 2011, Pestova). In terms of findings, Kurawa observed that 50% of the studies reviewed by him depicted negative relationship of credit risk with profitability., The literature mostly has used model based evaluation of the determinant factors of credit risk factor for banks (Kurawa 2014).However, a matrix based assessment of factors that impacts the level of credit risk are scanty. Even if there appear a very close link in approach and variable setting, the below stated conceptual framework is applied to set the model of the study and to contribute for the literature. In terms of variable definition, the literatures reviewed are mostly focused on variables which can easily be measured through quantitative ratios. Therefore, it seems highly dominated by quantity of credit risk variables that are directly inferred from the publicly available financial records of banks. Even in cases of studies done using both internal and external determinant factors, it is observed that quality of risk management related issues are not given the required attention. Hence, some studies ignore qualitative parameter which can indirectly be measured through mediating variables and can have utmost influence in the level of credit risk. The schematic diagram below provides a conceptual framework for holistic evaluation of the determinants and effects of credit risk. The conceptual framework has segregated credit risk to consist of quantity, direction and quality of credit risk management related factors. Most of the quantity and direction determinants might have a standard measurement to observe their trend and effect on selected measures. However, quality of credit risk management which is highly related with systems on credit granting, monitoring, and follow-up and oversight has obvious problem of direct quantitative representation. Hence,

properly screening out mediating variables that can closely measure the effectiveness and strength of the established credit risk management system is a necessity. In addition, the impact of credit risk on both the earning and capital position requires deeper assessment through considering the parameters in the credit risk matrix than a mere spotlight on the quantity variables or detaching other components of the matrix. There should also be consideration for changes in the regulatory approaches and the competition and innovation in the credit market. Therefore, the credit risk matrix appears as the final input to have a conclusive remark on the level and severity of credit risk of a bank with possible further analysis on its impact on performance, risk, price, efficiency etc related issues.

Figure 1: Conceptual Framework- The Credit Risk Matrix



Source: Basel Core principles for the Management of Credit Risk and Author Compilation of the Different concepts related to Credit Risk

Methodology

The study follows a quantitative approach consisting of both descriptive and econometrics techniques and relying on data from secondary sources. The major data sources are the various annual publications of the NBE and each commercial bank with coverage from 1990-2012. A total of eight big and middle sized banks, which are government or private owned, out of the 16 commercial banks in Ethiopia are considered for the research. This will represent 89% in terms of loan market share and 50% in number.

Model Specification

A multiple linear regression model is used to test the relationship between the level of credit risk exposure and its determinants stated in the credit risk matrix. The linear equation relating the stated relationship is as shown below:

$C_{jt} = f(QC_{jt} + QT_{jt} + DC_{jt})$ ……..(equation 1)

Where C_{jt} represents credit risk exposure measures for bank j during period t; QC_{jt} are quantity of credit risk determinants for bank j at time t; QT_t are quality of credit risk management related determinants at time t for bank j and DC_{jt} are determinants of the direction of credit risk at time t for bank j.

Hence, the general model to be estimated is of the following linear form:

$C_{jt} = \beta_j + \sum\beta_k X^K_{j\,t} + \varepsilon_{jt}$ ……. (equation 2)

$\varepsilon_{jt} = v_i + u_{jt}$

Where C_{jt} is the credit risk exposure of bank j at time t, with i= 1….N; t=1…T, β_j is a constant term, X_{jt} are k explanatory variables and ε_{jt} is the disturbance with v_j the unobserved effect and u_{jt} the idiosyncratic error.

Therefore, the explanatory variables are grouped as per equation 1 as quantity of credit risk measures, quality of credit risk management measures and direction determinants. Hence, substitution of equation 1 in to equation 2 yields the following general specification model:

$C_{jt} = \beta_j + \sum\beta_k X^{QC}_{jt} + \sum\beta_k X^{QT}_{jt} + \sum\beta_k X^{DC}_{jt} + \varepsilon_{jt}$…….(equation 3)

Where the xjt with superscripts QC, QT and DC represent the quantity of credit risk, quality of credit risk management and direction related determinants as stated in equation 1.

More specifically, the econometric model can be expressed in mathematical form incorporating the identified variables. In order to allow for the inexact relationship among the variables as in the case of most economic time series variables error term' u_t' is added to form equations.

Model :

$PRTL_t = LNTA_t + SBL_t + LNG_t + LOGTA_t + LNDP_t + NIM_t + CR2_t + LNGD_t + INFL_t + u_t$

Analysis and Discussion of Results

Descriptive Statistics

The proxy measure for the level of credit risk, the provision to loan (PRTL) ratio appear on the high side with mean and maximum value of 10.3% and 20.5 %, respectively (see table 1). This has witnessed the large stock of provision set aside for problem loans which by large exceeds the provision required for loans under pass(1%) and special mention (3%) status. The level therefore confirms that credit risk has been the major concern of the Ethiopian banking industry.

The share of loans from total assets with mean and maximum value of 44% and 58%, respectively revealed more than half of the bank's asset is held by loans advances. This provides a good indication that the lending activity and hence the traditional intermediation business has been the major source of income and remained the major business activity of banks. Similar fact has been revealed on the share of loans from the deposit stock of banks where at maxima about74% of mobilized deposit is converted to loans. Despite such record the growth rate of loans is with variation, standard deviation of 30.9% and minimum growth rate of -17% but the average growth rate is positive contributing for the expansion in the loan book. The possible exposure of a single obligor from the industry as a whole has a mean closer to 1 Billion Birr and extends at maximum of 4 billion. The variation in this regard is very large witnessing the huge lending capacity difference among Ethiopian banks. The disparity seems to have a strong link with the high concentration revealed in the credit market. The variable selected to show the trend and level of market concentration, the two banks concentration ratio (CR2) in fact has revealed a downward move but the level still witnessed the dominance of few players in the credit market. The improved trend, however, is an indication of the increased involvement of private banks in the market. Worse to note, before the policy measure of the 1990's that allows private banks to operate in the banking market, the credit market has been totally owned by the government banks and mainly by the Commercial Bank of Ethiopia.

Regression Analysis

The estimated variables in the regression model are a combination of three major classes of credit risk: quantity of credit risk, quality of credit risk management and direction of credit risk indicators. The specific variables used in each group are:

1. Quantity of credit risk indicators- The loan to total asset (LNTA) which measures the exposure level of banks to credit risk, the Single Borrower Limit (SBL), which is a measure of the risk from credit concentration or the maximum level of exposure to a single obligor and the growth rate of loans (LNG) which specify the rate of expansion of the credit activity of banks.
2. Quality of credit risk management indicators – the natural logarithm of total assets (LOGTA) which is the customary measure of bank size and hence the impact of the learning effect, the loan to deposit (LNDP) which is an efficiency measure that indicates bank's ability to convert their liquid assets in more productive investments like loans and advances and the net interest margin (NIM), a profitability indicator for the lending business.
3. Direction of credit risk indicators – the two- banks concentration ratio (CR2) that shows the level of concentration and hence the level of competition in the loan market, the natural logarithm of the real gross domestic product (LNGD) which shows the growth trend of the Ethiopian economy and the

inflation (INFL) variable, an external factor that can have impact on the price of lending and hence the debt repayment capacity of borrowers.

4. The provision to total loans (PRTL) is used as a dependent variable.

In order to establish which of group of variables are critically affecting the credit exposure of banks, the estimation of the coefficients has been done in four parts.

1. A separate estimation for the quantity of risk related variables;
2. A separate estimation for the quality of risk management related variables;
3. A separate evaluation of the direction of credit risk related variables and finally
4. A model comprising of the three group of variables have been estimated and the final result is presented based on the combined model.

Explanatory Power of the Model and Model Test

The results of the analysis of variance for the three groupings stated above and for the combined model shows that in most of the models the explanatory variable are significant in explaining the exposure of credit risk. However, in the direction of credit risk related model, the F-value is small and the calculated significance value (0.2643) stood above 0.05 showing the variables in the model cannot separately explain the change in the credit risk level (see table 2).

Similar fact has been revealed in the computed coefficient of determination values. The R-square and the adjusted R are higher for all models except the model for direction of credit risk. Separate evaluation of the three groupings witnessed that the variables in the quantity of credit risk model, which is an inward looking model, have got more power to explain the variation in credit risk followed by the model for quality of credit risk management. Hence, the result yielded variables related to quantity of credit risk and quality of credit risk management has got more influence to explain variation in credit risk. As mentioned above and as shown in the estimation result the direction related variables does not have much power to explain variations. Interestingly, the combined model for the three sub model groupings has a coefficient of determination exceeding the values revealed in each model. Therefore, it seems that the addition of more variables has increased the explanatory power of the model. A multicollianrity test applying the Variance Inflation factor and a correlation matrix has been done so as to assure if such increase has emanated from strong correlation between variables than the natural growth explanatory power of the model due to the addition of more variables. In all of the variables selected, the VIF appear less than 10. But in some of the variables (LOGTA and LNDP) the VIF exceeds 5, therefore part of the increase can be explained by the relatively high correlation among some of the variables (see table 3). This will not be a surprise as some of the variables are highly tied with major balance sheet components having a very close association such as assets, loans and deposits. However, the major part of the increase is a result of the combined effect of variables from each model which has increased the representativeness of the model. The Breusch-Pagan / Cook-Weisberg test shows heteroskedasticy is not significant in the model.

Empirical Result

The empirical result revealed that majority of quantity of risk related factors, all variables of the quality of credit risk management and one of the direction of credit risk related variables appear significant to affect the proxy measure for credit risk, the PRTL.

The quantity of credit risk variable, the ratio of loans to total asset has significant relationship with credit risk exposure. The relationship witnessed that as the share of loan book from the total asset increases the exposure to credit risk will be large and significant. This is in line with the expected result as Ethiopian banks are dependent on the intermediation business for their earning sources; the possibility of exposure to high risk borrower base is on the high side. In addition, the restricted access to high earning investments than loans and advances oblige banks to flex the credit approval procedures. The study also finds that the variable related credit concentration, the SBL also has significant influence on credit risk. The surprising result is that it has negative relationship with credit risk. This seems against some of risk management principles which by large counsel for risk diversification through reducing exposures. However, the empirical result shows that few and well managed large exposures could contribute positively to reduce credit risk of banks. This is supported by the ease to institute credit risk management strategies such as strong follow-up, portfolio management and monitoring system.

The quality of credit risk management variable, the LOGTA, which is a customary measure used to observe the effect of bank size on credit risk exposure resulted in significant relationship. The relationship in fact is in same direction. In Ethiopian context, the variable has a strong link with the age of banks. The main intention of its addition in the model is to test for the two contrasting opinion with regard to bank size. The first argument is that a bank staying long which obviously will have relative large size will enjoy the credit market in placing a better credit risk management framework. Hence a reduced level of credit risk is expected due to the

learning curve effect. The counter argument is that the high stock loans and advances in the portfolio of big and long staying banks will increase the chance for augmented credit risk level. The study finding is in favour of the second argument that high stock of loans is a cause for increased credit risk and outweighs the learning effect argument. A contrasting finding is that banks with a credit risk management system which is capable to convert deposit into loans are exposed to less credit risk. This seems the flip side of the large stock argument where high share of credit in the total asset could cause increased credit risk. However, the variable, LNDP, is a flow than a stock measure. Thus, a credit management system which is capable to produce new loans in line with mobilized deposits could have a possibility to reduce credit risk. The argument is also supported by the loan growth rate parameter, LNG. This is a natural phenomenon in banking environment where credit classification basically depends on loans past due date. Fresh lending usually takes time to be relegated to non-performing loans and high growth of loans coupled with accelerate conversion of deposit to loans for certain period could dilute the level of non-performing assets. However, as stated above the high stock of loans would be a cause of concern unless credit growth is backed by strong risk management system. The intermediation output measure, the NIM obviously has a negative relationship with credit risk. The effect of non-performing loans is not only limited to the cost of provisions but also affects the level of interest income to be realized from loans. As per National Bank Directives, interest recognition on accrual basis is allowed only for healthy loans. Therefore, high credit risk level creates increased level of non-accrued interest that directly impacts the net interest margin via reducing the level of recognizable interest income. This by large reflects the double-crossing effect of credit risk whose impact goes beyond the figures revealed in the publically available financial records of banks.

Among the identified direction of credit risk indicators, the two banks' concentration measure (CR2) appears significant to affect the level of credit risk. The surprising result is that it has positive association witnessing the competition level in the loan market is an important variable to be considered during credit risk assessment of banks. In other words, improving the competition in the market has positive implication on ensuring quality credit portfolio. The study finds that other external variables such as the growth rate of the economy and the inflation rate does not have significant effect on the proxy measure.

Conclusions and Recommendations

This paper investigates factors influencing credit risk. The study applied both descriptive and econometric model using data from1990-2012. The study finds that quantity of risk and quality of risk management related variables has got much influence on the credit risk level of Banks. Nevertheless, risk direction related measures, which are mostly external focus, have limited influence on credit risk. More specifically the variation in the effect of stock and flow measures entails banks to further enhance mostly two of Basel principles: operating under a sound credit granting process and maintaining an appropriate credit, administration, measurement and monitoring process.

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Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
PRTL	23	10.33845	5.146591	2.4246	20.4547
LNTA	23	43.99887	7.574944	29.9445	57.6226
SBL	23	956.3779	1194.669	30.4875	4195.425
LNG	23	22.32638	30.94217	-17.5254	137.7828
LOGTA	23	4.443152	.4939281	3.5209	5.3577
LNDP	23	54.14745	12.31678	30.1864	74.5704
NIM	23	2.096491	.7556385	.8625	3.1656
CR2	23	81.49463	15.76048	54.3897	100
LNGD	23	6.717391	5.346252	-4.4	12.5
INFL	23	10.204	11.1209	-7.2	36.4

Source: Author Compilation from the Bank's financial statements analyzed in STATA 10

Table 2: Explanatory Power of Models

Model Summary					
Model	**R Square**	**Adjusted R**	**Std. Error of the**	**F**	**Sig**
Quantity of Credit Risk	0.6081	0.5463	3.4667	9.83	0.0004
Quality of Credit Risk	0.5586	0.4889	3.6795	8.01	0.0012
Direction of Credit Risk	0.1845	0.0558	5.001	1.43	0.2643
Combined Model	0.8298	0.7120	2.7618	7.04	0.0010

Source: Author Compilation from the Bank's financial statements analyzed in STATA 10

Table 3: Correlation Matrix

	PRTL	LNTA	SBL	LNG	LOGTA	LNDP	NIM	CR2	LNGD	INFL
PRTL	1.0000									
LNTA	0.2084	1.0000								
SBL	-0.1594	-0.3836	1.0000							
LNG	-0.4556	-0.3723	0.1344	1.0000						
LOGTA	-0.5124	-0.2959	0.3742	0.1304	1.0000					
LNDP	-0.1237	0.4873	-0.1503	0.0064	0.1016	1.0000				
NIM	-0.6133	0.4119	0.3918	0.2440	0.3716	0.3407	1.0000			
CR2	0.1625	0.3636	-0.2270	0.1249	-0.8305	0.1211	0.0437	1.0000		
LNGD	-0.3599	-0.5595	0.4006	0.4317	0.5089	-0.1903	0.1247	-0.5064	1.0000	
INFL	-0.3841	-0.5884	0.4612	0.3528	0.3274	-0.4870	-0.1257	-0.3837	0.5338	1.0000

Source: Author Compilation from the Bank's financial statements analyzed in STATA 10

Table 4: Estimation

PRTL	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]	
LNTA	.8103491	.2929771	2.77	0.016	.1774107	1.443288
SBL	-.0087747	.0029984	-2.93	0.012	-.0152524	-.002297
LNG	-.0084513	.0342324	-0.25	0.809	-.0824059	.0655033
LOGTA	25.5787	10.3421	2.47	0.028	3.235958	47.92144
LNDP	-.6647678	.2271841	-2.93	0.012	-1.155569	-.1739664
NIM	-1.539577	2.02094	-0.76	0.460	-5.905552	2.826399
CR2	.2191843	.1559329	1.41	0.183	-.1176882	.5560568
LNGD	.00166	.2022326	0.01	0.994	-.435237	.4385569
INFL	-.0348523	.0930991	-0.37	0.714	-.2359807	.1662762
_cons	-108.6801	53.53633	-2.03	0.063	-224.3383	6.978119

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of prtl
chi2(1) = 1.20
Prob > chi2 = 0.2738

Source: Author Compilation from the Bank's financial statements analyzed in STATA 10

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