

The Effect of Dollarization on the Growth of Non-Performing Loans in the Zimbabwe Banking System: An Autoregressive Distributed Lag (ARDL) Bound Test Approach

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Abstract

This research evaluates the effect of dollarization and internal bank factors that caused unprecedented high levels of non-performing loans (NPLs) in the Zimbabwe banking system. In examining the surrounding issues, recommendations are made, which might resolve or at least ameliorate Zimbabwe's NPLs problem. The study employed an autoregressive distributed lag (ARDL) bound test procedure by making use of the financial soundness indicator data for a Zimbabwe banking system for the period 2000-2014 on a quarterly basis. Empirical findings indicated that the dollarization has no influence on the growth of NPLs both in the short and long run. Among bank fundamentals, however, liquidity, return on equity, efficiency and interest rate spread proved to be prominent bank-specific determinants of NPLs. The findings also suggest that return on equity and NPLs from previous period are positively related to current levels of NPL. On the other hand, however, liquidity, cost efficiency and interest rate spread variables in the long-run were found to have a negatively significant impact on NPLs.

Keywords: banking system, non-performing loans, dollarization, ARDL, Zimbabwe

INTRODUCTION

A well-developed banking system allows for competition that impacts on interest rates and has an undoubtedly positive effect on investment activities that generate economic growth (Sontakke and Tiwari, 2013). The importance of the banking systems in contributing to economic development has been magnified in recent studies, which has shown that banks' performance and profitability contribute to the countries' development (Levine, 1997).

The general view is that higher and sustainable real GDP growth usually translates into more income which, in turn improves the borrowers capacity to service the debt. There is, however, significant empirical evidence regarding the behaviour of the non-performing loans (NPLs) which are considered anti-cyclical. Conversely, when there is a slowdown in the economy the level of NPLs is likely to increase as unemployment rises and borrowers face greater difficulties to repay their debt (Fofack, 2005; Jimenez and Saurina, 2005; Rajan and Dhal, 2003; and Salas and Saurina, 2002).

NPLs have, therefore, often been related to bank failures and financial crises in the world and are part of the measurement of asset quality among lending institutions (Guy, 2011). The benchmarks used for identifying NPLs are more varied across Sub-Saharan Africa wherein some countries use quantitative criteria to distinguish between "good" and "bad" loans (for example, the number of days of overdue scheduled payments), while others rely on qualitative norms (such as the availability of information about the client's financial status, management ratings and perspectives about future payments) (Fofack, 2005).

BACKGROUND

Banks' main roles are to serve as the catalysts for savings mobilisation in the economy on the one hand and financing of investment and economic activity (both productive and consumptive) on the other, as well as being the platform of transmission of financial impulses across and among internal sectors, and propelling Zimbabwe's interface with the rest of the world's economic and financial systems (Makina, 2009).

Since the liberalization of the Zimbabwe economy in the late 1990's, there have been significant changes in the structure of the banking sector (Chigumira *et al.* 2014). In the 1990s following liberalization of the financial sector, there was a credit boom in which loans were issued without proper risk assessment or appropriate valued collateral. As a tightening of monetary policy to curtail high bouts of inflation during the period there was a reduction in aggregate demand which caused a slowdown in economic activity.

The reduction in economic activity resulted in the poor servicing of loans which caused a spike in NPLs. NPLs/Loans ratio peaked to levels never seen before. In 2003-2005 at the crescendo of the Zimbabwean financial crisis, many commercial banks became insolvent. By end December 2004 NPLs reached a staggering 28.9 percent (RBZ, 2005). The dramatic expansion of the banking sector in the late 1990's culminated with the financial sector crisis, leading to the closure of a number of banking institutions.

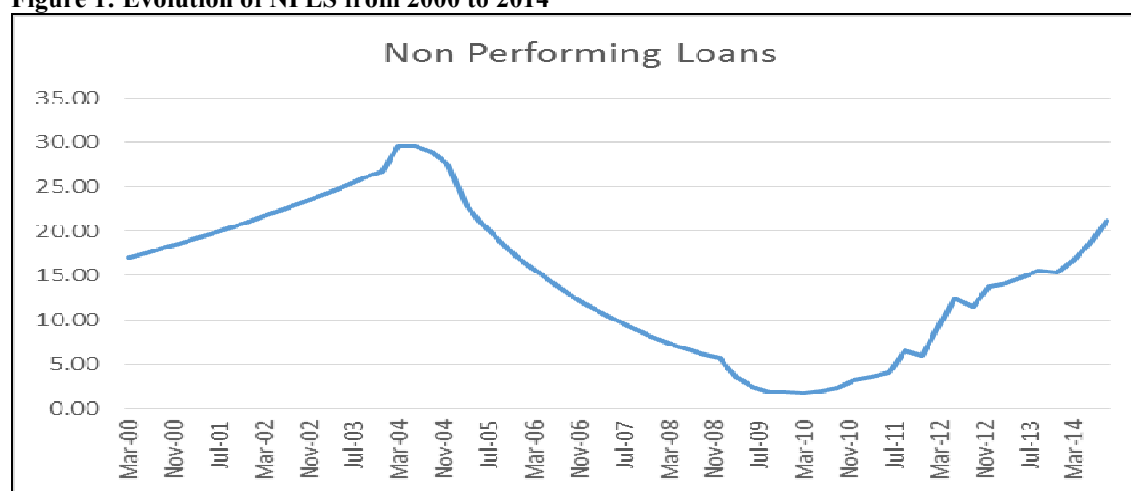
The turbulence in the Zimbabwean financial sector on the back of serious liquidity shortages during the last quarter of 2003, necessitated the introduction of the Troubled Banks Fund (TBF) in December 2003

with the aim of safeguarding and minimising disruptive medium-term liquidity mismatches, RBZ (2006). The TBF served as a contingent pool from where banks that faced liquidity challenges accessed funding to stabilise their operations.

The thrust was to ensure financial stability while the affected institutions put in place corrective and remedial measures to address the liquidity challenges. Banks that accessed the TBF were required to operate under close supervision by the Reserve Bank and also to provide a plan of measures to resolve their liquidity challenges

The monetary policy statement issued on 18 December 2003 marked a turning point for the Zimbabwean financial services sector. Amid fears of a deeper financial crisis to the whole banking industry through systemic risk, the Reserve Bank embarked on rigorous effort to instil discipline and bring sanity into the financial sector. Some banking institutions were found to be unsafe and unsound, such that NPLs rose from about 15% in 2000 to nearly 30% in 2004. Resultantly, in 2004 nine financial institutions were placed under curatorship (RBZ, 2004). From the period March 2005 to December 2008, the banking sector, however, witnessed a decline in NPLs from 22.84% to 5.695, respectively. Figure 1 shows how NPLs have evolved since 2000.

Figure 1: Evolution of NPLS from 2000 to 2014



Source: RBZ (2014)

After the adoption of the multicurrency system in February 2009 by the Zimbabwe Government, some measure of confidence was restored in the banking sector, as measured by the phenomenal increase in deposits from as low as US\$300 million in 2009 to US\$4 billion in 2013 (RBZ, 2014). During the same period, however, NPLs in Zimbabwe, increased significantly and rate of growth in loans also declined. The rate of NPLs increased from below 2% in March 2009 to above 20% by September 2014, in tandem with the decline in real economic growth from 11.4% recorded in 2010 to an estimate of 3.1% in 2014, (MOFED, 2014). The high levels of NPLs also reflect the lack of cooperation among banks in sharing customer information and the absence of a credit reference bureau, according to the RBZ (2014).

This study is motivated by the desire to fill a gap that exists in the literature on studies that examine the relationship between dollarization and banking sector performance and to establish a causal relationship. Literature relating to the causal relationship in Zimbabwe, is, however limited, as such, this study is expected to contribute to literature by providing insights into the effect of dollarization on banking sector performance using a quantitative approach. Recent studies using qualitative methods on the effect of dollarization on Zimbabwe banks performance were done by Chikoko (2012, 2013 and 2014) who investigated commercial banks' credit process with the objective of understanding the fundamental causes of asset impairment and also the potential sources and determinants of liquidity risk after dollarization whilst Mabvure (2012) undertook to understand the causes of NPLs at a specific commercial bank.

LITERATURE REVIEW

There are three elements of literature on NPLs as noted by Tracey (2011). The first focuses on the role of macroeconomic performance, and the management quality and policy choices in explaining NPLs across banks. The second element of literature examines the impact of micro-financial conditions on NPLs by highlighting the positive impact of NPLs on the probability of banking crisis, supported by Kaminsky and Reinhart (1999) who established that a large increase in NPLs could be used to predict a crisis. Finally, the third branch of literature focuses on predicting NPL at the macroeconomic level from aggregate NPL ratios.

Louzis *et al.* (2011), pointed out that the unique features of the banking sector along with the specific policy choices by individual banks in respect with efforts to maximize efficiency and improve in its risk management are expected to exert a vital influence on the evolution of NPLs.

Khemraj and Pasha (2009) examined the determinants of NPLs for Guyana, using a panel dataset and a fixed model. They were interested in determining the relationship between NPLs and bank specific variables namely, loans to total assets ratio, bank size, real interest rate and annual growth in loans. Their findings indicated that banks which charge relatively higher interest rates and lend excessively are likely to incur higher levels of NPLs.

Messai and Jouini (2013) conducted a study to detect the determinants of NPLs for a sample of 85 banks in three countries (Italy, Greece and Spain) for the period of 2004 to 2008. They employed some bank specific variables to the bank in their study. The bank specific variables which were used include the return on assets, the change in loans and the loan loss reserves to total loans ratio. Their findings indicated that NPLs vary negatively with the profitability of banks' assets and positively with the loan loss reserves to total loans.

Employing a balanced panel framework and utilizing quarterly data from six commercial banks in Barbados over the period 1996 to 2010, Guy and Lowe (2012) found that both macro and micro variables are critical to understanding the behaviour of NPLs. The research reviewed that the loan-deposit ratio, though insignificant, had a positive impact on NPLs in the same period, but has an alternating effect in later periods. Real GDP growth was proved to be significant in the model, with economic expansion reducing loan delinquency contemporaneously and with a lag of 1 year.

Tiffany and Kester (2011) also examined NPLs and bank stability in Barbados. They used a series of bank idiosyncratic variables to explain NPLs. The study employed a balanced panel framework, utilizing quarterly data from six commercial banks over the period 1996 to 2010. Using panel data techniques, the relationship between bank stability and NPLs was examined at the aggregate as well as the individual bank level. The idiosyncratic variables that were included in the study were the return on asset ratio, loans to deposit ratio and loan growth. Their findings suggested that micro variables are critical to understanding the behaviour of NPLs. The loan growth and loans to deposit ratio (risk appetite proxies) were considered to drive NPLs as more aggressive lending patterns attracted less qualified borrowers. These findings by Tiffany and Kester (2011) are in tandem with Guy and Lowe (2012) who found that the loan-deposit ratio, though insignificant, had a positive impact on NPLs.

Espinoza and Prasad (2010) using a dynamic panel estimated over 1995–2008 on around 80 banks in the Gulf Cooperative Council (GCC) region found that the NPL ratio worsens as economic growth becomes lower and interest rates and risk aversion increase. Also, firm-specific factors related to risk-taking and efficiency were also found to be related to future NPLs. Using panel VAR, the researchers noted that there could be a strong, albeit short-lived feedback effect from losses in banks' balance sheets on economic activity.

Investigating the relationship between NPLs and bank efficiency in Malaysia and Singapore, Karim *et al.* (2010) estimated cost efficiency using the stochastic cost frontier approach assuming normal-gamma efficiency distribution model proposed by Greene (1990). The Tobit simultaneous equation regression was then used to determine the effect of NPLs on bank efficiency, incorporating the cost efficiency score. The results indicated that there was no significant difference in cost efficiency between banks in Singapore and Malaysia although banks in Singapore exhibit a higher average cost efficiency score. The Tobit simultaneous equation regression results, therefore, indicated that higher non-performing loan reduces cost efficiency. Likewise, lower cost efficiency increases NPLs. The result also supported the hypothesis of bad management proposed by Berger & DeYoung (1997) that poor management in the banking institutions results in bad quality loans, and therefore, escalates the level of NPLs. Bercoff *et al.* (2002) also showed that operating efficiency helps explain NPLs.

After controlling for macroeconomic factors, Sinkey *et al.* (1991), found that bank-specific variables such as loan return, volatile-fund ratio and loan to asset ratio positively impact credit risk in large commercial banks in the United States of America. Other studies have indicated that loan delinquencies are associated with rapid credit growth. Keeton (1997) who used data from commercial banks in the United States (from 1982 to 1996) and a vector auto regression model indicate this association between loan and rapid credit growth. Salas and Saurina (2002) who studied Spanish banks found out that credit growth is associated with NPLs. Study by Bercoff *et al.* (2002) also shows that asset growth explains NPLs.

A study by Warue (2013) on the effects of Bank specific and macroeconomic factors on NPLs in commercial banks in Kenya using a comparative panel data analysis found evidence that bank specific factors contribute to NPLs performance at higher magnitude compared with macroeconomic factors. Therefore, for effective management of NPLs, the study concluded that it is critical for commercial banks to understand and focus more on the management of bank specific factors which they have more control over and seek practical and achievable solutions to redress NPLs problems.

Chikoko *et al.* (2012) studied the gradual deterioration in asset quality as reflected by the NPLs in 15 commercial banks in Zimbabwe after the adoption of the multiple currency exchange rate regime using a survey

research design method. The research findings showed that due to poor credit analysis processes banks were housing a huge portion of nonperforming loans; bank clients were being given wrong products; lending based on balance sheet strength made up of illiquid assets instead of cash flow based lending; comfort in security tendered as collateral; moral hazard due to information asymmetry; economic environment and political influence.

MATERIALS AND METHODS

Data Sources and Type: Statistics on the banking sector in Zimbabwe will be collected from the Reserve Bank of Zimbabwe (RBZ)'s Bank Licensing, Supervision and Surveillance (BLSS) Quarterly Reports for the period March 2000 to September 2014. The International Monetary Fund (IMF) annual Article IV Consultation Reports on Zimbabwe covering the period 2009 to 2014 will also be used to supplement some of the missing information from the BLSS's Quarterly Reports.

Model Specification: In this study we employ an autoregressive distributed lag (ARDL) econometric model that is similar to Jimenez and Saurina (2005) formulation to ascertain the effect of dollarization and bank specific determinants of NPLs in the Zimbabwe banking sector. The ratio of NPLs of the banking sector will be the dependent variable whereas bank capitalization, return on asset, loan provision, dollarization, expense to income ratio, liquidity, profitability, as well as interest rates spread will be the independent variables.

The derivation of the ARDL model follows the assumption by Pesaran *et al.* (2001) Case III with unrestricted intercept and no trend, and the statistical package to handle the investigation is E-views version 8. The bounds test seeks to determine whether or not there is a long run relationship amongst the variables by testing the F-statistic that is generated against the critical values that were stated by Pesaran *et al.* (2001). The estimated conditional ARDL model will be defined as follows:

$$\Delta \ln NPL_t = \delta_0 + \sum_{i=1}^m \theta_i \Delta \ln NPL_{t-1} + \sum_{j=1}^n \alpha_j \Delta \ln LQD_{t-1} + \sum_{j=1}^n \alpha_j \Delta \ln EFF_{t-1} + DLD + \sum_{l=1}^q \varphi_l \Delta \ln ROE_{t-1} + \sum_{m=1}^r \chi_m \Delta \ln SPD_{t-1} + \beta_1 \ln ROE_{t-1} + \beta_2 \ln LQD_{t-1} + \beta_3 \ln NPL_{t-1} + \beta_4 \ln SPD_{t-1} + \beta_5 \ln EFF_{t-1} + \varepsilon_t \dots \dots \dots (1)$$

Where δ_0 represents the NPLs when all the explanatory variables are equal to zero, NPL represents NPLs, LR represents the liquidity ratio, CAP represents capitalization, ROE, the return on equity represents profitability, SPD represents the interest rate spread, EFF, bank efficiency proxies the expense to income ratio and PROV represents the loan loss provision coverage ratio. DLD is the dummy variable representing dollarization. Its values are zero for the period before dollarization and one for the period with dollarization. All variables are expressed in their natural logarithms, except for the dummy variable. The short run dynamics are reflected by the variables with summation signs.

These short run variables represent the significant lags of the explanatory variables. The long run effects are represented by the explanatory variables with β s. The Greek symbols Δ represent the change in the dependent variable due to a percentage change in the explanatory variables. ε_t represent those changes in NPLs that are explained by other random and immeasurable effects.

Therefore, firstly, equation (1) is estimated using the ordinary least squares (OLS). Then the test for a long run relationship amongst the variables is conducted using the Wald test for the joint significance of the coefficients of the lagged level variables ($H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$). The computed F-statistic value is then evaluated against the critical values tabulated by Pesaran *et al.* (2001).

If the generated F-statistic is greater than the upper bound critical value, this means that the variables are co-integrated, that is, they are related in some way or are moving together in the long-run. If the generated F-statistic is lower than the lower critical value it shows that the variables are not co-integrated. However, if the F-statistic is in-between the critical bound, then the result is inconclusive and other co-integration tests may need to be used. If the variables are found to be co-integrated, hence a long run relationship exists and an Error Correction Model (ECM) can then be estimated.

The ECM will be stated as follows:

$$\Delta \ln NPL_t = \delta_0 + \sum_{i=1}^m \theta_i \Delta \ln NPL_{t-1} + \sum_{j=1}^n \alpha_j \Delta \ln LQD_{t-1} + \sum_{l=1}^q \varphi_l \Delta \ln ROE_{t-1} + \sum_{l=1}^q \lambda_l \Delta \ln EFF_{t-1} + \sum_{m=1}^r \chi_m \Delta \ln SPD_{t-1} + \pi_t ECT_{t-1} + \mu_t \dots \dots \dots (2)$$

Variables used in the Model

In this study, the NPLs of the banking sector is the dependent variable, measured using the ratio of gross loan provisions to total loans. Table 1 below presents the variable concepts, expected signs and data measurement.

Table 8: Summary of Variables Used in the Empirical Model

<i>Variable Name</i>	<i>Concept</i>	<i>Measurement</i>
<i>NPLs [NPL]</i>	<i>Perceived riskiness by banks of their loan portfolio. NPLs are defined as the aggregate of substandard, doubtful and loss loans</i>	<i>Ratio of non-performing loan to gross loans.</i>
<i>Liquidity Ratio [LQD](-)</i>	<i>Liquid Asset to Total Deposits</i>	<i>(Cash + securities (TBS, etc.)+ interbank deposits +deposits with foreign banks)/ Total Bank Deposits</i>
<i>Efficiency [EFF](-)</i>	<i>Captures the (in) efficiency of bank management.</i>	<i>Ratio of Expenses to Income</i>
<i>Profitability [ROE](-/+)</i>	<i>An increase in profitability in banks reflects a thriving banking sector.</i>	<i>Return on Equity</i>
<i>Interest Rate Spread [SPD] (+)</i>	<i>Measures of the opportunity cost of holding liquid assets.</i>	<i>Difference between average lending and deposit rate</i>
<i>Dollarization [DLD](+)</i>	<i>Dollarization reduces banking sector performance.</i>	<i>Dummy variable (0 presents period 2005-2008 and 1 presents 2009-2012)</i>

Source: International Monetary Fund (2004), *Financial Soundness Indicators – Concepts and Definitions*; and Staikouras, C. K. and Wood, G. E (2003): “The Determinants of European Bank Profitability.”

Non-Performing Loans [NPL]: The presence of credit risk requires the bank to put a risk premium in the interest rates charged on the credit extended (Fernandez de Guevara and Maudos, 2004). Staikouras and Wood (2003) state that an ideal measure for credit risk is the value of NPLs as the numerator and the total gross value of the loan portfolio as the denominator. This is used as a proxy for asset quality and is intended to identify problem with asset quality in the loan portfolio

Profitability [ROE]: The European Central Bank (ECB, 2010) defines bank performance in terms of its capacity to generate sustainable profitability. In this study, return on equity (ROE) will be used as a measure of profitability and is intended to measure how well a bank’s management is deploying the shareholders' capital. Therefore, *ROE* is more than a measure of profit; it's a measure of efficiency. A rising *ROE* suggests that a bank is increasing its ability to generate profit without needing as much capital. In other words, the higher the *ROE* the better and falling *ROE* is usually undesirable.

Efficiency [EFF]: The efficiency ratio is defined as ratio of bank’s operating expenses to its income and measures the (in) efficiency of bank management. In their seminal paper, Berger and DeYoung (1997) investigated the existence of causality among loan quality, cost efficiency and bank capital. In their study, two hypotheses were formulated as follows:

- ‘Bad management’ hypothesis: low cost efficiency is positively associated with increases in future NPLs. The proposed justification links ‘bad’ management with poor skills in credit scoring, appraisal of pledged collaterals and monitoring borrowers.
- ‘Skimping’ hypothesis: high measured efficiency causes increasing number of NPLs. According to this view, there exists a trade-off between allocating resources for underwriting and monitoring loans and measured cost efficiency. In other words, banks which devote less effort to ensure higher loan quality will be more cost-efficient, however, there will be a burgeoning number of NPLs in the long-run.

Dummy Variable - Dollarisation [DLD]: According to Levine *et al.* (1997), there are variables that can play a very important role in the explanation of an econometric model that are not numerical or easy to quantify. Thus, a dummy or indicator variable is an artificial variable created to represent an attribute with two or more distinct categories or levels. Therefore, a dummy independent variable (also called a dummy explanatory variable) which for some observation has a value of 0 will cause that variable's coefficient to have no role in influencing the dependent variable, while when the dummy takes on a value 1 its coefficient acts to alter the intercept. In this study, the time period with dollarisation, March 2009 to September 2014 is represented by 1s and 0s otherwise.

Interest Rate Spread [SPD]: This represents the difference between the average deposit rate and the average lending rate. Interest rate spread is also an indication of earnings and underlying profitability of bank and can also be used as a gauge of competitiveness within the banking sector. According to Collins *et al.* (2011) interest rate spread affect performing assets in banks as it increases the cost of loans charged on borrowers. Nampewo (2012) also found that NPLs significantly and positively affect the interest rate spreads.

Liquidity Ratio [LQD]: The liquidity ratio is the ratio of liquid assets to total deposits. Quispe-Agnoli and Whisler (2006), highlight that some of the prudential norms in dollarized banking systems to reduce liquidity risk entail maintaining higher liquidity reserve requirements. These in turn reduce banks’ profits since banks have to hold more liquid assets which earn little to no return. Thus the liquidity ratio is expected to be negatively related to NPLs.

RESULTS

Descriptive statistics: These are used to describe the basic features of a sample one is working with, and can also show data anomalies as well as any patterns emerging from the data. The descriptive statistics include mean, standard deviation, the measures of skewness and kurtosis. These statistics enables the analysis of normality of the variables. Table 2 below shows the descriptive statistics for the variables used in the study:

Table 9: Descriptive Statistics

	LQD	NPL	EFF	ROE	SPD
Mean	50.55	14.58	66.63	40.57	3310.79
Median	56.30	15.36	70.88	56.77	11.20
Maximum	87.06	29.64	179.30	94.06	73747.79
Minimum	24.27	1.70	7.73	-9.60	-6029.81
Std. Dev.	17.72	8.26	31.68	31.74	13004.00
Skewness	0.09	0.00	0.20	-0.24	4.14
Kurtosis	2.13	1.92	4.41	1.53	20.07
Jarque-Bera	1.94	2.87	5.24	5.89	885.22
Probability	0.38	0.24	0.07	0.05	0.00
Sum	2982.28	860.23	3931.38	2393.77	195336.70
Sum Sq. Dev.	18204.19	3952.65	58203.22	58440.62	981000000.00
Observations	59	59	59	59	59

Source: Eviews 8.0 – Own Calculations

The Jarque-Bera test, tests whether the distribution that the data comes from is a normal distribution. The null hypothesis for this test is that the data is normally distributed. From table 2 above, the Jarque-Bera statistics for the variables under study show that efficiency, return on equity ratio and interest rate spread variables are not normally distributed at 5% level of significant. This may reflect the presence of outliers such that the average spread in the period 2000 to 2007 was about 220%, in 2008 the spread averaged above 50 000% and then after the adaptation of multi-currency system the average interest rate spread is about 4.5%. The non-normality of these variables will be dealt with by transforming the data into logarithmic form.

Even though the average NPL ratio for the period under consideration is 14.85%, the variance of NPLs is very high at 68.23%, which implies that good banks fare better but bad banks are in worse position. These banks, whilst very few have the most serious and sticky bad loan problems, which if left unattended are likely to become much worse impacting adversely the whole banking sector through systemic risk.

Unit Root Test: For this study, the unit root test used was the ADF test. Engle and Granger (1987) contends that a reasonable regression can only be done only when all variables are stationary. The ARDL approach, however, does not require unit root tests of variables but, unit root testing may show the order of integration for each variable. The Augmented Dickey Fuller (ADF) test was used to test the variables for the presence of a unit root. Table 3 below shows the results of the unit root test.

Table 10: Unit Root Test for Stationarity

Variable	ADF t-Statistic		Overall Decision Rule
	In Levels	First Difference	
EFF	-2.109176	-11.64273***	Stationary @ I(1)
LQD	-0.804409	-4.242952***	Stationary @ I(1)
NPL	-1.299947	-2.031398**	Stationary @ I(1)
ROE	-0.954366	-7.317347***	Stationary @ I(1)
SPD	-3.365743***		Stationary @ I(0)

*(**) [***] Statistically significant at a 10 (5) [1] % level

The unit root test above reflects that all the variable except the interest rate spread variable are stationary after first difference, that is they are integrated of first order, I(1). The interest rate spread is stationary at level, that is I(0). Therefore, the study will employ an ARDL approach to co-integration because unlike the Johansen and Julius (1990) co-integration method, which requires that all variables be integrated of the order one, bounds testing is more flexible as it allows I(0) and I(1) variables to be combined. This technique is also suitable for small and finite sample sizes (Pesaran, *et al.* 2001), which is ideal for our sample of 59 observations.

The estimation of equation 1 using the ARDL model is reported in table 4. The robustness of the model has been definite by model diagnostic tests such as ARCH test, Jarque-Bera normality test and Ramsey RESET specification test and Breusch-Godfrey serial correlation LM test. The ARDL model was tested for stability using the cumulative sum of the recursive residuals test (CUSUM test, Brown *et al.* 1975). All the tests disclosed that the model has the aspiration econometric properties, such as correct functional form, and the model residual are serially uncorrected, homoscedasticity and normally distributed. The results are therefore

valid for reliable interpretation.

Table 11: Estimated Results for the ARDL Model Based on Equation 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.172798	1.177467	0.996034	0.3374
DLOG(NPL(-2))	0.793346	0.665447	1.192201	0.2545
DLOG(NPL(-1))	-1.101792	0.303652	-3.628475	0.0031
DLOG(EFF(-2))	-1.115941	0.846717	-1.317962	0.2103
DLOG(EFF(-1))	3.348354	1.517779	2.206089	0.0460
DLOG(LQD(-2))	1.196155	0.614814	1.945556	0.0737
DLOG(LQD(-1))	-1.683300	0.925404	-1.818989	0.0920
DLOG(ROE(-2))	-0.495657	0.152143	-3.257831	0.0062
DLOG(ROE(-1))	-0.494860	0.117164	-4.223637	0.0010
DLOG(SPD(-2))	0.042024	0.050085	0.839042	0.4166
DLOG(SPD(-1))	0.061906	0.051656	1.198421	0.2521
DLD	-0.542960	0.149824	-3.623989	0.0031
LOG(NPL(-1))	-0.509083	0.187650	-2.712943	0.0178
LOG(EFF(-1))	0.330003	0.164772	2.002782	0.0665
LOG(LQD(-1))	-0.541126	0.632362	-0.855722	0.4076
LOG(ROE(-1))	0.071969	0.161683	0.445127	0.6635
LOG(ROE(-1))	-0.019777	0.031200	-0.633890	0.5371
R-squared	0.929999	Mean dependent var		0.029012
Adjusted R-squared	0.811536	S.D. dependent var		0.171370
S.E. of regression	0.074396	Akaike info criterion		-2.099630
Sum squared resid	0.071951	Schwarz criterion		-1.087937
Log likelihood	60.79334	Hannan-Quinn criter.		-1.746522
F-statistic	7.850559	Durbin-Watson stat		2.430514
Prob(F-statistic)	0.000211			

Since the model passed the serial correlation and the stability tests, the existence of a long run relationship was then tested using the Wald test. This test for a long run relationship amongst the variables was conducted using the Wald test for the joint significance of the coefficients of the lagged level variables. The calculated F-statistic for the model is 6.65, which is greater than the upper bound of 3.94 for the chosen explanatory variables, thus indicating that there is a long-run relationship amongst the variables in the model.

Table 12: Bound Test for Co-integration Analysis

K	95% Level of Significant		
	I(0)	I(1)	F-Statistic
5	2.78	3.94	6.65

Long-run Relationship: Table 6 shows the outcome of long run estimates. The results shows that dollarization does not have an impact on the banking sector's NPLs because dollarization's P-value is greater than 0.05 and a t-statistic of less than 2. With the passage of time, banks adapt to the changed environment and adjust their credit policies. According to Belgrave, *et al.* (2001), Panama has experienced several major shocks that caused economic disruptions, however, due to dollarization the banking system has held up after domestic banks has established lines of credit with foreign banks with branches in Panama and has been able to draw on them during liquidity crunches. In contrast, a study by De Nicolo *et al.* (2003) found that dollarized economies have a great chance of experiencing financial instability. Quispe-Agnoli (2002), also noted that under full dollarization, the economy is shielded from a currency or balance-of-payments crisis, but the risk of a banking crisis is real and that financial instability is endemic to this system.

Return on equity, interest rate spread, efficiency and liquidity ratio variables were found to be statistically significant, since the p-values are less than 5% level of significant and the t-statistics are above 2. According to the model, return on equity has a positive influence on the level of NPLs, whilst liquidity, interest rate spread and efficiency have a negative impact on NPLs in the long-run. These results are in line with our initial assumptions. The positive impact on NPLs by the return on equity variable are in tandem with the pro-cyclical credit policy' hypothesis, which states that past earnings may be positively linked with future increases in NPLs, as it reflects liberal credit policy on the part of the bank, Louzis *et al.* (2011). On the issue of liquidity impact on NPLs, Kochebey *et al.* (2014) also found a negative a highly significant impact on risk as measured by NPLs, suggesting that banks lowers their riskiness by increasing their liquidity position.

In the case of efficiency which was estimated to be negatively related to NPLs, this result is in line with the bad management hypothesis suggested by Berger & DeYoung (1997). This suggests that after measured cost efficiency declines, NPLs increase, possibly because of poor loan portfolio management as predicted by the bad management hypothesis. In support of this result, Karim *et al.* (2010) also found out that bank efficiency is negatively related to NPLs in Malaysia and Singapore banking systems.

According to the long-run results the interest rate spread is negatively related to NPLs, which is inconsistent with the view that banks tend to shift the risk associated with NPLs to customer (Barajas *et al.* 1999). This result could be the result of inadequate provisioning for loan losses that is, higher NPLs would reduce banks' income, thereby lowering the spread in the absence of adequate loan loss reserves. The result could also reflect the fact that a banking system with a high proportion of bad loans may lower spreads (raise deposit rates and lower loan rates) as a way of trying to grow out of their troubles. This result is in line with the findings by Brock and Suarez (2000) who established that NPLs in Argentina and Peru were associated with smaller spreads.

Finally, lagged effects of NPLs were found to be positively and highly significant in influencing current levels of NPLs in the long-run as shown in the model. That is, an increase in past NPLs will almost double the current NPLs level. The results confirm the findings by Rinaldi *et al.* (2006) who suggested that in the long-run, an increase in household indebtedness to income is associated with higher levels of arrears on the previous loans.

Table 13: Estimated Long-run Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.706561	0.389496	4.381461	0.0001
LOG(NPL(-1))	0.968686	0.041538	23.32036	0.0000
LOG(SPD)	-0.046073	0.013700	-3.362943	0.0015
LOG(LQD)	-0.243254	0.105556	-2.304506	0.0254
LOG(EFF)	-0.190179	0.069353	-2.742197	0.0084
LOG(ROE)	0.078467	0.017955	4.370077	0.0001
DLD	-0.225514	0.167562	-1.345853	0.1845
R-squared	0.984258	Mean dependent var		2.423182
Adjusted R-squared	0.982054	S.D. dependent var		0.826976
S.E. of regression	0.110782	Akaike info criterion		-1.435057
Sum squared resid	0.613636	Schwarz criterion		-1.150858
Log likelihood	49.61665	Hannan-Quinn criter.		-1.324356
F-statistic	446.6120	Durbin-Watson stat		2.304674
Prob(F-statistic)	0.000000			

Short-Run Dynamics: A short run adjustment model can be constructed according to an Error Correction Mechanism (ECM) - that is, taking into account deviations from long run relationships. Similar to the long-run results, dollarization was also found not to have any impact on the level or growth of NPLs in the short-run as shown in table 11 above. This result is in contrast to Ozsoz (2007) who found that dollarization puts a downward pressure on the quality of loans in the banking sector resulting in higher loan defaults. Ozsoz (2007), further suggested that dollarization could result in fragility in financial intermediation in dollarized economies. de Nicoló, *et al.* (2003) also noted that dollarization is predictive of the share of non-performing loans.

The rate of adjustment is the coefficient of the variable ECT(-1), which is about -0.65. This means that about 65% of the shock clears the system in the next quarter and it takes about one and half quarters (4.5 months) for the system to adjust back to long-run equilibrium after the initial shock. This speed of adjustment can be evidenced by the continued slow decline in bank profitability and total loans in the banking sector which has stagnated since 2012 (RBZ, 2014) due to the fact that when the banking system started to experience an increase in NPLs the banks curtailed credit to the private sector. In other words, as assets (and accompanying income) upon which loans were created started to deplete, banks grew edgy and got worried about recouping their loans. They demanded higher interest rates and stringent requirements to lend out any further loans.

Table 14: Estimated Error Correction Model (ECM)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.000723	0.024267	-0.029801	0.9764
DLOG(NPL(-2))	0.084831	0.189767	0.447027	0.6573
DLOG(NPL(-1))	0.707654	0.271986	2.601804	0.0130
DLOG(EFF(-2))	-0.142903	0.085808	-1.665384	0.1039
DLOG(EFF(-1))	-0.069666	0.102464	-0.679911	0.5006
DLOG(LQD(-2))	-0.731612	0.377988	-1.935543	0.0602
DLOG(LQD(-1))	0.833567	0.349862	2.382556	0.0222
DLOG(ROE(-2))	0.049708	0.036133	1.375689	0.1768
DLOG(ROE(-1))	-0.042084	0.032095	-1.311231	0.1974
DLOG(SPD(-2))	-0.035828	0.023342	-1.534946	0.1329
DLOG(SPD(-1))	0.012285	0.025912	0.474118	0.6381
DLD	-0.000812	0.046305	-0.017538	0.9861
ECT(-1)	-0.650476	0.377230	-1.724349	0.0926
R-squared	0.631976	Mean dependent var		0.002854
Adjusted R-squared	0.480991	S.D. dependent var		0.161512
S.E. of regression	0.116357	Akaike info criterion		-1.218956
Sum squared resid	0.528018	Schwarz criterion		-0.604117
Log likelihood	51.13078	Hannan-Quinn criter.		-0.980585
F-statistic	4.185703	Durbin-Watson stat		2.038546
Prob(F-statistic)	0.000130			

CONCLUSION

This study has estimated the effect of dollarization and bank-specific determinants of non-performing loans in the Zimbabwe banking system using quarterly time series data from 2000 to 2014 by employing Bound Testing approach. The analysis demonstrates that in both the short-run and the long run, dollarization has no effect on NPLs growth, although they were found to be negatively related but statistically insignificant. Higher ratios of NPLs from previous period were found to be more likely to carry them out to the following periods according to both the short-run and long-run results, since the relationship were positive and highly significant, revealing the persistence of problem loans in the Zimbabwean banking system. Liquidity was found to have a negative impact on NPLs on both the short-run and long-run, contrarily to Chikoko (2013) who found a positive relationship between NPLs and liquidity. The negative relationship, according to Kochubey *et al.* (2014) means that liquidity shortages induces an increase in bank riskiness as measured by NPLs and vice versa and also that banks that face higher risk (NPLs) tend to decrease their liquidity buffer.

The return on equity variable which is a measure of profitability was found to have a positive relationship with the occurrence of problem loan conforms to the pro-cyclical credit policy' hypothesis, which states that past earnings may be positively linked with future increases in NPLs, as it reflects liberal credit policy, Louzis *et al.* (2011). In other words, bank managers' behaviour may be motivated by incentives to convince the market of bank's profitability in the short-run. Finally, the negative relationship between the level of NPLs and efficiency meets our initial expectations. This suggests that after measured cost efficiency declines, NPLs increase, possibly because of poor loan portfolio management as predicted by the bad management hypothesis (Berger and DeYoung, 1997).

The policy implication of this research would be that the Zimbabwe banking sectors NPLs can be impacted by liquidity, return on equity, efficiency and interest rate spread factors. These results imply that policy-makers have to evaluate liquidity as an integral part of the banking activity. Regulatory authorities through the imposition of liquidity thresholds would be able to affect the growth of NPLs. This suggests that bank liquidity is an important coordination tool and supports an implementation of the stable funding ratios in line the new Basel III regulations in addition to capital requirements as argued by Kochubey *et al.* (2014). The banking system regulatory authorities should also focus on managerial performance in order to detect banks with cost inefficiencies which might lead to potential NPLs increases. According to the bad management hypothesis by Berger and DeYoung (1997), the major risks facing financial institutions are caused internally. Therefore, this also suggests that regulatory authorities' bank supervision should consider cost efficiency along with other traditional predictors of troubled banks such as loan losses and credit risk.

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