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The Determinants of Credit Default Risk in Zambia: Does Bank Size Matter?

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Bank of Zambia Working Paper Series

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Abstract

The paper sought to provide answers to the question whether bank size matters in the way credit default risk is affected by its determinants in Zambia. With full knowledge of the structural breaks' breaking point for the series considered in the study, the results show that in the long run, both smaller and bigger banks are influenced by copper prices and capital adequacy. However, bigger banks are also influenced by real effective exchange rate. The estimated coefficients are relatively inelastic for smaller banks but relatively elastic for bigger banks. Both small and big banks pursue a moral hazard behaviour in the long run and bigger banks do so in the short run as well. In the short run, there is high persistence of credit default risk for both category of banks. Smaller banks have a relatively higher speed of adjustment to a long run equilibrium, which maybe characterised by relatively high credit default risk since November 2011. Bigger banks speed of adjustment to their long run credit default risk levels, although high, pushes these banks to a long run position characterised by relatively low levels of risk since 2012. This could explain the divergence in risk levels between the two categories of banks in Zambia. Based on these results, bank size does matter especially with regard to how credit default risk is affected between the two categories of banks in Zambia.

JEL classification: E51
Key words: Credit; risk; bank size

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1. Introduction

1.1. Background

Since the early 1990s, the Zambian banking sector has been substantially liberalized and interest rate controls discontinued. Particularly in the last decade, the relatively stable macroeconomic outturn and the advent of new technology principally mobile technology in addition to Government's liberal policies has substantially eased barriers to entry for new market participants in the banking industry. It can thus be predicted from standard economic theory that these factors should lead to two important outcomes: improvements in accessibility to financial services and a reduction in the cost of lending due to competitive pressure. However, interest rates seem to remain persistently high and market shares remain concentrated in the largest few firms.[2] As a result, intermediation specifically bank lending is low and interest margins are high compared to the rest of the world.[3]

2. Introduction

Credit risk is regarded to be a likelihood of a borrower failing to meet the loan obligation in accordance with the agreed terms contained in a facility letter - i.e. it is a matter implying default - (BIS, 2005). Sy (2007) adds a dimension of challenges faced by defaulters in helping to understand the concept of credit risk. In this regard, he identifies two concepts as underpinning credit default which are; delinquency (failure to meet a loan payment by a due date) and insolvency (the case when one's – company or individual - assets are less than liabilities).

Credit risk is a major concern to both loan underwriters (dominated by commercial banks) and regulators. For underwriters, this does not only adversely affect cash flow (when interest payments stop flowing) but can also result into a loss to the lender (if the principal is not paid in an extreme event when the loan is written off). Regulators are concerned with the adverse impact credit risk can pose to financial stability. A build-up of non-performing assets can adversely affect a bank balance sheet through the erosion of (particularly tier-1) capital (which is used to absorb losses). This can undermine confidence in a concerned bank particularly when liquidity risk manifests. The result may be a bank failure (the regulator's major concern) with a consequence of the problem becoming systemic. This event can grossly undermine financial stability. Credit risk is generally considered the precursor of a bank failure (see for example in Bhattacharya and Roy, 2008; Kaminsky and Reinhart, 1999; Rahman et al., 2004; Atikogullari, 2009; and Adebola et al, 2011).

Most studies on the determinant of credit default risk have often focused on looking at the entire banking industry (as though all banks are homogenous) without viewing big and small banks as being different (heterogeneous). The question that begs therefore, is: does bank

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2 Francis Z.M, Chungu K, Owen M, Tobias R, and Joe S (2014); "Determinants of Bank Lending Rates in Zambia: A Balance Sheet Approach". Bank of Zambia Working Paper No. WP/02/2014

3 Calixte Ahokpossi, Determinants of Bank Interest Margins in Sub-Saharan Africa, IMF Working Paper - African Department (WP/13/34), IMF, 2013

size matter in the way credit default risk is affected by its determinants? Put it differently, if banks are segregated as small and big and modelled separately can one get significantly different coefficients for respective variables of similar nature, or are the set of determinants (variables) different for each category?

The purpose of this paper therefore, is to assess the determinants of credit default risk among Zambian banks based on the heterogonous perspective and observe whether size matters in the context of Zambia. This approach is supported from three theories: structure performance (SP), information advantage (IA), and relationship development (RD) which suggest that lending performance of small banks is likely to be better than that of large banks. For more information on these theories one can look to Akhigbe and McNulty (2003). Based on literature, this maybe the first study to approach credit risk determinants from this angle. Studies on credit risk determinants on Zambia have had little attention in literature with Nikolaidou and Vogiazas (2016) being one contribution to literature on Zambia so far. That study in any case focuses on the entire banking system (treating all banks as homogenous). This study therefore, offers some unique contribution to literature.

In this study bank size is taken to mean market power of individual banks. It is a ratio of individual bank's total assets to industry total assets. Salas and Saurina (2002) provides an intuitive argument concerning relative bank size. They argue that bank size is a reflection of the banks' ability to offer portfolio diversification on the basis of geographical and business segment in order to deal with asymmetric shocks. In their view, the bigger the bank's balance sheet the higher the diversification of its loan portfolio and thus, the lower the risk.

The rest of the paper is structured as follows: section two provides country specific information on economic and banking sector developments. Section three has literature survey with section four providing information on the methodology and estimations. This includes a brief description of the variables (including a priori information) as well as the data used. Section five has concluding remarks and recommendations while section seven has the appendix.

3. Recent Developments in Zambia's Economy and Banking Sector

3.1. Performance of Zambia's Economy, 2005-2016

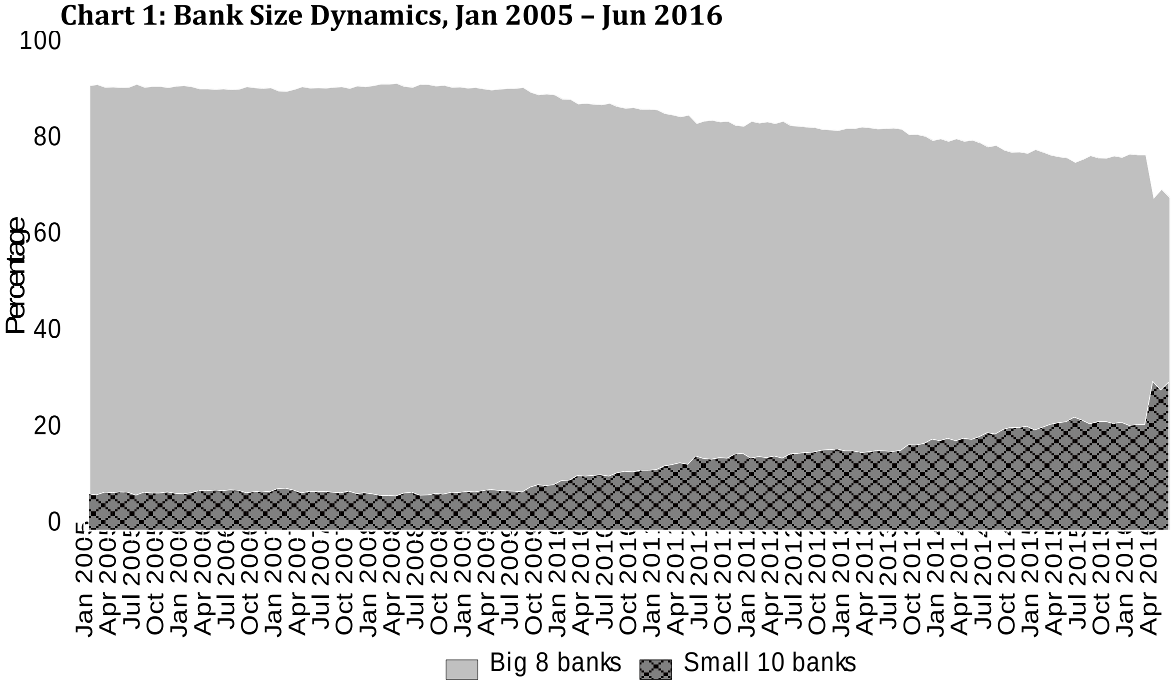
Zambia's reliance on copper and agriculture makes it vulnerable to adverse shocks that affects the two sectors. Prior to 2015, the Zambian economy grew at an average of 6.2% in the period 2003 and 2014. In 2015 and 2016 growth however, slowed down to an average of 3.2% due to a number of factors. Primarily, these are commodity price shock (Zambia is dependent on copper exports for its foreign exchange earnings), draught (which has severely affected hydro power generation and agriculture), and fiscal imbalances (due to a huge fiscal deficit the nation is running since September 2013).

While draught and commodity price shocks are beyond the authorities' control, fiscal performance is within their space of influence. The fiscal deficit that Zambia has been running (estimated to be 9.5% of GDP; BOZ, 2015) emanates from expenditure that is way above the budget. This has implications on the availability of credit to the private and household sectors and interest rates development as a result. Low supply of credit will likely lead to a rise in lending rates. In addition, attempts to wade off inflationary pressures due to macroeconomic perturbations arising from fiscal imbalances are likely to lead to an increase in policy rate by the central bank and thereby feed through to lending rates.

3.2. The Banking Sector, January 2005- June 2016

Since 2005 the number of banks in Zambia have increased from 13 to 19 with big banks[4] having dominated the market share (based on total asset) by over 90% until the first quarter of 2010 when this fell below 90% (see Chart 1). As new banks came on board (since 2010) market share by big banks has steadily declined. Even then, the combined market share in respect of big banks accounted for almost 70% as at end June 2016. With regard to asset quality, as measured by the ratio of non-performing loans to total loans, there have been some moment when the ratio was at least 10 percent. The worst period (for both small and big banks) was one during the global financial crisis (see Chart 2). But since end of 2011 small banks have a persistently high level of the ratio of non-performing loans (NPLs) to total loans (TLs) while bigger banks have a persistently low ratio. From this perspective, it appears bank size matters with regard to credit default risk as measured by the ratio of NPLs to TLs.

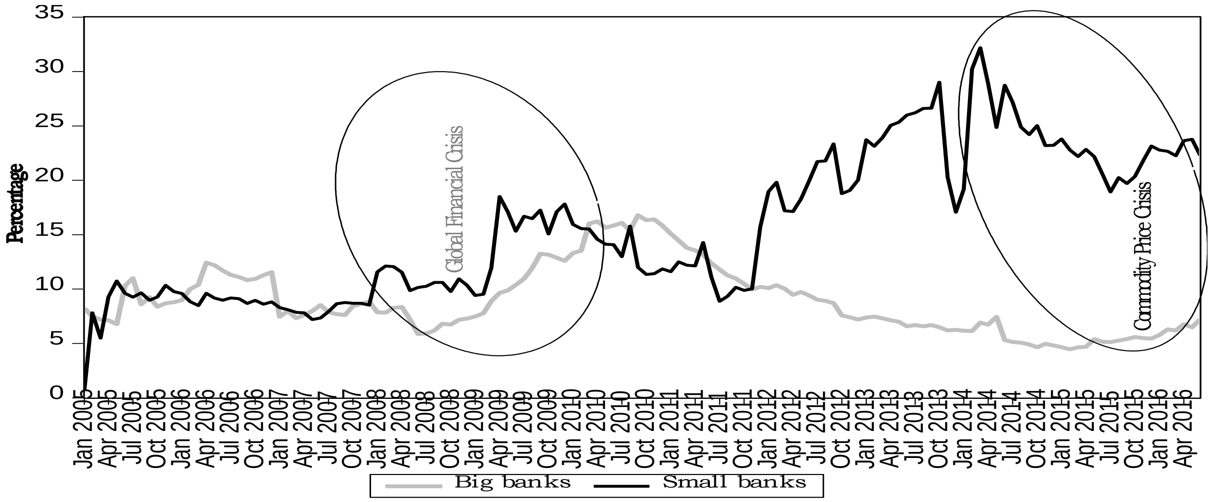
Chart 1: Bank Size Dynamics, Jan 2005 – Jun 2016



Source: Author's own computation using data from BoZ.

[4] For details on how size was arrived at, see the methodology section and for the category of separating banks into big and small (i.e. based on size) see Appendix I.

Chart 2: Non-Performing Loans as a Ratio of Total Assets, Jan 2005 – Jun 2016



Source: Author's own computation using data from BoZ

4. Literature Survey

In literature, two measures of bank credit risk are used being; non-performing loans (NPLs) (see for instance, Mesai and Jouini, 2013; Khemraj and Pasha, 2009; and Castro, 2013) and loan loss provision (LLPs) (see Kolapo, 2012; and Pain, 2003 for example). A loan is declared a NPL if it is in areas for at least 90 days and eventually get written off after some passage of time. The NPL variable is widely used as an indicator for bank credit default risk than LLP. Ranjan and Dhal (2003) provide a solid justification for the choice of NPL over LLP. They have argued that the choice of NPL as a variable proxying credit default risk is relevant because it is a broad based measure in the sense that it does not only suggest credit risk but also reflects asset quality and efficiency in the allocation of resources to productive sectors. In addition, Kauko (2012) argues that LLP may not be a true indicator of risk when one takes into account payments from loans that were once written off. In some case, NPL has been used as a determinant of LLP (see Hasan and Wall, 2003). In my view, the LLP is more of a bank's profitability indicator. From the modelling perspective, NPLs when incorporated with a lag have been used as determinants of credit default risk. A positive signing of its coefficients is anticipated (see for example Das and Ghosh, 2007 and Jimenez and Saurina, 2006). This is because it may take time before the non-performing assets are written off and are thus, expected to show some persistence in their underlying process.

Since bank size is an issue in this research it therefore, deserves some attention. In literature, bank size is measured in many ways. For example, Ranjan and Dhal (2003) reports that logarithm transformation of total assets, capital or deposits of a given bank is used as a measure of bank size by some researchers. This appears to be the case in the study by Ahmad and Ariff (2007) were a natural logarithm of total bank assets is used as an independent variable. However, its inclusion is not expressly stated as representing bank size. In fact, in their estimated parsimonious model, the variable is only significant in respect of one country among the eight considered. Nonetheless, Gunsel (2012) and Das and Ghosh (2007) clearly use log of total assets to represent bank size in a study on Cyprus and India, respectively. In both cases the variable was statistically significant. Notwithstanding the above, other measures have been considered and include the use of the ratio of individual banks' total asset over total assets for the entire industry (see for example Salas and Saurina, 2002; Louzis et al, 2012; and Mbao et al, 2014). When size is used in a modelling process it is anticipated to have a negative signing on its coefficient (see Salas and Saurina, 2002 and Hu et a.l, 2004).

Generally, two broad category of variables dominate empirical literature on credit default risk. These are macroeconomic (also called systematic) factors and bank specific (unsystematic) factors. From the modelling perspective, literature shows a variety of methods used to establish determinants of credit risk. The economic factors widely considered in credit default risk determination includes economic growth as measured by real gross domestic product growth (GDP) or industrial production index (IPI), inflation, interest rates, exchange rate (nominal), real effective exchange rate, monetary aggregates (which includes broad money - M2 or M3 - and credit growth), sovereign debt, and current account deficit/surplus, among others.

The real GDP (or the IPI in its absence) reflect real business cycles' effect on loan default risk with a negative relationship. This implies that when the economy is growing (expanding) will bring with it opportunities to improve incomes for the households and revenue for the corporates, which in turn is used to service loans. Louzis et al (2012) argues that this same opportunity compels banks to cash in by increasing their loan portfolio but with no much regard to the quality of borrowers as lower quality borrowers are contracted in banks loan books. They argue that the down side to this is a tendency by low quality borrowers to default when incomes and revenues get squeezed by diminishing economic opportunities owing to declining economy. Thus, when recession sets in there is an increase in the stock of NPLs as some workers get retrenched (for instance) and sales for companies slows down or decline (see Castro, 2013 for similar argument). The same thinking is applied when one uses IPI as a proxy for real GDP (see Das and Gosh, 2007 and Samanadevi et al, 2011). The reasons attributed to real GPD also holds as a justification of using credit growth as one of the determinants of credit default risk and this is as a result of the pro-cyclical nature of credit growth. Actually, Davis and Karim (2008) attribute credit growth to precede some banking crisis. However, Kauko (2012) has found credit growth to be significant in adversely affecting NPLs only when it is modelled together with current account deficit of the external sector. Current account has been described to precede banking crisis in Japan (Laeven and Valencia, 2008). This is the same observation held by Sarlin and Peltonen (2011).

In terms of sovereign debt and its interaction with credit default risk, the link is through market valuations and the relationship with credit default risk has been found to be positive. Louzis et al (2012) postulates that when sovereign debt mounts, the markets are likely to place a premium on interbank lending and other wholesale markets, which is likely to lead to low liquidity in the market. The downside to this is banks reducing lending as observed by Reinhart and Rogoff (2010). This act may amount to debtors failing to refinance their loans, resulting into the increase in NPLs. The other justification used in including sovereign debt as one of the economic conditions that have implications on credit default risk is that as fiscal deficit increase and that government has over borrowed but then realise the need to consolidate its fiscals so as to get to a sustainable. Fiscal consolidation may lead to a decrease in household incomes (through tax increase or retrenchments) and firms' revenue for those involved in the supply chain of offering goods and services to government. The argument on the loss of income and revenue described under business cycles (i.e. GDP) above holds in this instance as well. Ali and Daly (2010) confirms the significant role of sovereign debt on credit default risk for both Australia and the United States of Americ (USA).

With regard to interest rates, this should be looked at in light inflation. In my view both have similar implications somewhat. As inflation increases – in case it is a realisation that appears to be a surprise to the monetary authorities – or it is anticipated to increase will lead to an increase in interest rates in order to counteract it (i.e. monetary authorities' actions) or mitigate its undesirable effects (i.e. lenders actions). As Castro (2013) observes, an increase in interest rates exerts a burden on borrowers which may likely increase the stock of NPLs. Thus, inflation and or interest rates tend to have a positive relationship with credit default risk. However, Ali and Daly (2010) using short term nominal interest rates found a negative (but statistically insignificant) relationship with credit default risk for Australia and the USA. Notwithstanding this, Messai and Jouini (2013), Louzis et al (2012), and Jiminez and Saurina (2006), among others, found a positive relationship between real lending rates (treated as floating rates) with credit default risk. Real lending rates are rates adjusted of inflation, realised or expected. Empirical literature has confirmed a positive relationship between inflation and credit default risk see for instance, Gunsel (2012) and Rinaldi and Sanchis-Arellano (2006). Nonetheless, a negative relationship between inflation and credit default risk has also been found (see Zribi and Boujelbene, 2011 and Vogiazas and Nikolaidou, 2011). Notwithstanding the above, other studies have reported an insignificant role of inflation on credit risk (see Bofondi and Ropele, 2011 and Castro, 2012).

In relation to the exchange rate – nominal or REER –, its relevance is related to it as being one that captures the external sectors influence on credit default risk. This makes sense particularly for small open economies. As banks lend in both local and foreign currency denominated loans the latter component is sensitive to exchange rate movements. Particularly for firms (such as import dependent firms) and whose revenues are denominated in local currency (currency mismatch risk), any adverse movement in the nominal exchange rate increases their loan burden with a risk of defaulting. Kearns and Patel (2016) postulate that from the trade channel perspective an exchange rate appreciation is contractionary for domestic economic activity, while a depreciation is expansionary. However, the opposite is true from the finance channel point of view. Therefore, a depreciation may adversely affect the economy by weakening domestic balance sheets for those firms or individuals with foreign currency denominated loans and their revenue or earnings are in domestic currency. This view is also supported by Pratap and Urrutia (2004).

Other than private sector credit or its broad measure – domestic credit – other monetary aggregates used in empirical literature includes broad money supply either as M1, M2 or M3. Poude (2013) argues that changes in money supply have implications on interest rates as a rise in the stock of money will lead to a decline in interest rates with a consequence in the increase in borrowing. Empirically, the effect of changes in money supply have generally be found to be negative. For example, Nikolaidou and Vogiazas (2016) found a negative but highly significant signing for money supply (M1) on Zambia. Similar relationship was found for Uganda (M3) and Kenya, Namibia and South Africa (all for M2). Other studies that found a negative signing between money supply and credit default risk include Poude (2013), Ahmad and Araf (2007) and Vogiazas and Nikolaidou (2011). Notwithstanding the above, a positive relationship was found by Bofondi and Ropole (2011). In my view, money supply should have the same effect on credit default as GDP growth especially when there is no fiscal dominance financed by way of fiscal authorities making recourse to the central bank. The argument is that as economic activities increase, demand for money will rise in tandem thereby inducing the supply of money. In this regard, in the absence of reliable GDP data money supply can be used as a proxy variable especially that it is also influenced by seasonalities that broadly affects the economy.

Various variables have been used in empirical literature as bank specific factors in credit default risk determination with varying justifications. These include profitability measure, i.e. return on assets (ROA); measure of leverage, ratio of capital to assets (or ratio of total liabilities to total assets); measure of liquidity, ratio of loans to deposits (or deposits to loans); capital adequacy, ratio of tier1 capital to total assets; measure of inefficiency, ratio of operating expenses to operating income; and measure of solvency, ratio of owned capital to total assets, among others. Specifically, Nikolaidou and Vogiazas (2016) found profitability indicator to positively influence impaired assets in South Africa.

Asset prices have also been used including commodity prices (see for instance Nikolaidou and Vogiazas, 2016). The use of copper related variable is justified for Zambia in Nikolaidou and Vogiazas (2016). Copper mining is one of the major economic activities in Zambia with a sizable number of employees and contractors. Banks are exposed to this sector through salary backed and SME lending. When things are looking up in the copper sector lending does increase (also owing to the general increase in liquidity in the economy) and when things are looking down mining firms retrench workers and suspend capital projects, leaving banks with a stock of non-performing loans if its borrowers from the sector are victims of mining firms resource use rationalisation decisions.

With regard to estimation procedures used in credit risk default studies, a number of methods feature prominently in literature. The methods are largely informed by the nature of data and these include panel methods - including the traditional OLS estimation as well generalised methods of moment (GMM). However, the OLS approach to panel estimation has been found to be biased and inconsistent by Baltagi (2008) even in instances when the errors are not serially correlated. Logit regression is another estimation procedure found in literature (for instance see Ali and Daly, 2010). The Johannsen's vector error correction mechanism (VECM) also features prominently although its limitation is that it requires all variables to be integrated of the same order. Peseran and Shin's autoregressive distributive lag models (ARDL) are used largely due to the inherent advantage of accommodating variables with different orders of integration (see for example Adebola et al, 2010 and Nikolaidou and Vogiazas, 2016).

5. Data, Methodology and Empirical Analysis

5.1. The Data

4.1.1 Description of Variables and Source

Both macro and bank specific variables were considered in addition to asset/commodity prices as summarised in table 1 below. The table indicates a priori (expectation) and source of data as well.

Table 1: Variables and Source of Data

Variable	Description	A priori (signing)	Source
Bank Specific Variables			
CDR	Credit Default Risk, defined as Non- Performing Loans as a percentage of total loans.	This is a dependent variable	Bank of Zambia
LEV	Leverage measured as (shareholders' Funds/Total Assets)*100	Positive	Bank of Zambia
LIQ	Liquidity Ratio is measured as (Total Loans/Total Deposits)*100	Positive/Negative	Bank of Zambia
CAR	Capital Adquacy Ratio: This is a moral hazard measure in the sense that thinly capitalised banks will likely be aggressive in lending with a risk of underwriting bad loans. It is measured as (Tier 1 Capital/Total Loans)*100.	Negative (but a positive signing implies no problem of moral hazard)	Bank of Zambia
Macroeconomic Variables			
REER	Real effective exchange rate: A depreciation in the REER should stimulate exports and enable exporters service their local loans due to improved liquidity unless there is currency miss match	Negative/Positive	Bank of Zambia
RALR	Real Average lending rates	Positive	Bank of Zambia
RPSCG	Real private sector credit growth (RPSCG). PSC is domestic credit excluding net claims on government and public enterprises. This is considered in growth terms.	Positive	Bank of Zambia
M2	Broad money supply	Negative	Bank of Zambia
Asset Prices			
CUP	Copper prices: Taken as provided	Negative	London Metal Exchange

4.1.2 Unit Root Tests

Time series data is charecterised by either stationary or non-stationary process and this has implication on the order of long run integration. Regressing time series data without considering their order of integration may lead to spurious results, hence the need to undertake unit root tests. The Augmented Dickey-Fuller (ADF) together with the Zivot-Andrew's (ZA) are undertaken to determine the order of integration of each of the above variables.

When there are structural breaks in a series, the various ADF tests are biased towards the non-rejection of a unit root. The ZA test is suitable in such circumstances and is preferred over an alternative test provided by Philips Perron (PP). Unlike the PP, the ZA does not need one to know the exact location of the structural break in order to get an appropriate test statistic for the unit root. The ZA is able to detect any structural break in a given series and this makes it more suitable than the PP. The results of the ADF and ZA unit root tests are summarised in Table 2 below. Based on the ADF tests all the variables, except real private sector credit growth (RPSCG) and measure of liquidity (LIQ), are I(1) while the ZA also confirms similar results but differs on the measure of leverage for small banks. It suggest that this variable is an I(0) series.

Table 2a: ADF Test Statistic

Variable	*Level*	*P-Value*	*First Difference*	*P-Value*	*Integration Order*
Log(CAR_B)	-1.498064	0.5318	-10.15513	0.0000	I(1)
Log(CAR_S)*	-2.810861	0.1960	-12.68360	0.0000	I(1)
Log(CDR_B)	-1.453061	0.5544	-11.83509	0.0000	I(1)
Log(CDR_S)	-2.062075	0.2604	-10.27654	0.0000	I(1)
Log(LEV_B)	-1.557698	0.5014	-12.12809	0.0000	I(1)
Log (LEV_S)	-2.484689	0.1214	-14.06221	0.0000	I(1)
Log(LIQ_B)	-3.661442	0.0057			I(0)
Log(LIQ_S)	-3.175893	0.0236			I(0)
Log(CUP)*	-2.384287	0.3861	-11.98209	0.0000	I(1)
Log(REER)	-2.328487	0.4155	-11.45454	0.0000	I(1)
Log(M2)	-0.690565	0.8446	-13.01411	0.0000	I(1)
RPSCG	-10.68229	0.0000			I(0)
RALR	-1.621050	0.4691	-8.031122	0.0000	I(1)

critical values: 1% level (-3.478911) 5% level (-2.882748) 10% level (-2578158)

* Tested under an assumption of constant and trend

Table 2b: Zivot-Andrew Unit Root Test

Variable	*Test Statistic*	*Potential break point at position*
Log(CAR_B)	-4.5862	15 (Mar.2006)
Log(CAR_S)*	-4.9179	107 (Nov. 2013)
Log(CDR_B)	-3.5687	50 (Feb. 2009)
Log(CDR_S)	-4.9213	83 (Nov. 2011)
Log(LEV_B)	-3.7827	16 (Apr. 2006)
Log (LEV_S)	-5.2256	107 (Nov. 2013)
Log(LIQ_B)	-3.7569	53 (May 2009)
Log(LIQ_S)	-5.3799	84 (Dec.2011)
Log(CUP)*	-3.1088	66 (June 2010)
Log(REER)	-4.5464	128 (Aug. 2015)
Log(M2)	-4.9792	18 (Jun. 2006)
RPSCG	-8.6677	39 (Mar. 2008)
RALR	-3.8715	52 (Apr. 2009)

Critical values: 0.01= -5.57, 0.05= -5.08, and 0.1= -4.82

The ZA tests further reveal structural breaks in the variables of interest. For big banks, 2006 was a unique year with the CAR and LEV series experiencing structural breaks in March and April, respectively as both started falling (see charts in Appendix II). The year 2009 was also a unique period for big banks with CDR (in February) and LIQ (in May) undergoing some structural change. CDR started rising while liquidity started falling. This could be the effect of the global financial crisis particularly for CDR resulting from a rise in NPLs. This may have impacted on bank liquidity as a result due to non-interest payments from NPLs that were falling due. For small banks, the years 2011 and 2013 were unique. In 2011 CDR started rising - and it has since remained elevated despite some declines recorded between March 2014 and July 2015 – with, just like the big banks experience in 2009, an impact on LIQ, whose structural break was in the month of December. Liquidity has remained fairly more volatile with a bias towards a decline. In 2013, there was a structural break with the CAR and LEV. Both occurred in December, signalling an increase at the time. Both have since exhibited some declining behaviour. The increase in CAR most likely reflects the Bank of Zambia decision to increase capital requirement for all banks with the magnitude varying on whether one was a local or foreign owned bank.

Macro variables have also undergone some structural change. In 2006, around June, money supply (M2) experienced a structural break. Growth in money supply started increasing relatively faster. In 2009, RALRs (in April) also experienced a structural break. Two things may have been at play being (1) credit rationing as a response to escalations in NPLs among big banks causing lending rates to increase, and (2) nominal lending rates rising faster than inflation which had reverted back to double digit during the period. In the year 2015 the REER experienced a structural break in August. This was due to the massive depreciation of the Kwacha coupled with a level shift in the domestic CPI (also as a result of the exchange rate shock).

5.2. Methodology

4.2.1 Bank Size Determination

Bank size is computed using the following procedure:

(i) Determine the ratio of individual banks total asset to industry total asset using individual banks balance sheet and industry consolidated balance sheet data. The formula below was used:

$$\beta_{it} = \left(\frac{\theta_{it}}{\Omega_t}\right) 100\%, i = 1, \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots, 18 ------(1)$$
$$t = 0,1,2 \ldots . \ldots \ldots \ldots . \ldots . . , T$$

Where,

$$\beta = Bank\ Size$$
$$\theta = Individual\ bank\ total\ assets$$
$$\Omega = Industry\ total\ assets$$

(ii) Compute the average bank size for each individual bank for the period since January 2005 (or from the month of commencement of operations if the bank never existed as at January 2005). This is done using the formula below:

$$\bar{\beta}_i = (T-t)^{-1} \sum_{t=0}^{T} \beta_{it} ------------(2)$$

Where,

$$\bar{\beta}_i = Mean\ bank\ size\ for\ individual\ banks$$

$(T - t) \ = Number\ of\ observations$

(iii) Decision with regard to the bank being either big or small follows the decision rule below.

$$\bar{\beta_i} = \begin{cases} \geq 0.05, \text{big bank} \\ < 0.05, \text{small bank} \end{cases} \quad ------------ (3)$$

The decision rule above states that if the average bank size is at least five percent (0.05) then such a bank is considered a big bank. Otherwise it is a small bank. The five percent was arrived at primary because of two reasons. The first is to ensure that banks that make into the big bank category should have a combined market share of at least 60 percent. Secondly, the changing nature of bank size by some banks over the period indicates these banks have either rapidly grown or have had a stable share. The smaller banks have a range of market share of 0.1 percent to 2.7 percent. Big banks have a range of individual market size being 5.1 percent to 17.7 percent. Going forward, it would be important to segment the market into big, middle and small sized given the clear heterogeneity of the sector that clearly shows three such clusters.

4.2.2 Modelling Approach

Given that most of the variables of interest are integrated of order one, the Johansen approach to cointegration was considered with full knowledge of the structural breaks' break points in the series considered. The advantage with the Johansen methodology to modelling macroeconomic and financial data is that it is a system approach and can thus help exploit many long run relationships poised by economic theory the set of considered variables may be associated with. The estimation procedure involved estimating a VAR with credit default risk being one of the variables of interest alongside other I(1) variables (possible determinants). The VAR was used in guiding for an appropriate lag length (using the lag length criteria) that was ideal in inducing the white noise in the errors and thereby get a stable VAR for estimating long run relationship.

Long run (cointegrating) equation estimation for small banks was achieved using a lag length of 2 for data ranging from January 2005 to June 2016 on monthly frequency. This included a dummy variable for credit default risk (accounting for a structural break in the credit default risk series) as an exogenous variable. This was based on the assumption of one cointegrating equation. Both Trace test and Max-eigenvalue test indicated one cointegrating equation under the assumption of intercept but no trend in the cointegrating equation. The resulting cointegrating equation is presented in Table 3a. The same procedure was followed in estimating a cointegrating equation for big banks. Five lags were instead used (as suggested by the lag length criteria) and the estimation considered data from July 2005 to June 2016 also on monthly frequency. A specific dummy variable for credit default risk for big banks was included as an exogenous variable. The results of the ensuing long run equation are summarised in Table 3b.

Based on the long run results, the error correction term was extracted from each equation and respectively used in short run dynamic equations in which all I(1) variables were differenced with credit default risk indicator used as the dependent variable. The idea of modelling short run dynamics separate from the VECM was to benefit from a general to specific modelling approach were all possible macroeconomic and microeconomic determinants of credit default risk are considered. This gives an advantage of considering in the short run estimations procedure those variables that were statistically insignificant (and thus omitted) in long run estimations. Parsimonious short run dynamic equations are presented in tables 4a and 4b for small and big banks, respectively.

6. Empirical Results and Analysis

6.1. In the Long Run

The long run equation estimation results show some difference between the determinants of credit risk among Zambian banks. All the variables in each model are correctly signed and statistically significant going by their t-statistics which are at least two. While the REER is a factor for big banks in terms of credit default risk, it is not - nonetheless - a determinant for small banks. The other notable difference between the two results is that coefficients for big banks are more elastic while for small banks are relatively inelastic in the long run. This means small changes in credit default risk determinants among big banks are translated into relatively larger changes in the risk indicator than the case with small banks. For example, a unit change in copper prices will result into credit default risk for smaller banks to change by 0.58 units while for bigger banks this will translate into 4.3 units change. A unit change in capital adequacy ratio will lead to 0.39 units change in credit default risk indicator, which is less than unit, compared to a 3.3 units change for big banks, which is more than unitary.

Copper prices in both cases have relatively higher elasticity effect on CDR than what CAR impacts on the CDR. This implies that copper export earnings do not only dominate the trade channel in Zambia but also the finance channel. This is so by way of providing liquidity in the banking system (through sales of foreign exchange by mining firms). The supply of foreign currency in turn affects the exchange rate (with its attendant valuation effects) and this augments liquidity in the banking system to support lending. An adverse shock to copper prices is likely to cause the following effects: (1) a depreciation in the Kwacha thereby, causing adverse valuation effects to foreign currency denominated loans. This will increase the cost of servicing foreign currency denominated loans by borrowers with a currency mismatch. The risk of a rise in NPLs is certain in this case; (2) a depreciation will also feed adversely into the inflationary process with a likely consequence of the increase in policy rate that will automatically lead to lending rates adjusted upward. This is because bank lending rates are tied to the policy rate; and (3) a reduction in export earnings may cause some adverse liquidity shock in the banking system thereby reducing supply of loans as a response from banks. This may also lead to an increase in interest rates with a potential risk of the stock of NPLs rising in the banking system. Copper is thus a potential financial (in)stability issue in Zambia with regard to domestic financial markets given the role of its export earnings in generating liquidity in the banking system. Export diversification aimed at reducing the dominance of copper (as single dominant export commodity) in external sector earnings is therefore necessary in the long run as far as reducing the risks of single commodity dependence on foreign exchange earnings to augment domestic banking liquidity.

In the long run, a depreciation in the REER increases credit default risk with a unit rise in the REER leading to credit default risk escalating by 9.1 units. This means that the finance channel dominates the trade channel with regard to the impact of exchange rate and domestic inflation (relative to foreign inflation of trading partners) dynamics. The exchange rate component in the REER affects foreign currency denominated loans with a depreciation leading to the increase in the servicing burden for those with a currency mismatch. The domestic inflation component in the REER affects both Kwacha and foreign currency denominated loans via the interest rate channel. The results further, indicate that both big and small banks pursue moral hazard behaviour in the long run going by the statistical significance of the capital adequacy ratio variable.

Table 3a: Long Run (Cointegrating) Equation for Small Banks

Variable	*Coefficient*	*Standard Error*	*t- Statistic*
Constant	9.148909		
Log(CuP)	- 0.576553	0.18281	-3.15384
Log(CAR)	- 0.386143	0.15060	- 2.56404

Table 3b: Long Run (Cointegrating) Equation for Big Banks

Variable	*Coefficient*	*Standard Error*	*t- Statistic*
Constant	7.892114		
Log(CuP)	-4.310725	1.38052	-3.12254
Log(CAR)	-3.301967	1.20732	-2.73495
Log(REER)	9.072418	2.96387	3.06100

6.2. In the Short Run

Parsimonious short run estimations show satisfactory results with regard to issues of serial correlation and can thus be relied upon. These dynamic estimation results indicate that small banks tend to adjust faster to their long run position of credit default risk (which unfortunately is a relatively high level of risk compared to big banks) with a speed of adjustment of 92% compared with 79% for bigger banks. This, coupled with a significant result for credit default risk persistence as shown by its lagged variable's coefficient (in both cases), is evidence that there is a potential high tendency for credit default risk to persistently remain elevated among smaller banks and (or but) potentially stay persistently low (comparatively) among bigger banks. Perhaps, this explains the consistent divergence in the levels of credit default risk between the two categories of banks since November 2011 seen in chart 2. Unlike bigger banks, credit default risk is persistently high among small banks. The persistence in credit risk is consistent with literature (see Das and Ghosh, 2007 and Jimenez and Saurina, 2006).

There is some evidence of smaller banks not pursuing a moral hazard behaviour (as opposed to bigger banks) going by the positive signing of the coefficient for capital adequacy. This is contrary to expectations. Further, unlike the smaller banks, changes in average real lending rates have an influence on credit default risk among bigger banks – although it is relatively inelastic - with a unit change in real lending rates causing the measure of credit default risk rising by 0.02 units. Furthermore, leverage matters for both category of banks and it is comparatively elastic for bigger banks.

Table 4a: Short Run Dynamic Equation for Small Banks

Variable	Coefficient	Standard Error	t-Statistic	P-Value
C	-0.051130	0.015818	-3.232305	0.0016
D(LOG(CDR(-1)))	0.792090	0.143962	5.502078	0.0000
D(LOG(CAR_S))	0.226790	0.097268	2.331601	0.0213
D(LOG(LEV_S(-2)))	0.457511	0.117657	3.888498	0.0002
Dummy_NPL	0.149796	0.031918	4.693108	0.0000
ECM_S(-1)	-0.924491	0.154793	-5.972428	0.0000

R-squared, 0.322164; F-statistic, 12.26230; Prob (F-statistic), 0.000000; and Durbin-Watson, 1.800816

Table 4b: Short Run Dynamic Equation for Big Banks

Variable	Coefficient	Standard Error	t-Statistic	P- Value
C	-0.001993	0.007190	-0.277206	0.7821
D(LOG(CDR_B(-1)))	0.713086	0.300130	2.375924	0.0190
D(LOG(CAR_B(-1)))	-0.577355	0.244436	-2.361987	0.0197
D(LOG(LEV_B(-1)))	0.511545	0.230846	2.215958	0.0284
D(RALR)	0.015181	0.007043	2.155491	0.0330
ECM_B(-1)	-0.789464	0.303112	-2.604525	0.0103

R-squared, 0.117101; F-statistic, 3.448438; Prob (F-statistic), 0.005852; and Durbin-Watson, 2.054049

7. Conclusion and Recommendations

The paper sought to provide answers to the question whether bank size matters in the way credit default risk is affected by its determinants. It focused on establishing an understanding whether banks if segregated as small and big and modelled separately can provide significantly different coefficients for respective variables of similar nature, or indeed have different factors affecting each category.

Using the Johansen approach to cointegration modelling with full knowledge of the occurrence of structural breaks and using the long run cointegrating property to estimate a dynamic short run equation the results obtained are as follows: (1) In the long run, both smaller and bigger banks are influenced by similar factors in terms of the credit default risk being copper prices and capital adequacy. Real effective exchange rate has an influence on bigger banks only. Based on the long run results, bank size does matter especially with regard to the size of estimated coefficients. While coefficients are relatively inelastic in terms of smaller banks they are however relatively elastic for bigger banks; (2) Both small and big banks pursue a moral hazard behaviour in the long run but not in the short run. Bigger banks only follow a moral hazard behaviour in the short run; (3) In the short run there is high persistence of credit default risk for both banks. It is generally a relatively high level of risk for smaller banks (since November 2011) but a relatively lower level of risk for big banks in the post 2011 era. Smaller banks have a relatively higher speed of adjustment (92 percent) to a long run equilibrium (which, as stated above, may be characterised by relatively high credit default risk). Bigger banks, although equally have a high speed of adjustment (79 percent) to their long run credit default risk levels, are however charecterised by relatively low level of credit default risk (compared to smaller banks) and thus, somewhat desirable. The differences in the speed of adjustment and levels of persistence could explain the divergence in risk levels between the two categories of banks in Zambia obtaining since end 2011; (4) leverage is one of the determinants of credit default risk for both category of banks. (5) Real average lending rates matter to bigger banks and not smaller ones.

For policy purposes, smaller banks should be looked at as currently posing some risk to financial stability owing to the non-resolution of impaired loans on their balance sheets that have persisted on a relatively higher level since November 2011. This partly may explain why CAR declined from February 2014 among small banks (after a rapid rise from November 2013, see the graph in Appendix II) as capital absorbed some losses due NPLs. Investigations are needed to help break the tendency by smaller banks to revert quickly to their long run position currently charecterised by high credit default risk.

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Appendices

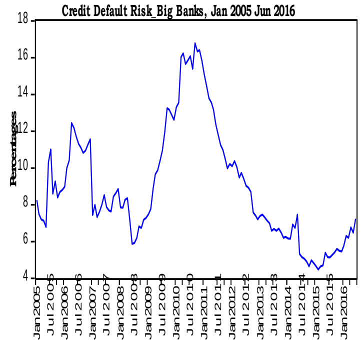
Appendix I: Categorisation of Bank Size

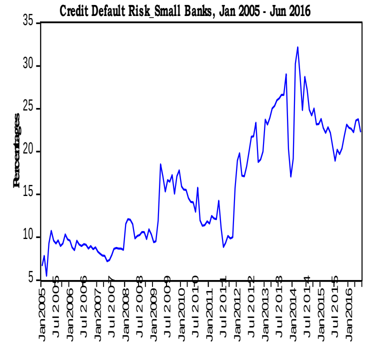
Following the procedure in the methodology above the categorisation of banks into big or small is summarised in the table below:

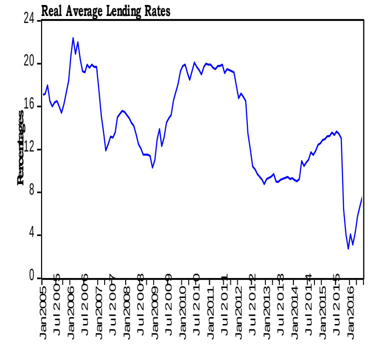
Table A1: Average Bank Size

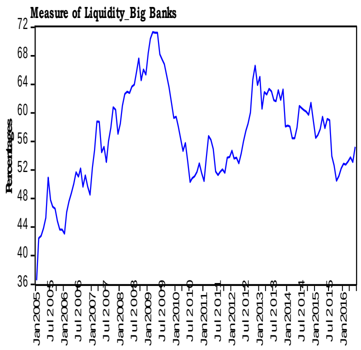
Description	Bank Size (%)	Category
Bank 1	0.061781087	Small
Bank 2	2.332724858	Small
Bank 3	0.777490663	Small
Bank 4	17.71723885	Big
Bank 5	5.200100414	Big
Bank 6	1.123264770	Small
Bank 7	6.556730842	Big
Bank 8	1.409410794	Small
Bank 9	1.255327418	Small
Bank 10	6.967406033	Big
Bank 11	0.488511750	Small
Bank 12	0.000000000	Not Considered
Bank 13	5.131254985	Big
Bank 14	0.806482852	Small
Bank 15	2.712914760	Small
Bank 16	15.58383103	Big
Bank 17	14.28800728	Big
Bank 18	0.743118158	Small
Bank 19	15.37863718	Big

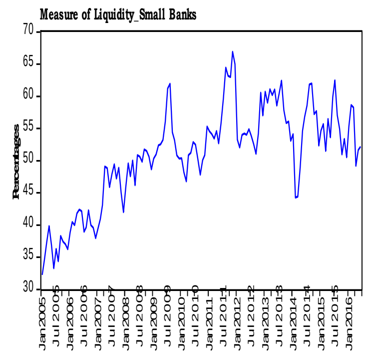
Appendix II: Charts for Variables of Interest

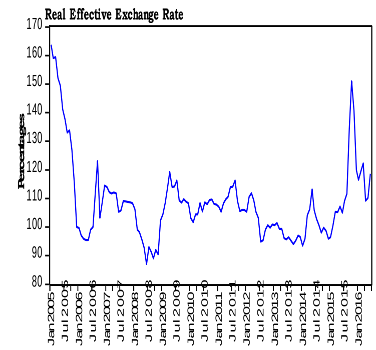


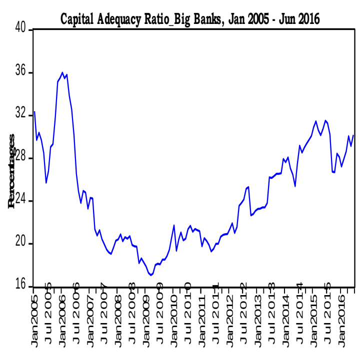


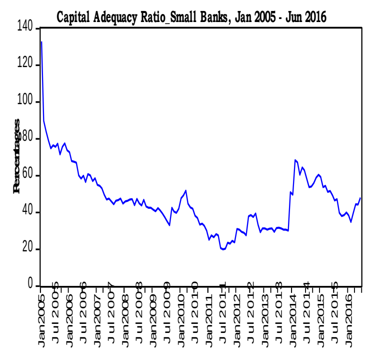


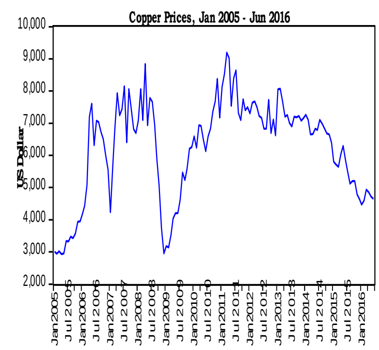


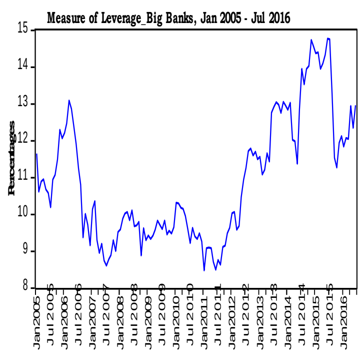


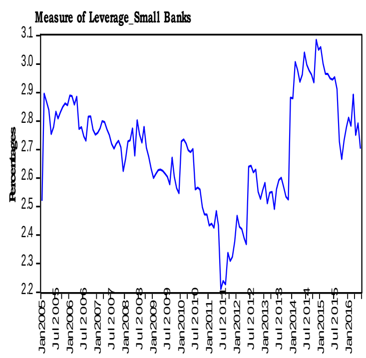


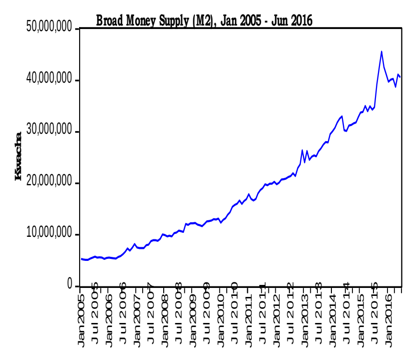












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