

Determinants of Commercial Banks Lending: Evidence from Ethiopian Commercial Banks

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Abstract

The study was mainly aimed to confirm the main determinants of commercial bank lending in Ethiopia by using panel data of eight commercial banks in the period from 2005 to 2011. It tested the relationship between commercial bank lending and its some determinants (bank size, credit risk, gross domestic product, investment, deposit, interest rate, liquidity ratio and cash required reserve). Seven years financial data of eight purposively chosen commercial banks were used for analysis purpose. Ordinary least square (OLS) was applied to determine the impact of those predictor variables on commercial bank lending. The result suggests that, there is significant relationship between commercial bank lending and its size, credit risk, gross domestic product and liquidity ratio. But deposit, investment, cash required reserve and interest rate does not affect Ethiopian commercial bank lending for the study period. The study suggests that commercial bank have to give more emphasis to credit risk and liquidity ratio because it weakens banks loan disbursement and leads a bank to be insolvent.

Keywords: Commercial Banking, credit risk, deposit, interest rate, lending,

1. INTRODUCTION

Lending is the main function of commercial banks- evidenced by the volume of loans that constitute banks' assets and the annual considerable raise of loan which is granted to borrowers both to private and public sectors of the economy. Lending is the principal business for most commercial banks. Consequently, loan portfolio is the largest asset and source of revenue for banks (Comptroller, 1998). In view of the significant contribution of loans to the financial health of banks through interest income earnings, these assets are considered the most valuable assets of banks. Bank loan is typically the largest asset and the predominant source of income for banks. Since 1963 commercial banks in Ethiopia perform several banking business like attracting all types of deposit and granting loan and advance to borrowers for the sake of increasing their investment capacity. As a result commercial bank plays a great role for the growth of the economy by maintaining three main operating guiding principles, which are profitability, liquidity and solvency. Hence, cash required reserve become an alternative way to maintain banks liquidity. Consequently, national bank of Ethiopia set this requirement. Nevertheless, these policies or requirements are at the center of an intense national debate. There is a world-wide contention on the issue- some researchers believe such requirements promote disintermediation of commercial bank credit while others stand at the opposite. Christian & Pascal (2012), Cargill and Mayer (2006), and Montoro and Moreno (2011) contended that, an increase in reserve requirement case to decrease bank credit. On the other hand Friedman and Schwartz (1963) claim that, a raise in Commercial Bank cash required reserves sources to increase its credit creation ability. Olusanya, s. et al, (2012) also reveal that, required reserve has positive impact on commercial bank loans and advances. I.e. banks credit raise when cash required reserve increase. Again, Meltzer (2003) reveals that a raise in reserve requirements would have little or no impact on credit supply. Chandler (1971) also supports by uttering that an increment in reserve requirements does not encourage banks to hold back their lending or sell securities or cause interest rates to rise. Further, Wilcox (2012) sustains that changes in reserve requirements had only small and statistically insignificant impacts on bank loans and investments. These various approaches have been used to examine the effects of cash required reserve on a broad array of banks credit. However, the evidence is not uniform and consistent in indicating that whether cash reserve affects commercial banks' credits or not a relative handful of studies (like; Chang, 1996, 1999; Wilcox, Olusanya, et al, 2012, Chandler, 1971, Christian & Pascal, 2012, Friedman & Schwartz, 1963) had specifically examined whether the amount of cash reserve requirement effect is positive, negative or no effect on bank loans and advance. Generally, this study aimed to determine the effect of common determinants of commercial banks lending; and thereby, to provide empirical evidence about the effects of cash required reserve on commercial bank credit. As far as the researcher is concerned, there is no a researcher who tried to deal with factors that determine commercial banks lending in Ethiopia.

2 LITERATURE REVIEW

As literature suggests determinants of commercial bank lending behavior may be classified into internal and external factors: named as liquidity ratio, interest rate, gross domestic product, cash reserve requirement, deposit, investment portfolio and exchange rate as of (olokyo, 2011). Olusanya, et al,(2012) also examines the

determinants of commercial bank lending behavior in Nigeria case and He found that, foreign exchange rate, investment portfolio, deposits and liquidity ration have positive impacts on commercial bank lending volumes, while the coefficients of lending interest rate and minimum cash reserve ratio were negative. Lastly, Chernykh and Theodossiou (2011) reveal that, the size of the bank which is measured by assets and the bank capitalization are the only determinants of businesses and long-term loans. Ewert et al. (2000) also examine the determinants of bank lending performance in Germany. And it gives a controversial finding which states riskier credit contracts are assigned lower interest rate premiums by banks. Chodechai (2004) in his investigation titled as, factors that affect interest rates, degree of lending volume and collateral setting in loan decision of banks; state that, banks have to be careful with their loan pricing decisions. Because if banks charge too low loan rates the revenue from the interest income will not be enough to cover the cost of deposits, general expenses and the loss of revenue from some borrower. Hence, charging too high loan rates may also create an adverse selection situation and moral hazard problems for the borrowers. Borio (1995) investigated the structure of credit to nongovernment sector and channel of monetary policy in fourteen industrialized countries and reveals that, the structure of credit was largely determined by interest rate. Irina B. (2003) assess bank liquidity and exchange rate in European perspective; and claim that, higher lending rates do not encourage banks to lend more. Abd Karim et al. (2011) investigated the impact of interest rate on bank lending in Malaysia context: and contented that, interest rate affect bank lending negatively, while controlling for other macroeconomic variables such as GDP and Inflation. Abd Karim, Mohd & Adziz (2007) also reveal that, monetary policy tightening instruments like interest rate in Malaysia reduces bank lending to all the sectors. But it is sever in some sectors such as manufacturing and suggest that, interest rates are positively associated with Islamic financing and negatively associated with conventional loan. Usman (1999) by investigating a major regulation affecting commercial banks lending in Nigeria; reveal that, while central bank reduces the rate what the bank charges from borrower, banks become reluctant to provide loan to firms. Bank charge high interest premium for the borrowers who have higher credit default risk to repay the loan (Ewert et al, 2000).

According to Bashir, (2003) large-sized banks have the advantage of providing a larger menu of financial services to their customers and there by mobilize more funds. Cole et al. (2004) also suggest that, smaller banks adopt small business loan underwriting practices that are riskier than those of larger banks. More over Salas and Saurina (2002) assert that, a big balance sheet allows managers to invest in different geographical or business segments to deal with asymmetric shocks. Rajan and Dhal (2003) indicates that, banks size has significance effect on occurrence of nonperforming loan.

King (1986) by investigating monetary transmission through bank loans and establishes that, change in GDP cause to change volume of loan. Baum, Caglayan and Ozkan (2005) found that, an increase in uncertainty of industrial production leads to somewhere a reduction in the dispersion of bank loans-to-asset ratio for total loans, real estate loans and household loans. Talavera, Tsapin and Zholid (2006) Found that, banks make out more loans during periods of boom and curtail lending when the economy is in recession. De Young, Gron, and Winton (2005) again found, during an economic expansion demand for lending is high and business profitability is good, resulting in more profitable loans, more bank capital and an expanding credit environment in which banks lend more at lower rates as they compete for business.

Mansor H. I. (2006) note that, gross domestic product affect bank loans positively since an increase in GDP causes a raises in both supply and demand for loans. An increase in GDP means more funds are available for banks to make loans since deposits are more likely to increase. Pruteanu-Podpiera (2007) investigated the impact of monetary policy, gross domestic product growth rate and inflation on growth rate of total loans in Czech banks from 1996 to 2001. The result suggests a strong positive effect of GDP growth on the growth rate of loans, but the impact of interest rates was negative. As Rehana and Rizwana (1998) found, the level of economic activity is expected to make a positive impact on bank advances as it does not increases the demand for advances only but the supply of loan able funds as well.

Abdul Karim, Azman-Saini & Abdul Karim (2011) investigated bank lending channel of monetary policy in Malaysia case from 1913 to 2008. And show that, bank liquidity determines banks' loan supply. According to Goldfield and Chandler (1980) commercial banks must pay more attention to its liquidity because high turnover obtained from their debt liabilities. Aisen and Franken, (2010) examine bank credit during 2008 financial crises: with a cross country comparison. The study argued that, banks which faced ultimate liquidity stress lost their ability to lend more.

Credit risk is critical since the default of a small number of important customers can generate large losses which can lead to insolvency (Bessis, 2002). Variation in credit risk may reflect a change in the health of a bank's loan portfolio (Cooper et al., 2003), which in turn may influence the performance of the institution. Lending is the primary functions of banks, and precisely assessing a borrower's credit worthiness has always been the only method of lending successfully (Andrew Fight, 2004). More financial institutions are exposed to high risk loans and the higher accumulation of unpaid loans. Implying that, these loan losses have produced lower returns to many commercial banks (Miller and Noulas, 1997). Chodechai (2004) further stressed that, banks' lending

decisions influenced by the past relationship with the borrowers, which enables to have more accurate understanding of the borrower's business and financial situation.

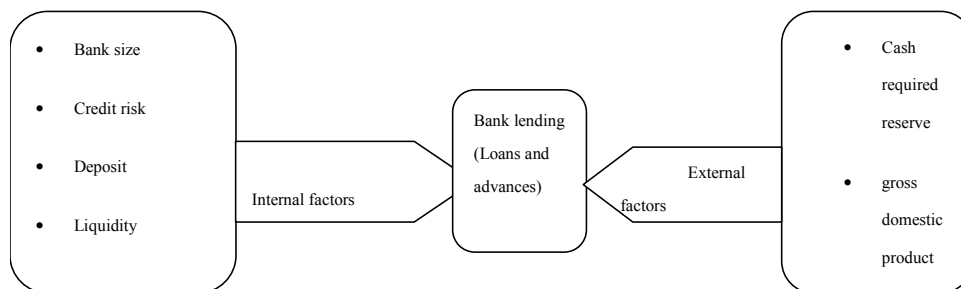
According to Mc Carthy et al. (2010) Customers' deposit is the primary source of bank loan. And thereby, deposits directly have a positive effect on lending. Moreover, Sebastian (2009) strongly reveal that, demand deposit liabilities had the most significant and positive influence on banks' credit allocations in Nigeria case.

Generally, lending is the main means of income and the most profitable asset for the bank which is determined by bank size, credit risk, liquidity, cash required reserve, deposit, Investment, interest rate and gross domestic product. Literature reveals mixed results concerning to the relationship between commercial bank lending and these expected factors. Despite its mixed results most of the finding reveals a positive association between bank size, , credit risk, deposit, gross domestic product and bank lending while investment and interest rate negatively associate it. However, the effect of cash required reserve on commercial bank lending falls under a serious argumentative issue. Some finding state that, cash required reserve reduce commercial bank credit; while others claim that, it encourage bank credit and the rest shows, no relation or its effect is insignificant. This lack of consensus among researchers requires further investigation; accordingly the researcher needs to look this issue in Ethiopia context.

2.5 CONCEPTUAL FRAMEWORK

As empirical evidences suggest commercial bank lending is affected by internal and external factors. Hence, this study used both internal and external determinants of bank lending jointly which includes; bank size, credit risk, deposit, liquidity, investment, cash required reserve, lending interest rate and gross domestic product.

Figure 1:



Source – Owen

GAP IN LITERATURE (NEED OF THE STUDY)

Olusanya et al. (2012) and Olokoyo F. (2011) had investigated the determinants of commercial banks lending to show the effect of internal and external variables on commercial banks' lending in Nigeria case and also Yannis and Aristotelis(2013) in Greece context. However, the issue investigated, it fails to look the effect of bank size and credit risk on commercial banks lending. Hence, this short coming of the study calls for further study. Accordingly, the researcher comes in a position to investigate this notion in Ethiopian case by using seven years panel data from eight commercial banks from 2005 up to 2011.

STATEMENT OF THE PROBLEM

Lending is undeniably the heart of banking business (Adedoyin and sobodun, 1996). Granting loans and advance for the borrower is the main activity that generates income for banks highly. Therefore, loan portfolio is typically the largest asset and source of revenue for banks. However, loans and advance is the most profitable and liquid asset for the bank to maintain its maximum liquidity obligation to their depositors or lenders; banks do not invest its entire fund in a profitable asset (Nwankwo, 2000).

Bank accept customer deposits and use that fund to grant loans to borrowers or invest in other assets that will yield a return higher than the amount bank pays the depositor (McCarthy et al., 2010). It is understandable that, the main source of lending is deposit or money accepted from the depositor but the amount that would have to be lent is a certain percentage of the total deposited amount and the remaining is kept as a reserve for the purpose of maintaining its liquidity.

In Ethiopia, under Article 2.1(a) of the directive, National Bank of Ethiopia requires any bank operating in Ethiopia to maintain in its reserve account of 5% (five percent) of all birr and foreign currency deposit Liabilities held in the form of demand or current, saving and time deposit. Although bank's loan portfolio is the main means of income for the bank, commercial banks in our country do not invest their entire resources in this profitable asset rather they keep a portion of its resources idle to meet cash required reserve. A consolidated balance sheet of commercial banks shows that, all commercial banks maintain; 750, 1030, 427, 855, 1411, 1995, 2799 billion birr from 2005 to 2011 as a legal reserve which is too large relatively to its asset. Nevertheless, this requirement is aimed at maintaining bank liquidity it open question whether a reserve requirement may achieve a contraction in domestic credit or not.

As far as the researcher is concerned, there is no a researcher who tried to deal with factors that determine commercial banks lending behavior in Ethiopia.

PURPOSE STATEMENT

The main objective of this study was to investigate the main determinants of Ethiopian commercial banks lending.

More specifically, the study was aimed at addressing the following specific objectives;

- To determine the effect of internal factors (bank size, credit risk, deposit, liquidity ratio and investment in security) on commercial bank lending.
- To determine the effect of external factors (Gdp, cash required reserve and interest rate) on commercial banks lending.

HYPOTHESIS OF THE STUDY

To achieve study’s objective the researcher developed the following research hypotheses i.e. the main arguments of the study were fashioned in to two alternative hypotheses.

- ✓ **H1:** There is significant relationship between commercial banks’ lending and internal factors- bank size, credit risk, deposit, liquidity ratio and investment in security.
- ✓ **H2:** There is significant relationship between commercial banks’ lending and external factors- Gdp, cash required reserve and interest rate.

3. RESEARCH METHODOLOGY

This section presents the methodologies that were employed to achieve studies objective. To achieve study objective as well as to test the hypothesis by large, the study employed quantitative research design. For the purpose of this study quantitative approach was employed to establish how independent variable affects dependent variable. Target population was all banks that engage in commercial activities and registered by National Bank of Ethiopia to act. In our country 19 Commercial Banks are operating. Out of these commercial banks, eight of them were taken for the purpose of this investigation purposively by taking in to account the availability of data, cost, time and due to the importance of experience in the industry to understand factors that would affect banks’ credit. Secondary data was sourced from financial statements of sampled banks which were submitted to national bank. Accordingly, panels of seven years financial data of sampled banks were obtained from National Bank of Ethiopia which covers from 2005-2011. The cut off year was by considering that it offers recent time series observations. Accordingly, the study would have 56 observations i.e. seven observations for each individual bank. Lastly collected data was analyzed and interpreted by using multiple regression analysis with a package of version 11 stata software.

OPERATIONALIZATION OF STUDY VARIABLES

This section presents the measurements that were employed to operationalize the study variables. For this study, lending was used as a dependent variable which is determined by many factors. And those factors were chosen by taking in to account the availability of data and its influence on bank lending as mentioned in literature.

Table 3.1 Definition of Variables (proxies), symbols and Expected Signs.

Symbol	variables	Operational Definition /Measurements/	Expected sign
Ld	Lending	Natural logarithm of Net loans and advances	
Bsiz	Bank size	Natural logarithm of total asset	Positive
Gdp	Gross domestic Product	Current year Real GDP minus Previous Year Real GDP / Previous year Real GDP.	positive
CR	Credit risk	A ratio of nonperforming loan / Total Asset	Positive
Lr	Liquidity ratio	Liquid asset / Total Deposit	Positive/Negative
Vd	Volume of deposit	Deposit/ Capital.	positive
Rr	Cash reserve	Cash required reserves / Total Asset	Positive/Negative
Ip	Investment portfolio	A bank’s total investment in security / Total Asset.	Negative
Ir	Interest rate	Annual average bank lending rate.	Positive/Negative

MODEL SPECIFICATION

To test the hypothesis the study model has been developed as follows . Ordinary least square model was used to test hypothesis.

$$Ld = f(Bsiz, Cr, Gdp, Ip, Ir, Lr, Rr, Vd).....(1)$$

Where Z restrains other variables not explicitly included in the model.

Thus, the regression equation for this study becomes;

$$Ldit = \alpha_0 + \beta_1 Bsizit + \beta_2 crit + \beta_3 Gdpit + \beta_4 Ipit + \beta_5 Irit + \beta_6 Lrit + \beta_7 Rrit + \beta_8 Vdit + \mu \dots \dots \dots (2)$$

Where:

Ld it: Loans and Advances of bank i at time t.

Bsiz it: size of bank i at time t

er it : credit risk of bank i at time t.

Gdp: gross domestic product.
 i at time t.

Ip i t: Investment Portfolio of bank

Ir it: Interest Rate (Lending Rate) of bank i at time t.
 at time t.

rr it: Cash required reserve of bank i

Lr it: Liquidity ratio of bank i at time t.

Vd it: Deposits of bank i at time t.

μ : error term or residual in the model.

α : intercept of the regression line.

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7$: are parameters or coefficients of the independent variables estimated.

4. RESULTS AND DISCUSSION

As displayed in regression result table below, R-square of the model was about 90.02%. Mean while, about 90.02 percent variation in commercial banks lending explained by factors (predictor variables) included in the model for the test period. P-value of F-statistics (Prob>F= 0.00000) is significant at 1 percent level of significance. Hence, it reveals that a model used for this study was good enough fitted.

As the empirical finding suggest there are positive statistically significant relationship between commercial bank lending and its size which is consistent to Cole et al. (2004) and Andreas & Gabrielle (2009) finding. The study also finds statistically significant positive relationship between commercial bank lending and credit risk which is similar with Chimérine (1998). Gross domestic product has positive statistically significant relationship with commercial bank lending for the test period which agrees with Mansor (2006) finding. It is evident from analysis that, liquid asset to deposit ratio had positive and statistically significant relationship with commercial bank lending which is significant at 1% level of significance. This result is consistent with Abdul Karim, Azman-Saini & Abdul Karim (2011).

The analysis suggests that, cash required reserve have positive statistically insignificant relationship with commercial bank lending. For that the null hypothesis, which states there is no relationship between cash required reserve and commercial bank lending was accepted and the alternative hypothesis was rejected. However, it is insignificant. Hence, Ethiopian commercial bank lending behavior does not influenced by cash required reserve from 2005 to 2011. This finding agrees with; Wilcox, James A. (1984), Meltzer (2003) and Chandler (1971); and refutes Christian & Pascal (2012) findings that show a significant relationship between reserve requirements and commercial bank credit.

Table 4.3 Linear regression result

	Coefficient	Std. Err.	T-statistics	P-value	
Bsiz	.012448	.0009044	13.76	0.000	Number of obs = 56
Cr	.0238813	.0030142	7.92	0.000	R-squared = 0.9002
Gdp	.0010799	.0009975	1.08	0.028	Adj R-squared = 0.8833
Ip	.0006896	.0028829	0.24	0.812	F (8, 47) = 53.02
Ir	.0242312	.0149754	1.62	0.112	Prob > F = 0.0000
Lr	.0072372	.0016689	4.34	0.000	RootMSE = .0011
Rr	.0134959	.0295741	0.46	0.650	
Vd	.0016074	.001027	1.57	0.124	
Cons	-.0318433	.0047986	-6.64	0.000	

As the empirical finding show, investment portfolio has been found as positive statistically insignificant relationship with commercial bank lending. This implies that, when a bank engages in investing its resources in different financial instruments that bears interest for the bank, its ability of lending also increase. However it is insignificant. In Ethiopia investment doesn't influence commercial bank lending. The reason might be, due to an absence of well developed financial market where commercial papers, stocks, treasury certificates and bankers' acceptances were traded.

Lending interest rate is another variable that has been found as positive statistically insignificant relationship with commercial bank lending. Thus, the researcher fails to reject the null hypothesis that states there is no relationship between lending interest rate and commercial bank lending. Hence, Ethiopian commercial banks

lending do not affected by lending interest rate. It might be due to a change in borrowers demand for loan in response to interest rate variation, which is not considered in this study. The finding is similar with Usman (1999).

The other hypothesis developed for this investigation was, relationship between liquid assets to deposit ratio with commercial bank lending. It is evident from analysis that, liquid asset to deposit ratio had positive and statistically significant relationship with commercial bank lending which is significant at 1% level of significance. As the finding shows, when a ratio of liquid asset to deposit becomes large (bank maintains large assets easily convert able to cash at a low cost) a bank's loans and advances also become high. As the regression coefficients shows, every 1% increase in liquidity ratio, on average, leads commercial banks lending to increases by 0.72372 %. This result is consistent with Abdul Karim, Azman-Saini & Abdul Karim (2011).

As regression coefficient reveals, deposit have positive statistically insignificant relationship with commercial bank lending. It concurs with Mc Carthy et al. (2010) finding which demonstrates deposit positively affects bank credit. It might be due to most of the deposits what a bank accept are in demand form which is repayable to depositors on demand. As a result banks may maintain large amount of customer deposits as a reserve to meet customers demand instead of lending. Or it may that banks does not issue immediate loan from currently deposited amount.

The analysis suggests the determinants of commercial bank lending are; bank size, credit risk, gross domestic product and liquidity ratio.

FINDINGS

Bank size had positive and statistically significant influences on commercial bank lending. Credit risk is statistically significant determinant of commercial bank lending. Gross domestic product affects commercial bank lending positively. Investment had positive statistically insignificant relationship with Ethiopian commercial bank lending. Lending interest rate has positive statistically insignificant relationship with commercial bank lending. Liquidity ratio had positive and statistically significant relation with commercial bank lending. Cash required reserve affects commercial bank lending positively however it is insignificant. Deposit has positive and statistically insignificant relationship with commercial bank lending.

RECOMMENDATION

Commercial bank is the leading financial institution in granting of loans advances to individuals, business or firms. Again this service is the main means of revenue for the bank. Accordingly, to improve commercial bank lending it is better to identify main determinants of its lending. Thus depending on studies major finding, I like to suggest the following points.

Ethiopian commercial banks should have to strive to strength its asset size, since its asset size determines its ability in new loan disbursement. I.e. large asset size allows banks to create new loan and to diversify loan investment which also makes possible to reduce credit risk.

Ethiopian commercial bank lending was mainly affected by credit risk. Therefore, Commercial bank should have to establish credit policies and standards that conform to regulatory requirements and the bank's overall objectives.

Loan portfolio is the most profitable asset. So, a concern body should have to review the adequacy of credit training across the bank.

CONCLUSIONS

The study examined the relationship between Ethiopian commercial banks' lending with bank size, credit risk, gross domestic product, investment, liquidity ratio, interest rate, cash required reserve and deposit from 2005 up to 2011 using lending (LD) as dependent variables. These predictor variables were included in the model to estimate its impact on commercial banks' lending. Parameters were estimated using the Ordinary Least Square (OLS) method and study findings reveal that; bank size, Credit risk, gross domestic product and liquidity ratio had positive statistically significant influences on commercial bank lending. Whereas Investment, interest rate, liquidity ratio, cash required reserve and deposit does not affect commercial bank lending for the test period. A positive regression coefficient of bank size, credit risk, gross domestic product and liquidity ratio implies that, they are tend to be move in the same direction with banks' lending. Hence, the regression coefficients show that, every 1% increase in bank size, credit risk, gross domestic product and liquidity ratios cause to change commercial bank lending by 0.012448, 0.2388, 0.0010799 and 0.0072372 percent respectively.

5.3 SUGGESTION FOR FURTHER RESEARCH

This investigation fails to consider factors that may affect individuals demand for loan and it focus only the determinants of commercial banks lending on supply side. So if someone investigates this issue by emphasizing both supply and demand side determinants of loan by incorporating excluded banks the finding may be relatively fruit full.

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Appendix A: Tests for Multiple Regression and Panel Data:

1. Multicollinearity Test Using Variance Inflation Factor:

Variable	VIF	1/VIF
cr	8.69	0.115077
bsiz	7.30	0.136911
ip	6.90	0.144883
lr	2.26	0.443441
rr	2.19	0.457064
ir	2.03	0.492020
gdp	2.00	0.500474
vd	1.56	0.642137
Mean VIF	4.12	

VIF greater than 10 and 1/VIF is less than 0.10 indicates the presence of multicollinearity. The result shows that, no multicollinearity problem since VIF less than 10 and 1/VIF is greater than 0.1

2. Normality Test: Shapiro wilk test for normal distribution of residuals.

H0: Variables are normally distributed

Shapiro-wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
residual	56	0.98099	0.978	-0.048	0.51927

The null hypothesis states that the distribution of the residuals is normal; here we fail to reject null hypothesis, as long as a Shapiro-wilk test is insignificant. Then we conclude that residuals are normally distributed.

3. Breusch-Pagan / Cook-Weisberg test for Heteroskedasticity

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity

H0: Constant variance

Variables: fitted values of ld

chi2(1) = 1.07
 Prob > chi2 = 0.3016

Since the result is insignificant rejecting alternative hypothesis becomes appropriate; that indicates the presence of heteroskedasticity, and accept null hypothesis which states there is constant variance (homoscedasticity).

4. Ramsey Test for Model Specification

Ramsey RESET test using powers of the fitted values of lending.

Regression specification error test for omitted variables (ovtest)

Ramsey RESET test using powers of the fitted values of ld

H0: model has no omitted variables

F(3, 44) = 9.79
 Prob > F = 0.0000

Ramsey reset test is significant at 1% level of significance; accordingly, we conclude that there are factors not included in the model.

5. Hausman Test for Random Vs Fixed Effect

Test: Ho: difference in coefficients not systematic

$$\begin{aligned} \text{chi2}(8) &= (b-B)'[(V_b-V_B)^{-1}](b-B) \\ &= 5.80 \\ \text{Prob>chi2} &= 0.6698 \end{aligned}$$

Hausman test was statistically insignificant. So, null hypothesis which states random effect is appropriate; was accepted.

6. Breusch and Pagan Lagrangian Multiplier Test for Random Effect

Breusch and Pagan Lagrangian multiplier test for random effects

$$1d[\text{bank}, \tau] = x\beta + u[\text{bank}] + e[\text{bank}, \tau]$$

Estimated results:

	Var	sd = sqrt(Var)
1d	.0000103	.0032111
e	1.22e-06	.0011060
u	0	0

Test: $\text{Var}(u) = 0$
 $\text{chi2}(1) = 0.76$
 $\text{Prob} > \text{chi2} = 0.3844$

Here we failed to reject the null and conclude that random effects are not appropriate. There is no evidence of significant differences across banks (no panel effects). Therefore, simple OLS regression was chosen.

7. Autocorrelation test

Breusch-Godfrey LM test for autocorrelation

lags(p)	chi2	df	Prob > chi2
1	0.205	1	0.6511

H0: no serial correlation

Since Breusch Godfrey result is insignificant we fail to reject a null hypothesis, which states no serial correlation. Therefore, we conclude that there is no serial correlation in the model.

Appendix B: List of Banks Sampled*

Awash International Bank
 Bank of Abyssinia
 Commercial Bank of Ethiopia
 Construction and Business Bank
 Dashen Bank
 Nib International Bank
 United Bank
 Wegagen Bank
 * ordered alphabetically

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